UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

March 8, 2012

In response refer to:
2011/00351

Lieutenant Colonel Torrey A. DiCiro
U.S. Department of the Army
San Francisco District, Corps of Engineers
1455 Market Street, 16th Floor
San Francisco, California 94103-1398

Dear Lieutenant Colonel DiCiro:

Thank you for your January 28, 2011, request for formal consultation on the *Santa Cruz Countywide Partners in Restoration Permit Coordination Program* (Program) in Santa Cruz County, California. This document transmits NOAA's National Marine Fisheries Service's (NMFS) programmatic biological opinion for the Program. The Program provides a framework for the U.S. Army Corps of Engineers (Corps) and the Resource Conservation District of Santa Cruz County to assist landowners with implementation of specific conservation activities on private lands. The biological opinion addresses the effects of the proposed Program on Central California Coast (CCC) Distinct Population Segment (DPS) steelhead (*Oncorhynchus mykiss*), South-Central California Coast (S-CCC) DPS steelhead (*O. mykiss*), CCC Evolutionarily Significant Unit (ESU) coho salmon (*0. kisutch),* and CCC steelhead, S-CCC steelhead, and CCC coho salmon critical habitats in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*).

NMFS concludes the proposed Program is not likely to jeopardize the continued existence of threatened CCC steelhead, threatened S-CCC steelhead, endangered CCC coho salmon, or adversely modify or destroy designated CCC steelhead, S-CCC steelhead, or CCC coho salmon critical habitat. NMFS expects the proposed action is likely to result in take of CCC steelhead, S-CCC steelhead, and CCC coho salmon and, therefore, an incidental take statement is included with this biological opinion. The incidental take statement includes reasonable and prudent measures necessary and appropriate to minimize incidental take of CCC steelhead, S-CCC steelhead, and CCC coho salmon. A complete administrative record of this consultation is on file at our North Central Coast office.

The project also includes areas identified as Essential Fish Habitat (EFH) for various life stages of coho salmon which are Federally managed under the Pacific Coast Salmon Fishery Management Plan. NMFS has reviewed the current condition of EFH in the Program area

and finds that no changes are needed to the EFH conservation recommendations included in the Biological Opinion dated July 18, 2006 (NMFS # 151422SWR04SR9195), for this proposed project. The EFH conservation recommendations refer to Reasonable and Prudent Measure #3 of the Biological Opinion dated July 18, 2006, which have been accepted and incorporated as part of the Program.

Mr. Devin Best is the lead biologist for this project. He can be contacted at (707) 578-8553 or via email at devin.best@noaa.gov if you would like additional information regarding the enclosed biological opinion.

Sincerely,

Rodney R. McInnis
Regional Administrator

Enclosure

cc: Chris Yates, NMFS, Long Beach
Bryan Chesney, NMFS, Long Beach
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Kelli Camara, Santa Cruz Resource Conservation District
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Roger Root, USFWS, Ventura
Copy to Administrative File: 151422SWR2004SR919

Enclosure

BIOLOGICAL OPINION

ACTION AGENCY:	United States Army Corps of Engineers
ACTION:	Corps: Authorization for Resource Conservation District Santa Cruz Countywide Partners in Restoration Permit Coordination Program (Program) for Santa Cruz County, California.
CONSULTATION CONDUCTED BY:	National Marine Fisheries Service, Southwest Region
TRACKING NUMBER:	2011/00351
DATE ISSUED:	**March 8, 2012**

I. CONSULTATION HISTORY

On January 28, 2011, the U.S. Army Corps of Engineers (Corps) requested formal consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq*.). The consultation request applies to the Corps' permitting of the Resource Conservation District of Santa Cruz County's (RCDSCC) *Santa Cruz Countywide Partners in Restoration Permit Coordination Program* (Program) under Section 404 of the federal Clean Water Act. Consultation was requested due to the Corps' determination the Program may affect Central California Coast (CCC) Distinct Population Segment (DPS) steelhead (*Oncorhynchus mykiss*), South-Central California Coast (S-CCC) DPS steelhead (*O. mykiss*), CCC Evolutionary Significant Unit coho salmon (*O. kisutch*), and designated CCC steelhead, S-CCC steelhead, and CCC ESU coho salmon critical habitat listed under the ESA. This consultation follows a prior consultation (#151422SWR2006SR00307) on a similar program between NMFS and NRCS that was in effect from 2005-2009. NRCS will not be overseeing the Program anymore as all responsibilities have been assumed by the Corps and RCDSCC. NRCS will continue to provide technical assistance to RCDSCCC during the lifetime of the Program. A revised project description was accompanied the request for formal section 7 consultation. A 60-day extension was requested on June 22, 2011 by NMFS to the Corps.

On December 31, 2009, the first five-year Program was completed (2005-2009). Conversations between the RCDSCC and NMFS began in 2009 regarding reissuance of the Biological Opinion (BO). A request for renewal (email dated November 11, 2009) was sent to NMFS by the RCDSCC to initiate conversations regarding renewal of the Program. As a follow up to this request, meetings among staff of NMFS, RCDSCC, the Corps, as well as the California Department of Fish and Game (DFG) were conducted on several occasions to refine the

Program's practices, extend the duration of the Program, and incorporate new protection and conservation measures based on the declining status of CCC coho salmon in the project area. The RCDSCC provided extensive documentation, in their Five-Year Evaluation of the Santa Cruz Countywide Partners in Restoration Permit Coordination Program Report, dated March 1, 2011, to NMFS on the past practices to guide these discussions. The new Program reflects changes based on these discussions regarding lessons learned during the 2005-2009 Program implementation period and increased protection for coho salmon. Specifically, the Program now contains a hierarchical tier approach of practices, where higher tiered and more complex projects require more coordination with resource agencies and more stringent avoidance measures to substantially limit the potential for incidental take of CCC coho salmon.

II. DESCRIPTION OF THE PROPOSED ACTION

A. Description of Proposed Work

The Corps will authorize RCDSCC under Section 404 of the Clean Water Act to administer the implementation and maintenance of 15 types of conservation practices on private lands, including, but not limited to, farms, ranches, and other rural properties in Santa Cruz County, California. RCDSCC will be responsible for working with cooperators[1] and overseeing project implementation and effectiveness. The purpose of the Program is to provide a streamlined regulatory permitting opportunity through RCDSCC for landowners interested in restoring and enhancing natural resources on their properties. The program will be in effect for ten years (2012-2022), with a review period after the first five years (2017). In general, projects will occur during the summer low flow period (June 15 – October 15).

After discussions with RCDSCC regarding projects in the immediate vicinity of the action area (Jim Robins, personal communication, March 16, 2011), and a review of past projects in the prior Program (2005-2009), NMFS does not anticipate any interdependent or interrelated activities associated with the proposed action. For example, projects are designed to improve stream habitat and roads on private property and are not expected to facilitate additional growth in rural areas.

A streamlined approach is needed to increase the number of stream restoration activities in Santa Cruz County. Many streams in the county have been degraded during the past century of land use. Increasing the number and pace of stream restoration projects will likely aid in restoring salmon and steelhead runs in county streams. Under the proposed Program, Federal, state, and local regulatory agencies will issue programmatic authorizations for implementation of specific, standardized conservation practices that will improve habitat and soil stability on private lands. Federal and State permits will be held by the RCDSCC and the Corps. Both the RCDSCC and the Corps will act as Program partners to ensure that all conditions of Federal, state, and local authorizations are adhered to for each project implemented under the Program.

[1] Cooperators are individual(s), such as property owners, working with RCDSCC to improve habitat conditions on private lands in Santa Cruz County.

Table 1 lists the 15 conservation practices[2] available to cooperators under the Program. A numbering system was established for consistency purposes and will be carried throughout the rest of the biological opinion (BO). Of the 15 proposed conservation practices listed below.

Table 1. Conservation practices and Associated Grading and Sediment Volumes for Santa Cruz Countywide Restoration Permit Coordination Program

Practice Name	Conservation Practice Descriptions	Grading Dimensions and Sediment Volumes
1. Wetland Management (657, 659, 356, 587, 644)	To restore and enhance wetlands conditions similar to those that existed prior to modification for farming, grazing, or other land use. This practice includes minor reshaping to restore topographic relief of the site, hydrological enhancement (increasing season of inundation or saturation), and vegetative enhancement to remove any undesired species that did not originally exist on the site or to plant native species. To actively manage the water regime to improve habitat for desired species or to be able to manage for pest control (*i.e.*, mosquitoes), dike and Structure for Water Control may be used. Once constructed, the maintenance of the practice(s) is allowable, including management of water levels and a wide range of vegetation management activities to maintain or improve the vegetative composition on a site.	**Length (ft)** N/A **Area(ft^2)** Max: 2 **Volume (yd^3)** Max:1500
2. Upland Wildlife Habitat Management (645, 382, 614, 516)	The practice will be utilized to create, restore, and/or enhance upland habitat for wildlife species. This practice may be used to install shelter, cover, and food, establish vegetation for shelter, food, and enable movement, and for manipulating vegetation to sustain optimal habitat conditions. The practice may include the creation of infrastructure to accomplish the intended purpose of the practice, including a livestock pipeline, fence, and watering facility. Use of a pipeline for conveying water from an existing source of supply to points of its use for livestock; to shift livestock to constructed waters sources and away from streams and lakes. This practice is designed to reduce bank erosion, sediment yield, and manure entering watercourses. Occasionally, a pipeline may cross streams or water courses. The Watering Facility practice is limited to the device that actually holds the water. It is not the well, spring, or other source of undeveloped water. The construction a fence across a riparian corridor or in a sensitive habitat may be utilized to improve grazing and land use management to achieve restoration goals.	**Length (ft)** Average: 50 Max: 200 (riparian) **Area (ft^2)** Max: 4,000 sq ft (riparian) **Volume (yd^3)** Average: 15 Max: 50 (riparian)

[2] The conservation practices were adopted from NRCS Field Office Technical Guide (available at: http://www.nrcs.usda.gov/technical/efotg/) for quick reference. The numbers in parentheses refer to the project number in the NRCS guide.

Practice Name	Conservation Practice Descriptions	Grading Dimensions and Sediment Volumes
3.Critical Planting (342, 612, 422, 391)	Planting vegetation such as trees, shrubs, vines, grasses, or legumes, for resource improvement. These practices can be used on eroding areas, to stabilize the soil, reduce damage from sediment and runoff to downstream areas, and improve wildlife habitat and visual resources. Common uses for Critical Area Planting (342) practice: To protect exposed soil area in agricultural ditches, and to revegetate gullies, roadway edges or farm roads, or exposed slopes or streambanks. Common uses for Hedgerow (442) practice: To provide food, cover and corridors for wildlife and provide insectary benefits that may reduce reliance on synthetic chemicals adjacent to agricultural fields, access roads and watercourses. Common uses for Tree/Shrub Establishment (612) and Riparian Forest Buffer (391) practices: To improve riparian habitat for aquatic species by creating shade to lower water temperature, provide a source of detritus and large woody debris, establish wildlife corridors, prevent against erosion within the floodplain, and provide for long-term water quality improvements.	**Length (ft)** N/A **Area (ft^2)** Average: 1 Max: 5 **Volume (yd^3)** Average: 700 Max: 1,000
4. Sediment Basins (350) [with or without water control (638)]	Construction of basin(s) to collect and store debris or sediment. Sediment basins will trap sediment, sediment associated materials, and other debris and prevent undesirable deposition on bottomlands and in waterways and streams. Basins are generally located at the base of agricultural lands adjacent to natural drainage or riparian areas. Sediment basins shall not be constructed in a stream channel or other permanent water bodies. This practice may also involve designing the sediment basin to control water volumes leaving a site and releasing the water at a natural flow rate. If water control were recommended by the NRCS, an earth embankment or a combination ridge and channel design constructed across the slope and minor watercourses would be implemented to form a sediment trap and water detention basin. The practice does not treat the source of sediment but provides a barrier to reduce degradation of surface water downstream. Due to the detention of runoff in the basin, there is an increased opportunity for soluble materials to be leached toward the ground water. Basins may also increase groundwater recharge. The design of spillways and outlet works will include water control structures to prevent scouring at discharge point into natural drainage.	**Length (ft)** N/A **Area (ft^2)** Average: 0.1 Max: 1 **Volume (yd^3)** Average: 400 Max: 4,000 (compacted embankment) (or 1,000 cu. yards in Coastal Zone Scenic Areas)
5. Grade Stabilization Structure (410) ***(In non-fish bearing streams, primarily for gully repair)***	Installation of a structure built into a gully to control the grade and prevent head cutting in natural or artificial channels. For the purposes of the Master Permit program, this practice will not be installed in current or historic fish bearing streams and would primarily be used for gully repair. This practice refers to rock, timber, or vegetative structures, such as a brush mattress, placed to slow water velocities above and below the structure, resulting in reduced erosion. This practice also involves earthmoving to reshape the area impacted by the gully. This will decrease the yield of sediment and sediment-attached substances and improve downstream water quality. An example of a practice from the CDFG' California Salmonid Stream Habitat Restoration Manual that could be	**Length (ft)** Average: 3 to 4 structures per 500 feet Max: 10 structures per 1,000 feet **Area (ft^2)** Average: 0.5 Max: 1.5

Practice Name	Conservation Practice Descriptions	Grading Dimensions and Sediment Volumes
	utilized during implementation of the Grade Stabilization practice is Brush Mattressing (p. VII-79).	**Volume (yd^3)** Max: 30 per structure; 300 total
6. Grassed Waterway (412)	Establishment of a natural or constructed channel that is shaped or graded to required dimensions and expected velocities, and establishment of suitable vegetation for the stable conveyance of runoff. This practice may reduce the erosion in a concentrated flow area, such as a gully. This may result in the reduction of sediment and substances delivered to receiving waters. Vegetation may act as a filter in removing some of the sediment delivered to the waterway, although this is not typically the primary function of a grassed waterway. Grassed waterways may be used to reduce the erosive force of runoff from agricultural lands into riparian or wetland areas or into a sediment basin. Grading and seedbed preparation may result in some short-term soil loss prior to establishment of vegetative cover.	**Length (ft)** Average: 1,000 Max: 2,000 **Area (ft^2)** Average: 0.5 Max: 2 **Volume (yd^3)** Average: 1,000 Max: 4,500 (or 1,000 cu. yards in Coastal Zone Scenic Areas)
7. Underground Outlets (620)	Installation of a conduit beneath the surface of the ground to collect surface water and convey it to a suitable outlet. The practice is typically, although not always, associated with a sediment basin (with or without water control). Excess surface water generated by farmland on steep terrain can be collected and conveyed to a sediment basin by installing pipe safely buried underground. Location, size, and number of inlets are determined to collect excess runoff and prevent erosive surface flow. This runoff is then discharged at sediment basin where high velocity runoff is calmed and suspended sediment is trapped prior to releasing water into natural drainage channel. The basin is designed to release water at a natural rate of flow.	**Length** Max: 50 (in riparian) **Area (ft^2)** Max: 1,000 sq ft (in riparian) **Volume (yd^3)** Max: 10[3]
8. Restoration and Management of Rare and Declining Habitats (643)	Restoring and conserving rare or declining native vegetated communities and associated wildlife species. This practice is used to restore land or aquatic habitats degraded by human activity; provide habitat for rare and declining wildlife species by restoring and conserving native plant communities; increase native plant community diversity; management of unique or declining native habitats (see Appendix 2 for lists of preferred and prohibited species for revegetation). This practice may be used to remove invasive plant species in sensitive resource areas in order to improve the quality of the adjacent aquatic habitat.	**Length (ft)** Average: 500 Max: 1 mile **Area (ft^2)** Average: .1 Max: 5 **Volume (yd^3)** Average: 50 Max: 1,000

[3] Area of practice within riparian area includes a 50' length and a 20' wide work area for equipment. Volume of soil is based on a 2' wide trench over 50' with pipe buried to an average depth of 2'.

Practice Name	Conservation Practice Descriptions	Grading Dimensions and Sediment Volumes
9. Stream Habitat Improvement and Management (395)	Improvement of a stream channel to create new fish habitat or to enhance an existing habitat. The practice is used to improve or enhance aquatic habitat for fish in degraded streams, channels, and ditches by providing shade, controlling sediment, and restoring/enhancing pool and riffle stream characteristics. Pools and riffles are formed in degraded stream sections through the strategic placement of logs, root wads, or natural rocks that reduces the flow velocity and increase shelter value through the area. This practice may also be used for removal or modification of fish barriers such as flashboard dams or logjams. The modification of flashboard dams may involve cutting a notch in the dam sill/footings or complete removal of dam abutments to allow for fish passage. Proposed modification of dam sites where long-term continuation of dam or resumption of dam operation is contemplated and 1602 agreements are not already in place will not be eligible for inclusion in the Permit Coordination Program without special approval from the local DFG Environmental Scientist or staff person in charge of 1602 agreement review. Complete removal of flashboard dams and associated structures is allowed under the program. Practice may be used to remove culverts that pose actual or potential barriers to fish movement. This practice may also be used to remove hardened crossings that pose barriers to salmonid passage such as culverts and simple fords that do not have complicated associated resource issues. Additional instream and floodplain practices could include, but not be limited to, installation of large woody debris structures, creation or restoration of backwater, side channel or ox-bow habitat, and installation of natural features that enhance channel, floodplain, and/or lagoon habitat complexity. Regardless of the specific project elements, all projects within this type will focus on increased habitat complexity focused on supporting a variety of life stages of aquatic species. This practice may also be used for the removal or modification of logjams that present a complete barrier to all life stages of anadromous fish passage. If the logjam does not act as a complete barrier, logjam removal may be implemented no more than two times annually under the program, but <u>only</u> if the following circumstance exists: In situations where water is actively or potentially deflecting water to a bank, threatening further erosion, bank failure, destruction of conservation practices installed to stabilize the bank, or threatening damage to life and housing, the logjam may be modified to minimize this threat. Efforts will be made to avoid "bucking" of wood and large pieces removed during modification will, if possible, be left in-channel downstream of the jam.	**<u>Length (ft)</u>** Max: 1 mile with multiple structures at multiple bank locations *Maximum area to be dewatered will not exceed 300[4] ft over the one mile maximum **<u>Area (ft^2)</u>** Max: 30 ft by 50 ft (across channel) for logjam modification Max: 20 ft by 100 ft (across channel) for small dam modification or removal Max: 20 ft by 100 ft (across channel) for dimensions for hardened crossing (*i.e.* fords) removal **<u>Volume</u>** 1,200 cu. yards

[4] The length of the conservation practices was increased from 200 to 300 lineal feet. From 2005-2009, a maximum of 200 feet was used to minimize impacts from project activities. Based on the success of the Program (nearly 20 miles of improved salmonid habitat), NMFS agreed to increase the length.

Practice Name	Conservation Practice Descriptions	Grading Dimensions and Sediment Volumes
10. Stream Crossing (578)	A stabilized area or structure constructed across a stream channel to provide a travel way for people, livestock, equipment, or vehicles. New crossings will be designed to be capable of passing high flows and not impeding fish migration and movement. Structures include culverts, bridges, and fords. Stream banks will be sloped, stabilized with appropriately sized rock or vegetation, and surface water redirected to prevent erosion.	**Length (ft)** Maximum area to be dewatered will not exceed 300 ft Max: 20 ft by 100 ft (across channel) for dimensions for hardened crossing (*ie*. fords) replacement **Area (ft^2)** Max: 100 ft (across stream) with 20 ft wide deck[5] **Volume (yd^3)** 100 cu. yards
11.Obstruction Removal (500)	Removal and disposal of unwanted structures from waterways including cars, large appliances, and garbage (items that are anthropogenic and not natural to the system). Large objects such as cars and appliances would be removed unless their removal would result in a (net) detrimental effect. For example, cars will not be removed if the action would result in disturbance to a significant area (beyond the scope of this program), which could result if it was discovered that multiple cars were stacked behind one another under a stream bank. Structures would be removed when the stream channel is dry or during the lowest flows to minimize impacts.	NA
12. Stream bank Protection (580)	Use of vegetation or structures to stabilize and protect banks of streams, lakes, or estuaries against scour and erosion. "Bioengineered" solutions using vegetation and soft materials (as opposed to concrete and rip rap, for example) are the preferred options where conditions are favorable for their use. The banks of streams and water bodies are protected by vegetation to reduce sediment loads causing downstream damage and pollution and to improve the stream for fish and wildlife habitat as well as protect adjacent land from erosion damage. Examples of this practice may include willow sprigging, brush mattressing, and live vegetative crib walls. This practice can be applied to natural or excavated channels where the stream banks are susceptible to erosion from the action of water or debris or to damage	**Length (ft)** Vegetation Average: 200 Vegetation Max: 2,000 Rock Max: 300' contiguous rock protection and 500' of

[5] The County of Santa Cruz prefers a 20 ft deck width for emergency vehicles but it's more likely that most bridges installed under the permit coordination program would not exceed 16 ft in width.

Practice Name	Conservation Practice Descriptions	Grading Dimensions and Sediment Volumes
	from livestock or vehicular traffic. The streambed grade must be controlled before most permanent types of bank protection can be considered feasible. Some examples of practices from the California Department of Fish and Game's *California Salmonid Stream Habitat Restoration Manual* that could be utilized during implementation of the Streambank Protection practice include Log Cribbing (p. VII-68), Live Vegetative Crib Wall (p. VII-69), Logbank Armor (p. VII-70), Native Material Revetment (p. VII-75), Willow Sprigging (p. VII-77), Brush Mattressing (p. VII-77), and Trenching (p. VII-80).	non-contiguous protection over 2,000 feet **Area (ft^2)** Average Vegetation: .1 Max Vegetation: 2.5 Rock protection: 0.1 acre **Volume (yd^3)** Average Vegetation: 500 Max Vegetation: 4,000 (or 1,000 cu. yards in Coastal Zone Scenic Areas)[6] Average Rock: 200 Max Rock: 800[7]
13. Stream Channel Stabilization (584)	Stabilization of the channel of a stream with suitable structures. "Bioengineered" solutions using vegetation and soft materials (as opposed to concrete and rip rap, for example) are the preferred options where conditions are favorable for their use. This practice applies to non-fish bearing stream channels undergoing damaging aggradation or incision that cannot be reasonably controlled with upstream practices (establishment of vegetative protection, installation of bank protection, or by the installation	**Length (ft)** Average: 200 Max: 2,000 **Area (ft^2)** Average: 0.1 Max: 4.5[8]

[6] For vegetation treatments, soil disturbance is assumed to be a maximum of 700' of 2,000' maximum reach. The average depth of soil grading (cut or fill) is 3 feet.

[7] Numbers provided for rock armoring refer to actual areas and volume of rock placed only. Total soil disturbance limits are same as for vegetative treatments since remainder of work area will be vegetated. Rock placed will be used at the toe of the bank in conjunction with bioengineering techniques. The maximum amount of rock allowed under the Program has been increased (Compared to allowable rock under the previous 5-year program) to add more stream complexity (*i.e.*, j-hooks, root wads, rock weirs). RSP for bank protection is limited to approximately 200 cubic yards.

Practice Name	Conservation Practice Descriptions	Grading Dimensions and Sediment Volumes
	of upstream water control measures). The Master Permit program does not cover projects that involve installation of grade stabilization structures in current or historic fish bearing streams.	**Volume (yd^3)** Average: 200 Max: 7,500 (or 1,000 cu. yards in Coastal Zone Scenic Areas
14. Structure for Water Control (587)	This practice may be installed in conjunction with Access Road Improvement or independently. Installation of a structure in an irrigation, drainage, or other water management system, including streams and gullies, that conveys water, controls the direction or rate of flow, or maintains a desired water surface elevation, such as culverts, pipe drops or chutes within gullies, debris screens, *etc*. Structure for water control is used to replace or retrofit existing infrastructure that either is non-functional or undersized. The placement of new structures to control water and improve habitat for desired native species within a wetland is also covered by this practice. By controlling the velocity of water running through an area, this practice is intended to reduce erosion and prevent down cutting of stream channels. Culverts will be consistent with California Department of Fish and Game's "Culvert Criteria for Fish Passage" (April 2003) and National Marine Fisheries Service Southwest Region's "Guidelines for Salmonid Passage as Stream Crossings" (September, 2001).	N/A
15. Access Roads (Improvement) (560) [9]	Improvement of an existing road used for moving livestock, produce, and/or equipment to provide access for property management while controlling runoff to prevent erosion and maintain or improve water quality. This practice also includes improvement of rural residential roads required for access to residences. An example of this practice might include re-grading, outsloping, or the addition of a rolling dip to a road to dissipate water velocities. This practice may also be used for repair, removal, or addition of ditch relief or drop inlet culverts. Ditch relief culverts that discharge onto slopes over 30% require additional measures to dissipate energy and avoid erosion. This practice is used only on existing roads. Practices will generally comport with the recommendation	**Length (ft)** Average[10]: 1,000 over ten years Max[11]: 10,000 **Area (ft^2)** Average: 0.8 Max: 4.5

[8] The practice includes removal of accumulated sediment from up to 100 ft (across channel), if the channel has been widened due to scour associated with a dam, log jam or other barrier.

[9] Access road improvements typically involve multiple installations spread out over a long reach of road. Maximum dimensions refer to actual area of improvement.

[10] Work performed over an average of 2 miles.

[11] Work performed over a maximum of 12 miles.

Practice Name	Conservation Practice Descriptions	Grading Dimensions and Sediment Volumes
	and concepts found in Weaver and Hagan (1994). Some examples of practices from the California Department of Fish and Game, California Salmonid Stream Habitat Restoration Manual that could be utilized during implementation of the Access Road (Improvement) practice include Waterbars (p. VII-96).	**Volume (yd^3)** Average: 750 Max: 7,500 (or 1,000 cu. yards in Coastal Zone Scenic Areas)

1. Project Specific Environmental Protection Measures

The Corps permit issued for the Program will include specific conditions for the implementation of the conservation practices. These conditions include temporal or seasonal constraints, limitations on the size or general location of the specified practices, and pre-construction notification for specific activities. These types of conditions will avoid or minimize the impact of the work to water quality and sensitive habitats and will ensure that regulatory agencies' mandates are fulfilled.

2. Environmental Protection Measures and Conditions for All Projects

The Corps, RCDSCC and NMFS have developed the following general measures shown in Tables 2 and 3 that are intended to reduce or avoid the potential adverse effects associated with actions to be covered by the Program.

Table 2. General Conditions for all Projects

Temporal Limitations on Construction	The general construction season will be from April 15 to October 31; however modifications to that time frame may be made on a site-specific basis as follows. Work in upland areas may begin as early as April 15 and may be approved to continue throughout the rainy season as long the actions are not likely to affect adjacent wetlands and stream resources. Revegetation work for all projects may extend beyond October 31 to November 30. All earthmoving activities, including grading and re-grading, will be complete by October 31. Additional erosion control measures, as described below under Conditions for Erosion Control, will be implemented for work conducted during the winter period (generally defined as October 15 through May 15). Where habitat for Federally listed species is identified on or adjacent to the project work site, construction and activities that may disturb the breeding, feeding, mating and sheltering of these species shall be limited to avoid potential impacts. If working within 75 feet of established riparian vegetation, work may not begin until after August 1 or unless authorized by DFG. In these cases, an individual approved by DFG shall conduct pre-construction surveys for bird nests or nesting activity in the project area and if nesting sites are observed, those sites shall be avoided during the nesting season. For invasive species removal in riparian habitat, work will only be conducted during the rainy season if there are no known occurrences of listed species within the past two years that could be impacted by removal. Pre-construction surveys and on-site monitoring will be completed by qualified individuals. Additionally, no work will be done in the creek.

	Instream work beyond the proposed construction period may be authorized on a project specific basis following consultation with DFG, USFWS, Corps, and/or NMFS and provided the work would be completed prior to November 30th.
Limitation on Earthmoving and Vegetation Removal (Site Disturbance)	In addition to the limitations on the amount of grading, the following conditions also apply: Disturbance to existing grades and vegetation will be limited to the actual site of the conservation project and necessary access routes. Placement of temporary access roads, staging areas, and other facilities shall avoid and limit disturbance to habitat as much as possible. Disturbance of native shrubs, woody perennials or tree removal the streambank or stream channel shall be avoided or minimized to the fullest possible extent. If trees over 6" dbh (diameter at breast height) are removed, they will be replaced at a 3:1 ratio, unless the site is being restored to historical or other designated habitat conditions. If riparian vegetation will be disturbed, it will be replaced with similar species. Finished grades will not be steeper than 2:1 side slopes unless pre-construction condition is so steep that site conditions prohibit a 2:1 slope on the final grade. All access roads and trails will be re-contoured to pre-project slope conditions or appropriate angles of repose and decommissioned and rehabilitated following completion of the project. If access will be required in subsequent years, roads will be barricaded to prevent unauthorized access, but slopes will not be required to be re-contoured to pre-project conditions. Special care will be given to stands of riparian habitat of a size greater than 0.5 acres. To the greatest extent possible, project activities will avoid thinning out stands of riparian vegetation to minimize potential for increased predation. If vegetation removal is required in or around stands of this size, riparian vegetation will be cleared by hand, leaving as much as possible of the root wad and base of plants intact. Following completion of construction, poles and branches will be replanted on banks. Implementation of practices shall minimize all potential contributions of sediment to waterways, and will result in short-term disturbance resulting in insignificant amounts of fine sediment during construction. To the greatest extent possible, excavated materials will be re-integrated on site. In the rare situations where excavated material is not used in the implementation of the practice it will be removed and placed at sites that have no direct connectivity to a waterway. Upon completion of grading, slope protection of all disturbed sites will be provided prior to the end of the construction season through a combination of permanent vegetative treatment, mulching, geotextiles, and/or rock. Only native plant species or non-invasive, non-persistent grass species will be used.
Limitations on Construction Equipment	Equipment operators will ensure that contamination of habitat does not occur during routine operations. The use or storage of petroleum-powered equipment shall be accomplished in a manner to prevent the potential release of petroleum materials into waters of the state (Fish and Game Code 5650). All workers shall be informed of the importance of preventing spills and of the appropriate measures to take should a spill occur.

	The following precautionary measures will be adhered to: 1. Schedule excavation and grading activities for dry weather periods between June 15 and October 31. 2. A contained area is designated for equipment storage, short-term maintenance, and refueling. It is located 100 feet from waterbodies. If site conditions (property size) make this 100-foot distance infeasible, these activities will occur at the maximum distance possible from aquatic areas. 3. Vehicles are inspected for leaks and repaired immediately. 4. Leaks, drips and other spill are cleaned up immediately to avoid soil or groundwater contamination. 5. Major vehicle maintenance and washing are done off site. 6. All spent fluids including motor oil, radiator coolant, or other fluids and used vehicle batteries are collected, stored, and recycled as hazardous waste off site. 7. All construction debris and sediments are taken to appropriate landfills or in the case of sediments, disposed of away in upland areas or off-site. 8. Dry cleanup methods (i.e. absorbent materials, cat litter, and/or rags) are used whenever possible. If water is used, the minimal amount required to keep dust levels down is used. 9. Spilled dry materials are swept up immediately. Heavy equipment shall not be used in flowing or standing water, except to cross a stream or pond to access the work site. When possible, equipment shall use existing ingress or egress points and/or perform work from the top of the creek banks. Use of heavy equipment shall be avoided, where feasible, in a channel bottom with rocky or cobbled substrate. If access to the work site requires heavy equipment to travel on a rocky or cobbled substrate, a rubber tire loader/backhoe is the preferred vehicle. Only after this option has been determined impossible will the use of tracked vehicles be considered. The amount of time this equipment is stationed, working, or traveling within the creek bed will be minimized. When heavy equipment is used, woody debris and vegetation will be replaced to a similar density with native species. No staging will occur in wetlands. If it is not feasible to completely avoid movement of construction vehicles through wetlands, whenever possible rubber tired vehicles will be used or a mat will be laid down prior to moving across these areas. Additional measures for in-channel work in fish-bearing streams: When work is conducted in fish-bearing streams, the following additional measures will be implemented. • Oil absorbent and spill containment materials will be located on site when mechanical equipment is present and in operation. If a spill occurs, (1) no additional work will occur in-channel until mechanical equipment has been inspected and the leak has been repaired, (2) the spill has been contained, and (3) the DFG and NMFS are contacted to evaluate the impacts of the spill. • All questionable motor oil, coolant, transmission fluid, and hydraulic fluid hoses, fitting, and seals on construction equipment will be replaced. All mechanical equipment will be inspected on a daily basis to ensure there is no motor oil, transmission fluid, hydraulic fluid, or coolant leaks. All leaks will be repaired in the equipment staging area or other suitable location (away from watercourses) prior to resumption of construction activity. • Hydraulic fluids in mechanical equipment working within the active stream channel shall not contain organophosphate esters.

	• Construction equipment will be staged at least 100 feet from any watercourse with direct connectivity to Class 1 streams. If site conditions (property size) make this 100-ft distance infeasible, these activities will occur at the maximum distance possible from the watercourse. Equipment will be parked in the staging area when not in use. Equipment will not be parked or stored near the active channel. • During construction the operator will not dump any trash or construction debris into the wetted channel. • During the project activities, all trash and food that may attract potential predators of salmonids (*e.g.*, raccoons, birds, *etc*.) will be properly contained, removed from the work site, and disposed of daily.
Revegetation and Removal of Exotic Plants	The project area shall be restored to pre-construction condition or better. All exposed soil resulting from the project's construction activities shall be revegetated using live planting, seed casting or hydroseeding. Any stream bank area left barren of vegetation as a result of the implementation or maintenance of the practices shall be restored to a natural state by seeding, replanting, or other agreed upon means with native trees, shrubs, and/or grasses prior to the close of the construction season of the project year. Soil exposed as a result of construction, soil above rock riprap, and interstitial spaces between rocks shall be revegetated by live planting, seed casting, or hydroseeding prior to the close of the construction season. Annual inspections for the purpose of assessing the survival and growth of revegetated areas and the presence of exposed soil shall be conducted for two years following the end of the project installation. For projects that have removed native vegetation, post-construction revegetation success shall be equivalent or better to the pre-project condition provided in the project description. Revegetation success will be documented in the annual report provided to the regulatory agencies each year. The spread or introduction of exotic plant species shall be avoided to the maximum extent possible by avoiding areas with established native vegetation during project activities, restoring disturbed areas with native species where appropriate, and post-project monitoring and control of exotic species. Removal of invasive exotic species shall be strongly recommended. Mechanical removal (hand tools, weed whacking, hand pulling, brush raking) of exotics shall be done in preparation for establishment of perennial plantings. To the greatest extent possible, vegetation will be removed by hand. To the extent possible, revegetation should be implemented at the same time removal of exotic vegetation occurs. All plant material will be disposed of in a manner that will not allow re-establishment to occur. Native plants characteristic of the local habitat type shall be the preferred alternative when implementing and maintaining the practices in natural areas. Non-invasive, non-persistent grass species (*i.e*., barley grass) may be used as nurse crops or for their temporary erosion control benefits to stabilize disturbed slopes until natives are established.
Conditions for Erosion Control	Nearly all of the conservation practices included under the permit coordination program are designed to control erosion and sedimentation. However, the construction and installation of the practices can potentially result in short term, minor erosion or sedimentation. The following measures will be used to prevent or minimize sediment deposition as a result of implementation and maintenance of projects. Earthmoving activities will be completed prior to October 31. For any other work conducted during the winter period (generally defined as October 15 through May 15), all inactive work areas (inactive for a five-day period) shall have all necessary soil stabilization practices in place two days after identification of inactivity or before a rain event, whichever comes first.

	Erosion control and sediment detention devices shall be incorporated into the project design and implemented at the time of construction. These devices shall be in place prior to the onset of rains for the purposes of minimizing fine sediment and sediment/water slurry input to flowing water, and of detaining water to retain sediment on-site. These devices will be placed at all locations where the likelihood of sediment input exists. Sediment collected in these devices shall be disposed in a location where it will not re-enter the waters of the state. Projects that may result in increased in-stream turbidity will require regular monitoring of turbidity levels both upstream and downstream of the project site. Various techniques for turbidity monitoring that could be utilized include: observation and photo documentation of water quality by a qualified monitor; photo documentation of suspended sediment through photographing water samples; and/or use of either a Secchi disc or an optical turbidity meter. In general, qualitative approaches will be used for most projects. If changes in turbidity are noted through qualitative approaches, quantitative approaches such as Secchi discs or optical meters will be required to quantify turbidity. If quantitative monitoring is being conducted instream turbidity resulting from project activities shall not exceed 20 NTU for a period longer than 1 hour at any time. If instream turbidity exceed 20 NTU for a period longer than 1 hour, all activities will cease until for a period of 3 hours or until turbidity is less than 20 NTU. The project site shall be restored to pre-construction condition or better. Streambank, ground and/or soil (except for soil in agricultural fields) exposed as a result of construction, and soil above toe-rock shall be revegetated by live planting, seed casting, or hydroseeding prior to the close of the construction season of the project year. All debris, sediment, rubbish, vegetation or other material removed from waterway will be removed to a location where they shall not re-enter the waters of the state.
Limitations on Work in Streams and Permanently Ponded Areas	If it is necessary to conduct work in or near a live stream, the workspace will be isolated from flowing water to prevent sedimentation and turbidity. Prior to construction activities, sandbag cofferdams, straw bales, silt fences, culverts or visqueen (diversions) will be installed to divert streamflow away from or around workspace at an appropriate rate to maintain downstream flows during construction. Projects that may result in increased in-stream turbidity will require regular monitoring of turbidity levels both upstream and downstream of the project site. Various techniques for turbidity monitoring will be utilized and include: observation and photo documentation of water quality by a qualified monitor; photo documentation of suspended sediment through photographing water samples; and/or use of either a Secchi disc or an optical turbidity meter. In general, qualitative approaches will be used for most projects. If changes in turbidity are noted through qualitative approaches, quantitative approaches such as Secchi discs or optical meters will be required to quantify turbidity. If quantitative monitoring is being conducted, instream turbidity will not exceed 20NTU for a period longer than 1 hour at any time. If instream turbidity exceed 20 NTU for a period longer than 1 hour, all activities will cease until for a period of 3 hours or until turbidity is less than 20 NTU. The maintenance of projects will not be allowed to deliver sediment to a clean bottom of stream channel. A “clean” bottom is characterized by natural stream substrate (cobbles, gravel and small stones or similar to background conditions). If the substrate of a seasonal pond, creek, stream or water body is altered during work activities and the alteration is not the goal of the practice being implemented (*i.e*. channel stabilization), it will be returned to approximate pre-construction conditions after the work is completed, unless the NMFS or DFG determine that other measures should be implemented. All debris, sediment, rubbish, vegetation or other material removed from the channel banks, channel bottom, or sediment basins will be removed to a location where they will not re-enter

	the waters of the state. All petroleum products, chemicals, silt, fine soils, and any substance or material deleterious to fish, plant, or bird life will not be allowed to pass into, or be placed where it can pass into the waters of the State. Fish-Bearing Streams vs. Non-Fish-Bearing Streams If a project requires dewatering any area (with the exception of a fish-bearing stream), either a pump will remove water to an upland disposal site, or a filtering system will be used to collect the water and return clear water to the creek. Impacts to the stream from water retuning from upslope pumping will be avoided through monitoring of turbidity of water returning to the channel. If turbidity is present, the water will be treated by pumping into a settling pond or pumped through a vegetative riparian buffer. If dewatering in a fish-bearing stream is proposed as part of a project implemented under the permit coordination program, the RCDSCC or cooperator will use a qualified fish biologist as described below to capture and relocate fish to suitable habitat upstream or downstream, away from the work site. Projects will not dewater more than 300 contiguous feet of stream channel.
Limitations on use of Herbicides	Except as noted below, no pesticides or soil amendments will be used in the streambed or bank to hasten or improve the growth of critical area plantings. Soil amendments will only be used when the establishment of new plants is prevented by poor soil structure that cannot support new plantings. In most circumstances, organic soil amendments will be used to ensure successful establishment of restored vegetation associated with the practices. In situations where organic amendments will not guarantee adequate establishment of restored vegetation, application rates for non-organic soil amendments will be based on soil nutrient testing and will utilize slow release or split applications to minimize leaching or runoff into water bodies. Soil amendments may be used on stream banks above the normal high water mark during the year of planting if necessary. Where it is necessary to use herbicides to control established stands of exotics or to control the invasion of exotics into restoration plantings, the herbicides must be applied according to registered label conditions. When herbicides are used near waterways, an approved glyphosate-based herbicide that is safe to use in or near aquatic habitats would be utilized. To the greatest extent feasible, herbicide will be hand-painted on target species to minimize exposure of non-target species to the herbicide. Roundup® will not be used within 100 feet of open water. Rodeo®, or an equivalent with no-to-low aquatic toxicity can be used in this zone. Glyphosate with the surfactant Agri-Dex is also permitted in this zone. No other surfactants or formulations will be used in this zone without the prior written approval of the Service. Herbicides must be applied directly to plants and may not be spread upon any water or where they can leach into waterways in subsequent rains. Herbicides may be applied to control established stands of non-native species including Vinca, Ivys, and Brooms.

3. Additional Environmental Protection Measures and Conditions for Specific Conservation Practices

In addition to the general measures and conditions listed above in Table 2, additional environmental protection measures will be applied to specific conservation practices. The specific conservation practice is identified by the NRCS electronic field guide number in the first column of Table 3 below. Table 3 provides the details of each specific conservation practices and the additional environmental practices that will be employed if and when those conservation practices are implemented under the Program.

Table 3. Additional Environmental Protection Measures and Conditions for Specific Conservation Practices

Wetland Management (657, 659, 356, 587, 644)	• Activities will seek to emulate properly functioning conditions (PFCs)[12.] • Activities will not result in significant loss of vegetation or disturbance which would negatively impact species' habitat, cover, food, *etc*.
Upland Wildlife Habitat Management (645, 382, 516, 614)	•Pipelines will be installed and maintained only when a streambed is dry or properly dewatered. Trenching associated with this practice must be a minimum of three feet deep. If dewatering in a fish-bearing stream is proposed as part of a project implemented under the permit coordination program, the RCDSCC or cooperator will use a qualified fish biologist as described below to capture and relocate fish to suitable habitat upstream or downstream, away from the work site. •No development of new water sources is included in this practice.
Planting (342, 612, 422, 391) and Restoration and Management of Declining Habitats (643)	•Measures will be taken to plant a sufficient diversity of native species to ensure that monocultures are not established as a result of this practice. Non-native invasive species will not be planted. •To meet success criteria for revegetation or invasive plant removal, maintenance will occur as needed within appropriate temporal limitations. •When implementing or maintaining a Planting above the high water line, a filter fabric fence, fiber rolls and/or straw bales will be utilized, if needed, to keep sediment from flowing into the adjacent water body. Straw bales would likely be separated and used as mulch. Planting above the ordinary high water mark that does not involve soil disturbance may occur at any time of the year. When vegetation is sufficiently mature to provide erosion control, it may be appropriate to remove the fence, fiber rolls and/or hay bales. Annual review for at least two years by RCDSCC will occur until the critical area planting is established to control erosion.
Sediment Basin and Water (350) [with or without Structure for Water Control (638)]	•Maintenance may occur only after August 1st. •Sediment basins will not be constructed in a stream channel or other permanent water bodies. The work may involve grading along one shore of the stream to remove gullies or eroded banks prior to building a stream-side basin. Where construction of a sediment basin includes a pipe or structure that empties into a stream, an energy dissipater will be installed to reduce bank scour.
Grade Stabilization Structure (410)	Construction and maintenance of Grade Stabilization Structures in streams or creeks that support a fishery, including non-anadromous fisheries, are not covered under this program. Structures may be installed in gullies and non-fish bearing streams. Projects seeking to implement conservation practices in fish habitat will seek individual permits from appropriate regulatory agencies.
Grassed Waterway (412)	•Grassed waterways will be designed to convey the runoff associated with the contributory area along a prescribed slope to avoid erosion caused by the concentrated flow. The waterway may not divert water out of the natural subwatershed.
Underground Outlet (620)	• A properly sized energy dissipater will be installed to reduce bank scour and bank erosion.
Stream Crossing (578)	•Construction and maintenance of any practice that results in a change in volume of flow in streams are not covered under this program.

[12] PFCs are defined as riparian-wetland areas that are functioning properly when adequate vegetation, landform, or large woody debris is present to dissipate stream energy associated with high waterflows, thereby reducing erosion and improving water quality; filter sediment, capture bedload, and aid floodplain development; improve flood-water retention and ground-water recharge; develop root masses that stabilize streambanks against cutting action; develop diverse ponding and channel characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses; and support greater biodiversity (Bureau of Land Management, 1998).

Obstruction Removal (500)	•Wherever possible, hand labor will be used, however, heavy equipment such as mechanical excavators may be employed in some projects, particularly where the project requires removal of larger items such as cars and appliances. Large objects removed from the area will be lifted out of the area, ensuring the obstruction is kept upright during removal and will not be pulled, dragged, or pushed to minimize potential impacts to the aquatic and terrestrial habitats. If the obstruction is easily accessible and/or an access road is adjacent to the work site, equipment such as a boom would be used to lift the obstruction out of the area. Additional limitations on the use of construction equipment are described in the General Project Conditions under Limitations on Construction Equipment. •If dewatering in a fish-bearing stream is proposed as part of a project implemented under the permit coordination program, the RCDSCC will or cooperator will use a qualified fish biologist as described below to capture and relocate fish to suitable habitat upstream or downstream, away from the work site.
Streambank Protection (580)	•Construction and maintenance of any practice that results in a change in volume of flow in streams that support a fishery are not covered under this program. •No creosote treated timbers will be used for grade or channel stabilization structures, bulkheads or other instream structures. No gabions or concrete will be used in fish bearing streams or streams leading to fish bearing streams. In non-fish-bearing streams they may be used above the high water mark.
Stream Channel Stabilization (584)	•Construction and maintenance of any practice that results in a change in volume of flow in streams that support a fishery are not covered under this program. •Sediment removal from the stream channel or ponds may occur if it will improve biological functioning of the stream and restore channel capacity. Sediment removal would occur as a one-time event and not a repeated maintenance practice to improve channel capacity. Sediment removal may not occur in a flowing stream or standing water. Sediment will not be stored in wetlands or waterways.
Structure for Water Control (587)	• Crossings will be consistent with California Department of Fish and Game's "Culvert Criteria for Fish Passage" (April 2003) and National Marine Fisheries Service Southwest Region's "Guidelines for Salmonid Passage as Stream Crossings" (September, 2001). RCDSCC. • Ditch relief culverts which outlet onto a slope >30% will have a review letter by an engineer.
Fish Passage Improvement (396)	•Construction and maintenance of any practice that results in a change in volume of flow in streams that support a fishery are not covered under this program. •Practices will be designed and implemented in accordance with the California Department of Fish and Game's *California Salmonid Stream Habitat Restoration Manual.* •Design of in-stream structures will be compatible with the dynamic nature of watercourse to encourage natural geomorphic processes as much as possible. In-stream structures in fish-bearing streams will be designed in consultation with staff from NMFS and DFG.
Access Road (Improvement) (560)	•Road improvements in Santa Cruz County will be modeled on the "Handbook for Forest and Ranch Roads: A guide for planning, designing, constructing, reconstructing, maintaining and closing wildland roads," by William Weaver and Danny Hagens (1994).

4. <u>Additional measures for protection of CCC or S-CCC steelhead and CCC coho salmon for projects implemented under the Santa Cruz Countywide Permit Coordination Program</u>

In addition to the general project conditions and protection measures established for implementation of each conservation practice, the following measures will be implemented during activities taking place where listed species are present.

a. Tiered Approach for Project Requirements

The conservation practices and environmental protection measures have been categorized in a tiered impact matrix, an approach developed by the Central Coast Regional Water Quality Control Board (CCRWQCB). For instance, *Tier I* level projects have the lowest impacts on riparian and aquatic habitat, whereas *Tier IV* projects are likely to dewater sections of stream and relocate ESA listed species. The matrix provides a framework of environmental protection measures that increase in complexity with a practice's or project's increasing potential impact. The tiering strategy was developed as a way to ensure maximum protection of CCC coho salmon, given their poor condition throughout their range.

Tier I projects occur in the upland areas only and implemented between April 15 to October 31 of each year. *Tier II* Projects occur in streams or riparian areas where salmon and steelhead do not exist (*e.g*., ephemeral channels in headwater streams or screened irrigation ditches). In order to implement the *Tier II* project, a stream may be dewatered temporarily and the project will be constructed from June 15 to October 31 of each year. *Tier III* and *IV* projects occur in streams that have salmonids or salmonid critical habitat with the distinction that *Tier IV* projects occur in areas of high importance for coho salmon due to presence of coho salmon or impacts to their critical habitat. RCDSCC will provide an electronic Pre-Construction Notification (PCN) by May 15th for *Tier III* and *IV* projects to NMFS. *Tier III* projects occur in areas where steelhead are present or their critical habitat occurs and temporary dewatering of the site from June 15 to October 31 will be needed. *Tier IV* will have greater restrictions because of the presence of CCC coho salmon and their critical habitat. Projects that occur in Core Areas[13] or having a high intrinsic potential (IP>0.70), as identified in the draft Coho Recovery Plan (NMFS 2010), or occur where coho salmon are present will adopt methods to avoid or minimize take of coho salmon. These methods will be described in the PCN sent to NMFS. Projects that occur where coho salmon are known to be present will be surveyed (via snorkel) 1-2 weeks prior to implementation. If coho are detected in the surveyed area, the project will be postponed for 2 weeks and NMFS will be immediately contacted to discuss implementation of the project[14]. Implementation of *Tier IV* projects will occur from June 15 to October 31.

b. Notification and Reporting

PCNs for *Tier III* and *IV* projects will include information on listed species and critical habitat present in the area affected by the project, potential impacts to listed species and critical habitat, and all applicable environmental protection and mitigation measures. After reviewing the draft PCN, if NMFS staff determine there are projects that require further review and/or modification to meet the criteria established by the Program, RCDSCC will be contacted to discuss those specific projects and resolve the outstanding issues. During these discussions, if NMFS determines additional protection measures or other project revisions are required, they will work with the RCDSCC to determine how these measures/revisions will be incorporated into the

[13] Core areas are focal points for immediate restoration based on recent occupancy of CCC coho salmon (NMFS 2010).

[14] The purpose of conducting snorkel surveys is to determine the implementation schedule of the proposed project. If coho are present, NMFS and the RCDSCC will discuss delaying the project in order to avoid impacts to coho. In the case the project cannot be delayed, and coho are present, RCDSCC will not have take exemption beyond what is authorized in this biological opinion (Refer to Section X: Incidental Take Statement).

project. Following discussions with NMFS, the RCDSCC will send a revised PCN (Final PCN) to NMFS, incorporating any revisions necessary. Projects that cannot be revised to fit into the Program will be consulted on separately if they may affect listed salmonids.

Following the annual review of projects, the RCDSCC will provide an annual Program status report to NMFS of all *Tier III* and *Tier IV* projects implemented during the previous year, as well as projects previously constructed that were monitored during the year, and describe each project's purpose, area affected, size and volume of material removed or placed, and the participating landowners. Conservation benefits achieved by each project will be discussed, and any net gains in riparian or other aquatic habitat described. Finally, all actions taken to avoid adverse effects to listed species will be noted, any incidental take of Federally listed species noted and explained, and photo documentation of site conditions prior to and following construction provided. The report will be submitted to NMFS by January 31 of each year.

c. Guidelines for Monitoring and Relocation of Listed Salmonids

1. For work proposed when listed species are present, a qualified individual approved by NMFS will act as a biological monitor during construction. The biological monitor will monitor construction activities and instream habitat and performance of sediment control devices. The biological monitor will have the authority to halt work activity and recommend measures for avoiding adverse effects. Work activity will not recommence until the situation is resolved to the satisfaction of the biological monitor.

2. If a streamflow diversion is necessary in a stream known to contain listed salmonids, the biological monitor will monitor placement and removal of the streamflow diversion structures. If necessary a pump will be used to dewater the work space and will be screened according to NMFS' screening criteria (NMFS 2001).

3. If streamflow is diverted in fish bearing streams, or the biological monitor determines coho salmon or steelhead must be removed from a workspace, or if an unanticipated event occurs that could impact individuals of either of these species, he/she will notify a NMFS approved fisheries biologist qualified to capture and transport salmonids.

The NMFS approved fisheries biologist will capture any steelhead and coho salmon stranded in residual wetted areas as a result of the streamflow diversion and/or workspace dewatering and relocate them to a suitable location immediately upstream or downstream of the project area. The biologist will note the number of steelhead and coho salmon observed, the number relocated, and the date and time of the collection and relocation. One or more of the following NMFS collection methods will be used by a qualified fisheries biologist: electrofishing, seine netting, or other collection method approved by NMFS.

5. <u>Five-year Program Assessment and Evaluation</u>

After five years of implementation of the Program, following the 2017 construction season, the RCDSCC will compile a comprehensive assessment of the Program and all projects constructed to that point. The assessment will summarize the types of projects and conservation practices installed, and discuss the Program's successes and challenges, including the regulatory process

required to comply with the Program's permits and authorizations. The compiled data will be utilized to provide NMFS with a general overview of the Program's effectiveness, and provide an opportunity for NMFS and RCDSCC to discuss needed improvements before continuance of the next five years of the Program. At the end of the Program (2022) a final comprehensive assessment will be submitted to NMFS.

6. Maintenance and Monitoring of Conservation Practices Under the Program

RCDSCC will perform formal status reviews on all RCDSCC funded projects during the life of the contract (expected to be 1-2 years after installation) or until the practices are functioning as planned for all projects constructed under the Program. An additional 20 percent of all projects will be randomly selected for review by RCDSCC for up to five years following installation. These reviews will include an examination of the practices' current condition, a comparison of as-built conditions with the original plans (including all plantings and other vegetation), and recommendations for resolving any problems encountered.

7. Training for Project Workers

Trainings the RCDSCC provide for Program implementation will clearly stipulate the special conditions of this Program and the level of attention RCDSCC and Corps project staff is required to expend on design and monitoring duties for projects that may affect listed species.

Prior to activities that result in the disturbance of habitat or individuals of any listed species, all project workers including RCDSCC staff, consultants and construction workers, and cooperators, will be given information on the listed species in the project area, a brief overview of the species' natural history, the protection afforded the species by the Endangered Species Act, and the specific protective measures to be followed during implementation of the practices. Qualified RCDSCC staff or biological consultants will conduct the training and supply the information.

8. Compliance and Non-Compliance

Prior to implementation of the conservation practices, the RCDSCC will notify the cooperator of the Program's environmental protection measures and all permit conditions through the signed Cooperator Agreement. If the work carried out is not consistent with design standards of the Program, including the environmental protection measures as proposed, RCDSCC staff will notify the cooperator and work directly with them to resolve the problem.

If a cooperator fails to work with the RCDSCC and resolve the problem, the RCDSCC will notify the cooperator in writing that their activities are inconsistent with the Program and that the cooperators' actions are no longer covered by the Program's permits and agreements. The cooperator will then be responsible for obtaining individual permits from the appropriate regulatory agency and will be held liable for all violations.

B. Compliance with the California Endangered Species Act

For projects funded by grants, the funding assurance will be the Grant agreement itself, showing monies earmarked for implementation of necessary protection measures during implementation

and follow-up monitoring, or another mechanism approved by DFG in writing. For projects that do not have grant funding, the applicant will be required to provide security in the form of a cash deposit in an amount approved in writing by DFG and held by DFG or secured by another mechanism approved in writing by DFG. The funding security will be held until the required measures have been successfully implemented

For projects implemented under the Program that have the potential to result in incidental take of coho salmon, the RCDSCC will provide DFG with a copy of the implementation grant or Farm Bill contract necessary to implement the required mitigation measures. The required mitigation measures that will be funded are: 1) projects in known coho salmon streams and/or within areas delineated as Core Implementation Areas in NMFS's 2010 draft Coho Salmon Recovery Plan that require dewatering; 2) the dewatering and relocation plan; 3) relocation efforts by a qualified fisheries biologist; and 4) a biological monitor during project implementation.

C. Action Area

The action area is defined as all areas affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The area considered in this biological opinion includes all waterways and adjacent lands in Santa Cruz County. The project area boundary (Santa Cruz County) encompasses a total of 284,930 acres (445 square miles) and is situated between the San Francisco Bay and Monterey Peninsula along the central coast of California. RCDSCC works primarily on private lands although RCDSCC has performed some work on State Parks lands and Soquel State Demonstration Forest in the County.

Major watersheds in Santa Cruz County include the San Lorenzo River, Scott, Soquel, Aptos, and Waddell Creeks, and the Corralitos and Salsipuedes subbasins of the Pajaro River. Smaller watersheds in the County include Arana Gulch, Rodeo Gulch, and the North Coast streams of San Vicente, Molino, Liddell, Laguna, Davenport, Majors, San Andreas, Baldwin, and Wilder creeks. Associated waterways and land uses within Santa Cruz County watersheds are described in detail in the biological assessment (Corps 2010).

III. ANALYTICAL FRAMEWORK

A. Jeopardy Analysis

In accordance with policy and regulation, the jeopardy analysis in this biological opinion relies on four components: (1) the Status of the Species, which evaluates the CCC coho salmon ESU and CCC and S-CCC steelhead DPS's range-wide conditions, the factors responsible for that condition, and the species' likelihood of both survival and recovery; (2) the Environmental Baseline, which evaluates the condition of this listed species in the action area, the factors responsible for that condition, and the relationship of the action area to the likelihod of both survival and recovery of this listed species; (3) the Effects of the Action, which determines the direct and indirect effects of the proposed Federal action and the effects of any interrelated or interdependent activities on this species in the action area; and (4) Cumulative Effects, which evaluates the effects of future, non-Federal activities in the action area on this species.

The jeopardy determination is made by adding the effects of the proposed Federal action and any Cumulative Effects to the Environmental Baseline and then determining if the resulting changes in species status in the action area are likely to cause an appreciable reduction in the likelihood of both the survival and recovery of this listed species in the wild.

The jeopardy analysis in this biological opinion places an emphasis on the range-wide likelihood of both survival and recovery of this listed species and the role of the action area in the survival and recovery of this listed species. The significance of the effects of the proposed Federal action is considered in this context, taken together with cumulative effects, for purposes of making the jeopardy determination. We used a hierarchical approach that focuses first on whether or not the effects on salmonids in the action area will impact their respective population. If the population will be impacted, we assess whether this impact is likely to affect the ability of the population to support the survival and recovery of the DPS or ESU.

B. Adverse Modification Determination

This Biological Opinion does not rely on the regulatory definition of destruction or adverse modification of critical habitat at 50 CPR 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.

The adverse modification analysis in this Biological Opinion relies on four components: (1) the Status of Critical Habitat, which evaluates the range-wide condition of critical habitat for the CCC coho salmon ESU and CCC and S-CCC steelhead DPS in terms of primary constituent elements (PCEs - sites for spawning, rearing, and migration), the factors responsible for that condition, and the intended conservation value of the critical habitat overall; (2) the Environmental Baseline, which evaluates the condition of critical habitat in the action area, the factors responsible for that condition, and the conservation value of the critical habitat in the action area; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the PCEs in the action area and how that will influence the conservation value of affected critical habitat units; and (4) Cumulative Effects, which evaluates the effects of future, non-Federal activities in the action area on the PCEs and how that will influence the conservation value of affected critical habitat units.

For purposes of the adverse modification determination, we add the effects of the proposed Federal action on CCC coho salmon and CCC and S-CCC steelhead critical habitat in the action area, and any Cumulative Effects, to the Environmental Baseline and then determine if the resulting changes to the conservation value of critical habitat in the action area are likely to cause an appreciable reduction in the conservation value of critical habitat range-wide. If the proposed action will negatively affect PCEs of critical habitat in the action area we then assess whether or not this reduction will impact the value of the DPS or ESU critical habitat designation as a whole.

C. Use of Best Available Scientific and Commercial Information

To conduct the assessment, NMFS examined an extensive amount of information from a variety of sources. Detailed background information on the biology and status of the listed species and critical habitat has been published in a number of documents including peer reviewed scientific journals, primary reference materials, and governmental and non-governmental reports. Additional information regarding the effects of the project's actions on the listed species in question, their anticipated response to these actions, and the environmental consequences of the actions as a whole was formulated from the aforementioned resources, the biological assessment (BA) for this project (USACOE 2010), the five-year evaluation report (RCDSCC 2011) and information developed during several meetings among NMFS, Corps, RCDSCC and NRCS staff. For information that has been taken directly from published, citable documents, those citations have been referenced in the text and listed at the end of this document.

IV. STATUS OF THE SPECIES AND CRITICAL HABITAT

Available information indicates that the following DPS of steelhead and ESU of coho salmon and designated critical habitats are found within the action area of Santa Cruz County.

CCC Distinct Population Segment (DPS) steelhead
Reaffirmed listed as threatened on January 5, 2006 (71 FR 834);
Critical Habitat for CCC DPS steelhead
Designated on September 5, 2005 (70 FR 52488);
S-CCC DPS steelhead
Reaffirmed listed as threatened on January 5, 2006 (71 FR 834);
Critical Habitat for S-CCC DPS steelhead
Designated on September 5, 2005 (70 FR 52488)**;**
CCC Evolutionarily Significant Unit (ESU) coho salmon
Listed as Endangered on June 28, 2005 (70 FR 37160); and
Critical Habitat for CCC ESU coho salmon
Designated on May 5, 1999 (64 FR 24049).

A. Species Description and Life History of CCC and S-CCC Steelhead

In this opinion, NMFS assesses four population viability parameters to help us understand the status of CCC and S-CCC steelhead and the population's ability to survive and recover. These population viability parameters are: abundance, population growth rate, spatial structure, and diversity (McElhany *et al.* 2000). NMFS has used existing information to determine the general condition of each population and factors responsible for the current status of the DPS.

We use these population viability parameters as surrogates for numbers, reproduction, and distribution, the criteria found within the regulatory definition of jeopardy (50 CFR 402.20). For example, the first three parameters are used as surrogates for numbers, reproduction, and distribution. We relate the fourth parameter, diversity, to all three regulatory criteria. Numbers, reproduction, and distribution are all affected when genetic or life history variability is lost or

constrained resulting in reduced population resilience to environmental variation at local or landscape-level scales.

1. General Life History

Steelhead are anadromous forms of *O. mykiss*, spending some time in both freshwater and saltwater. Steelhead young usually rear in freshwater for one to three years before migrating to the ocean as smolts. Migration to the ocean usually occurs in the spring. Steelhead may remain in the ocean for one to five years (two to three years is most common) before returning to their natal streams to spawn (Busby *et al*. 1996, Moyle 2002). The distribution of steelhead in the ocean is not well known. Coded wire tag recoveries indicate that most steelhead tend to migrate north and south along the continental shelf (Barnhart 1986). The timing of upstream migrating CCC and S-CCC steelhead adults is correlated with higher flow events, in winter or spring. In contrast to other species of *Oncorhynchus*, steelhead may spawn more than one season before dying (iteroparity); although one-time spawners represent the majority.

Because rearing juvenile steelhead reside in freshwater all year, adequate flow and temperature are important at all times. Outmigration appears to be more closely associated with size than age. In Waddell Creek, Shapovalov and Taft (1954) found steelhead juveniles migrating downstream at all times of the year, with the largest numbers of young-of-year (YOY, or Age 0+) and yearlings (Age 1+) steelhead moving downstream during spring and summer. Cover is an important habitat component for juvenile steelhead, both as a velocity refuge and as a means of avoiding predation (Meehan and Bjornn 1991). However, juvenile steelhead tend to use riffles and other habitats not strongly associated with cover during summer rearing more than other salmonids (Everest and Chapman 1972, Smith and Li 1983). Young steelhead feed on a wide variety of drifting aquatic and terrestrial insects (Everest and Chapman 1972, Moyle 2002). In winter, juvenile steelhead become less active and hide in available cover, including gravel or woody debris (Moyle 2002).

Water temperature can influence the metabolic rate, distribution, abundance, growth, and habitat use of rearing juvenile steelhead (Smith and Li 1983, Barnhart 1986, Bjornn and Reiser 1991, Myrick and Cech 2005). Optimal temperatures for steelhead growth range between 10 and 20 degrees (°) Celsius (C) (Hokanson *et al.* 1977, Wurtsbaugh and Davis 1977, Myrick and Cech 2005). Fluctuating diurnal water temperatures are also important for the survival and growth of salmonids (Busby *et al.* 1996). Suspended sediment concentrations, or turbidity, also can influence the distribution and growth of steelhead (Bell 1973, Sigler *et al*. 1984, Newcombe and Jensen 1996). Bell (1973) found suspended sediment loads of less than 25 milligrams per liter (mg/L) were typically suitable for rearing juvenile steelhead.

2. Status of CCC Steelhead DPS

Historically, approximately 70 populations[15] of steelhead existed in the CCC steelhead DPS (Spence *et al.* 2008). Many of these populations (about 36) were independent, or potentially

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

independent, meaning they had a high likelihood of surviving for 100 years absent anthropogenic impacts (Spence *et al.* 2008). The remaining populations were dependent upon immigration from nearby CCC steelhead DPS populations to ensure their viability (McElhaney *et al.* 2000, Bjorkstedt *et al.* 2005).

While historical and present data on abundance are limited, CCC steelhead numbers are substantially reduced from historical levels. A total of 94,000 adult steelhead were estimated to spawn in the rivers of this DPS in the mid-1960's, including 50,000 fish in the Russian River – the largest population within the DPS (Busby *et al.* 1996). Near the end of the 20th Century, McEwan (2001) estimated the wild run population in the Russian River Watershed was between 1,700-7,000 fish. Abundance estimates for smaller coastal streams in the DPS indicate low but stable levels with recent estimates for several streams (Lagunitas, Waddell, Scott, San Vicente, Soquel, and Aptos creeks) of individual run sizes of 500 fish or less. For more detailed information on trends in CCC steelhead abundance, see: NMFS 1997 and Good *et al.* 2005.

Some loss of genetic diversity has been documented and attributed to previous among-basin transfers of stock and local hatchery production in interior populations in the Russian River (Bjorkstedt *et al.* 2005). Reduced population sizes and fragmentation of habitat in San Francisco streams has likely also led to loss of genetic diversity in these populations.

CCC steelhead have experienced a serious decline in abundance and long-term population trends suggest a negative growth rate. This indicates the DPS may not be viable in the long term. DPS populations that historically provided enough steelhead immigrants to support dependent populations may no longer be able to do so, placing dependent populations at increased risk of extirpation. However, because CCC steelhead have maintained a wide distribution throughout the DPS, roughly approximating the known historical distribution, CCC steelhead likely possess a resilience that is likely to slow their decline relative to other salmonid DPSs or ESUs in worse condition. The most recent status review concludes steelhead in the CCC steelhead DPS remain "likely to become endangered in the foreseeable future" (Good *et al.* 2005), a conclusion that was consistent with a previous assessment (Busby *et al.* 1996) and supported by the most recent NMFS Technical Recovery Team work (Spence *et al.* 2008). On January 5, 2006, NMFS issued a final determination that the CCC steelhead DPS is a threatened species, as previously listed (71 FR 834). Data from the 2008/09, 2009/10, and 2010/2011 adult CCC steelhead returns indicate a decline in returning adults across their range compared to other recent returns (*e.g.*, 2006/2007, 2007/2008) (Jeffrey Jahn, NMFS, personal communication, December 2011). For example, counts of returning adult steelhead in 2009 and 2010 at both Warm Springs Dam (Dry Creek, Russian River Watershed) and Lake Mendocino Dam (East Fork Russian River) have been lower than the average returns the previous ten years (Jeffrey Jahn, NMFS personal communication, December 2011). In the most recent status update (NMFS 2011, Williams *et al.* 2011) NMFS concluded there was no evidence to suggest the status of the CCC steelhead DPS has changed appreciably since the publication of previous status review (Good *et al.* 2005) and therefore CCC steelhead remain listed as threatened (76 FR 76386).

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definition as a starting point from which they define four types of populations (not all of which are mentioned here).

2. Status of S-CCC steelhead DPS

Annual steelhead runs within the S-CCC steelhead DPS have declined dramatically. Estimates for the five historically highest producing steelhead watersheds (Pajaro, Salinas, Carmel, Little Sur and Big Sur rivers) dropped from 4,740 adults in 1965, to less than 500 returning adult fish in 1996. While a majority of watersheds historically supporting *O. mykiss* are still occupied, steelhead run-sizes have been sharply reduced in most watersheds – all four of the largest watersheds (Pajaro, Salinas, Nacimiento/Arroyo Seco, and Carmel Rivers) have experienced declines in run-sizes of 90 percent or more (Boughton *et al*. 2006).

Data suggests steelhead populations exist in most streams within the geographic boundaries of the DPS, though NMFS' Biological Review Team (BRT) is concerned the two larger river systems, the Pajaro and Salinas basins, are much degraded and have steelhead runs significantly reduced in size (Good *et al*. 2005). The Pajaro and Salinas basins are ecologically distinct from the populations in the Big Sur area and San Luis Obispo County; therefore, their degradation affects the DPS's spatial structure and diversity (Good *et al*. 2005). The Interior Coast Range populations (*e.g*., Pajaro and Salinas basins) are likely to be highly variable, due to their inland position (less winter rainfall, and prone to hot dry summers) and the long migration corridors through alluvial valleys, likely to have been impassable in some drought years, even before the development of water resources in these basins (Boughton 2006). The strongest BRT concern was for spatial structure, but abundance and productivity were also a concern (Good *et al*. 2005). A much larger (on average) run is likely necessary in the Interior Coast Range in order to compensate for the high year-to-year variability in run size (Boughton 2006). In the most recent status update (NMFS 2011, Williams *et al.* 2011) NMFS concluded there was no evidence to suggest the status of the S-CCC steelhead DPS has changed appreciably since the publication of previous status review (Good *et al.* 2005) and therefore S-CCC steelhead remain listed as threatened (76 FR 76386).

B. Species Description and Life History of Coho Salmon

The life history of coho salmon in California has been well documented by Shapovalov and Taft (1954) and Hassler (1987). In contrast to the life history patterns of other anadromous salmonids, coho salmon in California generally exhibit a relatively simple 3-year life cycle (Shapovalov and Taft 1954, Hassler 1987). Adult salmon typically begin the freshwater migration from the ocean to their natal streams after heavy late-fall or winter rains breach the sand bars at the mouths of coastal streams (Sandercock 1991). Delays in river entry of over a month are not unusual (Salo and Bayliff 1958, Eames *et al.* 1981). Migration continues to March, generally peaking in December and January, with spawning occurring shortly after returning to the spawning grounds (Shapovalov and Taft 1954).

Coho salmon are typically associated with small to moderately-sized coastal streams characterized by heavily forested watersheds; perennially-flowing reaches of cool, high-quality water; dense riparian canopy; deep pools with abundant overhead cover; instream cover consisting of large, stable woody debris and undercut banks; and gravel or cobble substrates.

Female coho salmon choose spawning sites usually near the head of a riffle, just below a pool, where water changes from a laminar to a turbulent flow and there is small to medium gravel substrate. The flow characteristics of the location of the redd usually ensure good aeration of eggs and embryos, and flushing of waste products. The water circulation in these areas also facilitates fry emergence from the gravel. Preferred spawning grounds have nearby overhead and submerged cover for holding adults; water depth of 10 to 54 cm; water velocities of 20 to 80 cm/s; clean, loosely compacted gravel (1.3 to 12.7 cm diameter) with less than 20 percent fine silt or sand content; cool water (4 to 10°C) with high DO (8 mg/l); and an intergravel flow sufficient to aerate the eggs. The lack of suitable gravel often limits successful spawning in many streams.

Each female builds a series of redds, moving upstream as she does so, and deposits a few hundred eggs in each. Fecundity of coho salmon is directly proportional to female size; coho salmon may produce deposit from 1,000 to 7,600 eggs (reviewed in Sandercock 1991). Briggs (1953) noted a dominant male accompanies a female during spawning, but one or more subordinate males also may engage in spawning. Coho salmon may spawn in more than one redd and with more than one partner (Sandercock 1991). Coho salmon are semelparous (they spawn once and then die). The female may guard a nest for up to two weeks (Briggs 1953).

The eggs generally hatch between 4 to 8 weeks, depending on water temperature. Survival and development rates depend on temperature and DO levels within the redd. According to Baker and Reynolds (1986), under optimum conditions, mortality during this period can be as low as 10 percent; under adverse conditions of high scouring flows or heavy siltation, mortality may be close to 100 percent. McMahon (1983) found that egg and fry survival drops sharply when fines make up 15 percent or more of the substrate. The newly-hatched fry remain in the gravel from two to seven weeks until emergence from the gravels (Shapovalov and Taft 1954).

Upon emergence, fry seek out shallow water, usually along stream margins. As they grow, they often occupy habitat at the heads of pools, which generally provide an optimum mix of high food availability and good cover with low swimming cost (Nielsen 1992). Chapman and Bjornn (1969) determined that larger parr tend to occupy the head of pools, with smaller parr found further down the pools. As the fish continue to grow, they move into deeper water and expand their territories until, by July and August, they are in the deep pools. Juvenile coho salmon prefer well shaded pools at least 1 meter deep with dense overhead cover; abundant submerged cover composed of undercut banks, logs, roots, and other woody debris; preferred water temperatures of 12 to 15°C (Brett 1952, Reiser and Bjornn 1979), but not exceeding 22 to 25°C (Brungs and Jones 1977) for extended time periods; DO levels of 4 to 9 mg/l; and water velocities of 9 to 24 cm/s in pools and 31 to 46 cm/s in riffles. Water temperatures for good survival and growth of juvenile coho salmon range from 10 to 15°C (Bell 1973, McMahon 1983). Growth is slowed considerably at 18°C and ceases at 20°C (Stein *et al.* 1972, Bell 1973).

Preferred rearing habitat has little or no turbidity and high sustained invertebrate forage production. Juvenile coho salmon feed primarily on drifting terrestrial insects, much of which are produced in the riparian canopy, and on aquatic invertebrates growing in the interstices of the substrate and in the leaf litter in the pools. As water temperatures decrease in the fall and winter months, fish stop or reduce feeding due to lack of food or in response to the colder water, and

growth rates slow down. During December-February, winter rains result in increased stream flows and by March, following peak flows, fish again feed heavily on insects and crustaceans and grow rapidly.

In the spring, as yearlings, juvenile coho salmon undergo a physiological process, or smoltification, which prepares them for living in the marine environment. They begin to migrate downstream to the ocean during late March and early April, and out migration usually peaks in mid-May, if conditions are favorable. Emigration timing is correlated with peak upwelling currents along the coast. Entry into the ocean at this time facilitates more growth and, therefore, greater marine survival (Holtby *et al.* 1990). At this point, the smolts are about 10 to 13 cm in length. After entering the ocean, immature salmon initially remain in nearshore waters close to their parent stream. They gradually move northward, staying over the continental shelf (Brown *et al.* 1994). Although they can range widely in the north Pacific, movements of coho salmon from California are poorly known.

Juvenile coho salmon prefer water temperatures of 12-15° C, but not exceeding 22-25° C for extended time periods, dissolved oxygen levels of 4-9 milligrams per liter, and water velocities of 9-24 centimeters per second (cm/s) in pools and 31-46 cm/s in riffles. Water temperatures for good survival and growth of juvenile coho salmon range from 10-15° C (Bell 1973, McMahon 1983). Growth is slowed considerably at 18° C and ceases at 20° C (Stein *et al.* 1972, Bell 1973).

1. Status of CCC Coho Salmon ESU

Historically, the CCC coho salmon ESU was comprised of approximately 76 coho salmon populations. Most of these were dependent populations that needed immigration from other nearby populations to ensure their long term survival, as described above. Historically, there were 11 functionally independent populations and one potentially independent population of CCC coho salmon (Spence et al. 2008). Most of the populations in the CCC coho salmon ESU are currently doing poorly. Low abundance is common, and some populations have been extirpated, as described below. A comprehensive review of estimates of historic abundance, decline, and present abundance of coho salmon in California is provided by Brown et al. (1994). They estimated that annual spawning numbers of coho salmon in California ranged between 200,000 and 500,000 fish in the 1940's, which declined to about 100,000 fish by the 1960's, followed by a further decline to about 31,000 fish by 1991. Brown et al. (1994) concluded that the abundance of California coho salmon had declined more than 94 percent since the 1940's, with the greatest decline occurring since the 1960's. More recent abundance estimates vary from approximately 600 to 5,500 adults (NMFS 2005). Recent NMFS status reviews (NMFS 2001, NMFS 2003, Good et al. 2005, Spence et al. 2008) indicate that the CCC coho salmon are likely continuing to decline in number.

CCC coho salmon have also experienced acute range restriction and fragmentation (Brown and Moyle 1991). Adams et al. (1999) found that in the mid 1990's coho salmon were present in 51 percent (98 of 191) of the streams where they were historically present, and documented an additional 23 streams within the CCC coho salmon ESU in which coho salmon were found for which there were no historical records.

Recent genetic research in progress by both the NMFS Southwest Fisheries Science Center and the Bodega Marine Laboratory has documented a reduction in genetic diversity within subpopulations of the CCC coho salmon ESU (Bjorkstedt et al. 2005). The influence of hatchery fish on wild stocks has also contributed to the lack of diversity through outbreeding depression and disease. Available information suggests that CCC coho salmon abundance is very low, and the ESU is not able to produce enough offspring to maintain itself (population growth rates are negative). CCC coho salmon have experienced range constriction, fragmentation, and a loss genetic diversity.

Many dependent populations that supported the species overall numbers and geographic distributions have been extirpated. This suggests that populations that historically provided support to dependent populations via immigration have not been able to provide enough immigrants for many dependent populations for several decades. The near-term (10 - 20 years) viability of many of the extant independent CCC coho salmon populations (Garcia River, Gualala River, Russian River, and San Lorenzo River) is of serious concern.

Recent information clearly documents CCC coho salmon abundance is very low, and the ESU is not able to produce enough offspring to maintain itself (population growth rates are negative). CCC coho salmon have experienced range constriction, fragmentation, and a loss of genetic diversity. Many subpopulations that may have acted to support the species' overall numbers and geographic distribution have been lost. The extant subpopulations of CCC coho salmon may not have enough fish to survive additional natural and human caused environmental change. Recent status reviews for CCC coho salmon conclude that this ESU is presently in danger of extinction (NMFS 2001, NMFS 2003, NMFS 2005, Spence and Williams 2011). On June 28, 2005, NMFS issued a final listing determination for CCC coho salmon, changing their status from threatened to endangered (70 FR 37160). The most recent status review (Spence and Williams 2011) document conditions for CCC coho salmon have worsened since the last status review in 2005 (NMFS 2005). Poor returns from 2006 to 2010 indicate that adult abundance for CCC coho salmon ESU have continued to decline to the extent risk of extinction has increased since Good *et al*. concluded CCC coho were in danger of extinction in 2005.

C. Status of Critical Habitat

The condition of critical habitat for the CCC and S-CCC steelhead DPS and CCC coho salmon ESU, specifically its ability to provide for their conservation, has been degraded from conditions known to support viable salmonid populations. NMFS has determined present depressed population conditions are, in part, the result of multiple human-induced factors affecting critical habitat including: logging, agricultural and mining activities, urbanization, stream channelization, dams, wetland loss, and water withdrawals, including unscreened diversions for irrigation. Impacts of concern include 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 large woody debris, degradation of water quality, removal of riparian vegetation resulting in increased stream bank erosion, increases in sedimentation in streams from upland areas, loss of shade (higher water temperatures) and loss of nutrient inputs (61 FR 56138, Busby *et al.* 1996, 70 FR 52488). Depletion and storage of natural river and stream flows have drastically altered natural hydrologic cycles in many of the

stream and stream reaches designated as critical habitat. Alteration of flows results in migration delays, loss of suitable habitat due to dewatering and blockage; stranding of fish from rapid flow fluctuations; entrainment of juveniles into poorly screened or unscreened diversions, and increased water temperatures harmful to salmonids. Overall, current condition of CCC steelhead and CCC coho salmon critical habitat is degraded, and may not provide the conservation value necessary for the recovery of the species.

D. Factors Responsible for Stock Declines: Changes to Habitat and Other Impacts

Threats to naturally reproducing steelhead and coho salmon are numerous and varied. Among the most serious and ongoing threats to the survival of CCC and S-CCC steelhead and CCC coho salmon are changes to natural hydrology, habitat degradation, and complete habitat loss. The following discussion provides an overview of the types of practices and conditions adversely affecting steelhead DPSs and coho salmon ESUs in California watersheds, in general, with some specific examples of impacts in the geographical area encompassed by the ESU/DPSs.

1. Habitat Degradation and Destruction

A major cause of the decline of steelhead and coho salmon is the loss or severe decrease in quality and function of essential habitat features. Most of this habitat loss and degradation has resulted from anthropogenic watershed disturbances caused by agriculture, logging, urban development, water diversion, wetlands loss and management, confined animal facilities, road construction, erosion and flood control, dam building, and grazing. Most of this habitat degradation is associated with the loss of essential habitat components necessary for salmon and steelhead survival. For example, the loss of deep pool habitats from sedimentation and stream flow reductions has reduced rearing and holding habitat for juvenile and adult salmonids.

The alteration of estuaries in conjunction with increased sediment loads in watersheds from land use activities and lower stream flows due to water diversions and other watershed changes, have delayed sandbar breaching in the fall, delayed adult steelhead and coho salmon migration into streams, reduced and degraded estuary rearing habitat for juveniles, and created a poor freshwater-saltwater transition zone for steelhead smolts (DFG 1998). These factors alter habitat conditions and have exacerbated the adverse effects of natural environmental variability from such factors as drought, poor ocean conditions, and predation.

2. Natural Stochastic Events

Natural events such as droughts, landslides, floods, and other catastrophes have adversely affected steelhead and coho salmon populations throughout their evolutionary history and yet these species persisted, due in large part to a flexible life history (for steelhead), high fecundity levels (for steelhead and coho salmon), and some degree of straying in reproductive adults allowing recolonization of streams (for steelhead and coho salmon). The effects of natural events are often exacerbated by anthropogenic changes to watersheds such as logging, road building, and water diversion at a rate exceeding the species ability to adapt to rapidly changing conditions. Additionally, the ability of species to rebound from natural stochastic events may be

limited as a result of other existing anthropogenic factors *(e.g.*, barriers to migration) or depressed populations.

3. Ocean Conditions

Variability in ocean productivity has been shown to affect salmon production both positively and negatively. Beamish and Bouillion (1993) showed a strong correlation between North Pacific salmon production and their marine environment from 1925 to 1989. Beamish *et al.* (1997) noted decadal-scale changes in the production of Fraser River sockeye salmon that they attributed to changes in the productivity of the marine environment. They also reported the dramatic change in marine conditions occurring in 1976-77 (an El Nino year), when an oceanic warming trend began. These El Nino conditions, which occur every 3-5 years, negatively affect ocean productivity. Johnson (1988) noted increased adult mortality and decreased average size for Oregon's Chinook *(O. tshawytscha)* and coho salmon during the strong 1982-83 El Nino. It is unclear to what extent ocean conditions have played a role in the decline of CCC and S-CCC steelhead and CCC coho salmon; however, ocean conditions have likely affected populations throughout their evolutionary history and the species has likely adapted to these events.

4. Water Manipulation

Depletion and storage of natural flows have drastically altered natural hydrological cycles in many California rivers and streams including within streams providing habitat to CCC and SCCC steelhead and CCC coho salmon. Alteration of streamfiows has increased juvenile salmonid mortality for a variety of reasons: migration delay resulting from insufficient flows or habitat blockages; loss of usable habitats due to dewatering and blockage; stranding offish resulting from rapid flow fluctuations; entrainment of juveniles into unscreened or poorly screened diversions; and increased juvenile mortality resulting from increased water temperatures (Chapman and Bjornn 1969, Berggren and Filardo 1993, 61 FR 56138).

5. Harvest

There are few good historical accounts of the abundance of steelhead and coho salmon harvested along the California coast (Jensen and Swartzell 1967). Early records did not contain quantitative data by species until the early 1950s. In addition, the confounding effects of habitat deterioration, drought, and poor ocean conditions on salmon and steelhead survival make it difficult to assess the degree to which recreational and commercial harvests have contributed to the overall decline of salmonids in West Coast rivers.

6. Artificial Propagation

Releasing large numbers of hatchery fish can pose a threat to steelhead and coho salmon stocks through genetic impacts, competition for food and other resources, predation of hatchery fish on juveniles Critical habitat for the CCC coho salmon ESU was designated by NMFS on May 5, 1999, and includes all accessible reaches of all rivers (including estuarine areas and tributaries) between Punta Gorda in northern California south to the San Lorenzo River (inclusive).

Excluded are areas above specific dams or above longstanding, naturally impassable barriers (*i.e.*, natural waterfalls in existence for at least several hundred years).

7. Marine Mammal Predation

Predation is not believed to be a major factor contributing to the decline of West Coast steelhead or coho salmon populations relative to the effects of fishing, habitat degradation, and hatchery practices. Predation may have substantial impacts in localized areas. Harbor seal (*Phoca vitulina*) and California sea lion (*Zalophus californianus*) numbers have increased along the Pacific Coast (NMFS 1999). However, at the mouth of the Russian River, Hanson (1993) reported foraging behavior of California sea lions and harbor seals with respect to anadromous salmonids was minimal. Hanson (1993) also stated predation on salmonids appeared to be coincidental with the salmonid migrations rather than dependent upon them.

8. Reduced Marine-Derived Nutrient Transport

Reduced marine-derived nutrient (MDN) transport to watersheds is another consequence of the past century of decline in salmon abundance (Gresh *et al.* 2000). MDN are nutrients accumulated in biomass by salmonids while in the ocean and transported back to their freshwater spawning sites. Salmon may play a critical role in the survival of their own species. MDN (from salmon carcasses) has been shown to be vital for the growth of juvenile salmonids (Bilby *et al.* 1996, Bilby *et al.* 1998). The return of salmon to rivers makes a significant contribution to the flora and fauna of both terrestrial and riverine ecosystems (Gresh *et al.* 2000). Evidence of the role of MDN and energy in ecosystems suggests this deficit may result in an ecosystem failure contributing to the downward spiral of salmonid abundance (Bilby *et al.* 1996). The loss of this nutrient source may perpetuate salmonid declines in an increasing synergistic fashion.

E. Additional Threats to Salmonids

Global climate change presents an additional potential threat to listed salmonids and their critical habitat. Modeling of climate change impacts in California suggests that average summer air temperatures are expected to increase (Lindley *et al.* 2007). Heat waves are expected to occur more often, and heat wave temperatures are likely to be higher (Hayhoe *et al.* 2004). Total precipitation in California may decline; critically dry years may increase (Lindley *et al.* 2007, Schneider 2007). The Sierra Nevada snow pack is likely to decrease by as much as 70 to 90 percent by the end of this century under the highest emission scenarios modeled (Luers *et al.* 2006). Wildfires are expected to increase in frequency and magnitude, by as much as 55 percent under the medium emissions scenarios modeled (Luers *et al.* 2006). Vegetative cover may also change, with decreases in evergreen conifer forest and increases in grasslands and mixed evergreen forests. The likely change in amount of rainfall in Northern and Central Coastal streams under various warming scenarios is less certain, although as noted above, total rainfall across the state is expected to decline. For the California North Coast, some models show large increases (75 percent to 200 percent) in rainfall amounts while other models show decreases of 15 percent to 30 percent (Hayhoe *et al.* 2004). Many of these changes are likely to further degrade CCC steelhead habitat by, for example, reducing stream flows during the summer and raising summer water temperatures. Estuarine productivity is likely to change based on changes in freshwater flows, nutrient cycling, and sediment amounts (Scavia *et al.* 2002). In marine

environments, ecosystems and habitats important to sub adult and adult salmonids are likely to experience changes in temperatures, circulation and chemistry, and food supplies (Feely *et al.* 2004, Brewer 2008, Osgood 2008, Turley 2008). The projections described above are for the mid to late 21st Century. In shorter time frames natural climate conditions are more likely to predominate (Cox and Stephenson 2007, Smith *et al.* 2007).

V. ENVIRONMENTAL BASELINE

The Environmental Baseline is an analysis of the effects of past and ongoing human and natural factors leading to the status of the species, its critical habitat and the ecosystem in the action area. 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 this consultation (50 CFR §402.02).

A. Status of the Species in the Action Area

1. Status of CCC Steelhead in Santa Cruz County

Steelhead are present in most of Santa Cruz County's streams that are accessible from the ocean including Waddell Creek, Scott Creek, San Vicente Creek, Laguna Creek, Majors Creek, Baldwin Creek, Wilder Creek, the San Lorenzo River, Arana Gulch, Rodeo Gulch, and Soquel Creek (CNDDB 2003) (Note: Pajaro populations are considered part of the S-CCC DPS described below).

McEwan and Jackson (1996) noted that steelhead in most streams tributary to San Francisco and San Pablo Bays have been extirpated, although small "fair to good" runs of steelhead reportedly occur in coastal Marin County tributaries. Only two estimates of historical (pre-1960s) abundance specific to this DPS are available for Santa Cruz County streams: the first reported an average of about 500 adults in Waddell Creek in the 1930s and early 1940s (Shapovalov and Taft 1954), and the second estimated 20,000 steelhead in the San Lorenzo River before 1965 (Johnson 1964). Recent data for the San Lorenzo River suggested that this basin had populations smaller than 15% of the size they had had 30 years previously (NMFS 2005).

At the Kingfisher Flat Hatchery, broodstock are taken by divers netting adults usually in Big Creek, a tributary to Scott Creek, below the hatchery, but can occur throughout the Scotts Creek system. Steelhead are also taken at a trap on the San Lorenzo River in Felton. San Lorenzo steelhead are kept separate and released back into the San Lorenzo Basin (NMFS 2005). Since 1976 when the MBSTP began operations at the Big Creek location, broodstock have been taken from either Scotts Creek or the San Lorenzo River and there have been no introductions into the broodstock (NMFS 2005).

2. Status of S-CCC Steelhead in Santa Cruz County

Current status of the population in the Santa Cruz County portion of the Pajaro River is

unknown. However, relatively detailed information on historical distribution of *O. mykiss* in the Pajaro River is available due to surveys conducted by Snyder (1913), DFG (Lollock 1968), Moyle *et al*. (1982), and Smith (1982). Nehlsen *et al* (1991) estimated adult steelhead escapement at less than 200 in the entire Pajaro River. Corralitos Creek is the first major tributary spawning steelhead can access as they migrate into the Pajaro River drainage. DFG records beginning in the 1930s, and Smith's (1982) later work, provide a comprehensive overview of steelhead and rainbow trout use in these streams. In late fall 1981, the mean density of smolt-sized steelhead at nine Corralitos Creek sites was 5.3 trout/meter, which was above the county-wide average. The mean density of smolt-sized steelhead at two sites in Brown's Valley Creek (tributary to Corralitos Creek) was 5.4 trout/meter, also, well above the countywide average (Titus *et al.* 2002).

The most recent estimate of steelhead population size (Nehlsen *et al*. 1991) indicate the Pajaro River population has declined significantly. McEwan and Jackson (1996) reported adult run estimates of 1,500, 1,000, and 2,000 in the Pajaro River for the years of 1964, 1965, and 1966, respectively. Nehlsen *et al*. (1991) estimated adult escapement in the Pajaro River at less than 200, and the primary factor cited as the cause of decline was habitat destruction. In Santa Cruz County, the lower Pajaro River and its tributaries are channelized, leveed, and dewatered. Virtually no mature riparian vegetation has been allowed to establish in the lower reaches due to agricultural and flood control activities. The river itself no longer provides suitable spawning or rearing conditions for steelhead because of high summer water temperatures, low summer stream flows and sandy or silty substrate (Harding ESE 2001). The current status of the Pajaro River steelhead population is uncertain although juvenile steelhead were present in all rearing tributaries in 1997 (K. R. Anderson, CDFG, pers. comm. of 9 July 1992, Smith unpublished data). Nehlsen *et al*. (1991) listed the Pajaro River steelhead stock as being at a high risk of extinction (Titus *et al*. 2000).

3. Status of CCC coho salmon in Santa Cruz County

Historically, coho salmon were believed to inhabit all or most of the accessible coastal streams along San Mateo and Santa Cruz County, possibly as many as 50 coastal drainages. By the 1960's coho salmon were present in seven stream systems in Santa Cruz County including Waddell Creek, Scott Creek, San Vicente Creek, San Lorenzo River System, Soquel Creek, Aptos Creek, and the lower Pajaro River System (Bryant 1994). According to Bryant (1994), of the streams and rivers known to historically support coho salmon south of San Francisco Bay (including rivers and streams in San Mateo, Santa Cruz, and Monterey counties) until the mid-1970's, only Scott Creek and Waddell Creek in Santa Cruz County have coho salmon returning (Bryant 1994). More recently coho salmon have also been found in San Vicente and Soquel Creeks[16] in Santa Cruz County (Kristen Kittleson, personal communication). Soquel Creek is south of the stated current range of the Central California Coast ESU and is south of the areas considered critical habitat for this ESU (64 FR 24049 24062). NMFS is proposing extending the range of CCC coho down to Aptos Creek (76 FR 6385), south of Soquel Creek. NMFS notes that recent observations of coho salmon in Laguna Creek from the winter of 2005-2006 were made by NMFS SWFSC. Recent survey information indicates only Scott had successful wild spawning in 2010/2011 (no juveniles detected in San Vincent Creek in 2011).

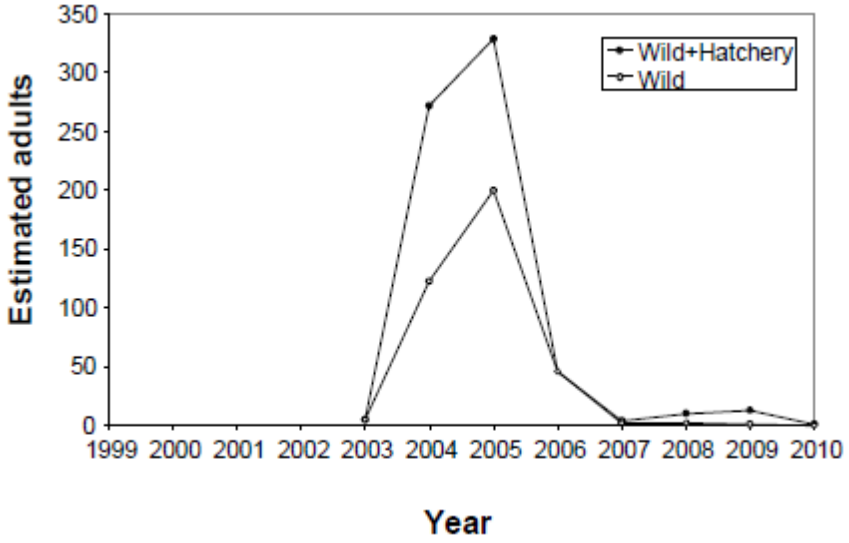
[16] Coho Salmon Recovery Plan for Central California Coast Coho salmon (NMFS 2010).

The Monterey Bay Salmon and Trout Program (MBSTP) has operated the Kingfisher Flat Hatchery, located on Big Creek, tributary to Scott Creek, since 1976 (NMFS 2003). Since 1976, only local brood stock have been used at the hatchery. In its 1996 coho salmon status review update, NMFS' biological review team (BRT), concluded that the Kingfisher Flat hatchery population should be considered part of this ESU and essential for its recovery (NMFS 2003). The MBSTP has produced few coho salmon for release in the last six years due to low adult returns to Scott Creek. In 2003, a captive broodstock program for coho salmon was initiated at Kingfisher Flat with oversight from the NMFS SWFSC (NMFS 2003). In 2011, the captive broodstock program for coho salmon had sufficient abundance of coho smolts to seed Scott Creek and other neighboring watersheds (Mathew Rowley, Kingfisher Flat Director, personal communication 2011).

Long-term, historical data on the abundance of coho salmon in streams within Santa Cruz County are limited. Records of adult spawners and outmigrating smolts from Waddell Creek between 1933 and 1942 (Shapovalov and Taft 1954) constitute the main historical record of abundance in the county. Jerry Smith (San Jose State University) has conducted juvenile surveys in Scott and Waddell creeks since 1992. Surveys have also been conducted regularly in the San Lorenzo River and its tributaries; between the mid-1980's and 2000 no juvenile coho salmon had been documented in the San Lorenzo River (NMFS 2001). Data from Waddell and Scott creeks indicate that over the past decade coho salmon were most abundant in 1993, 1996, and 1999. The 1994/1997/2000 brood lineage appears to have been extirpated from Waddell creek and is very weak in Scott Creek. Smith (2001) reported that juvenile coho salmon numbers were lower in 2000 than in any of the previous nine years. The 1992/1995/1998 brood lineage is considered to be particularly weak in Waddell Creek (NMFS 2001).

NMFS Southwest Fisheries Science Center review of coho salmon indicates populations of coho south of San Francisco Bay are extinct or nearly so (Spence and Williams 2011). Since the last formal review (Good *et al.* 2005) all evidence indicates conditions have worsened for populations in the ESU, especially populations south of San Francisco Bay. Scott Creek population abundance trends (shown in figure 1) unequivocally illustrate the increased risk of extinction.

Figure 1. Coho salmon redd counts, weir counts, and abundance estimates for Scott Creek (2003-210)



Population density data for CCC coho are sparse. RCDSCC implementation of a program similar to the proposed Program from 2005-2009, provides some data from dewatering and fish relocation activities. In the five-year evaluation report from RCDSCCC (2011), coho take estimates were developed in parallel with the steelhead estimates and were roughly based on historic density estimates of juvenile coho in affected streams. During the past 5 years, coho observations and resulting density estimates are significantly lower than the 0.21 fish/feet estimated from historic data, indicating that coho are on the brink of extirpation throughout the southern portion of their range (*i.e.*, in Santa Cruz County). In addition, survey data suggest that coho are not distributed equally across a stream, but are instead found in small pockets of suitable habitat (*i.e.*, deep pools) within the larger stream setting- thus making density data somewhat useless for estimating take of coho. Also, while the previous biological opinion allowed for capture of up to 31.5 coho a year and a total of 157 over the 5-year duration, zero coho were taken under the previous biological opinion.

a. Estimated number of juvenile CCC/S-CCC steelhead and coho salmon present in the action area

The estimated number of fish present in the action area and the rationale used to derive these population estimates per stream are discussed in Appendix B. Table 6 summarizes the population densities of CCC coho salmon, and CCC and S-CCC steelhead based on the best available information.

The methodology for estimating take of listed salmonids follows the approach developed in the prior biological assessment for the Program, which covered the Program from 2005-2009. A few key modifications have been made to the methodology based on the levels of incidental take recorded over the past 5 years. As mentioned previously, coho densities were significantly lower than estimated for implementation of the Program (2005-2009). Due to the low abundance of coho in the action area and the unequal distribution of coho in streams, NMFS and RCDSCC

expect that no more than 100 coho juveniles will need to be relocated during the life of the Program, with a maximum of 10 juvenile coho per year.

Table 6. Estimated densities of juveniles CCC/S-CCC steelhead and coho salmon, Santa Cruz County

ESU/DPS	Density Estimate (fish/ft)
CCC Coho salmon	<0.21[17]
CCC Steelhead	0.43
SCCC Steelhead	0.46

B. Status of Salmonid Habitat, including Critical Habitat in the Action Area

The current condition of most salmonid habitat, including critical habitat, in Santa Cruz County streams is degraded from conditions that are known to support robust populations of salmon and steelhead. Some areas of adequate habitat remain, along with a few areas of good quality. Table 7 summarizes the condition of coho salmon and steelhead habitat in Santa Cruz County streams.

Table 7. Summary of Habitat Condition for Coho salmon and Steelhead in Santa Cruz County Watersheds (Updated with data from 2010 CCC Coho Salmon Recovery Plan)

Watershed	Spawning Habitat	Juvenile Rearing Habitat
Waddell Creek	Good quality habitat for both coho salmon and steelhead. Waddell and Scott considered the best spawning habitats for anadromous species south of San Francisco. However spawning habitats are compromised by sedimentation and high levels of embeddedness.	Sub-adequate pool habitat, shelter habitat, and floodplain connectivity are major limiting factors articulated in the Coho Salmon Recovery Plan.
Scott Creek	Good quality habitat for both coho salmon and steelhead. Coho salmon habitat under-utilized. Waddell and Scott considered the best spawning habitats for anadromous species south of San Francisco. However, habitats are compromised by sedimentation and high levels of embeddedness.	Sub-adequate pool habitat, shelter habitat, and floodplain connectivity are major limiting factors articulated in the Coho Salmon Recovery Plan.
San Vicente Creek	Areas of good quality habitat exists for both coho salmon and steelhead, though recent observations indicate that spawning gravels	Rearing habitat for juvenile steelhead and coho salmon appear to be adequate. The lower reaches do contain deep pools and

[17] Previous juvenile density estimates for the 2005-2009 BO were estimated at 0.21 fish/ft based on historical information. No coho were found from 2005-2009 from activities conducted under the Program. Unless rapid recovery of spawning and rearing success occur in the near future, it can be assumed that density estimates will be less than 0.21.

Watershed	Spawning Habitat	Juvenile Rearing Habitat
	may be insufficient to support be for both species.	LWD, recent work on backwaters and future work to increase LWD should improve rearing conditions for coho salmon.
Laguna Creek	Spawning habitat quality varies.	Rearing habitat for juvenile steelhead adequate.
Majors (Coja) Creek	Spawning habitat for steelhead limited- gravels for steelhead scarce.	Rearing habitat poor for steelhead (better for resident trout in upstream sections).
Baldwin Creek	Salmonid spawning habitat exists, fair condition with large-sized substrate.	Juvenile rearing habitat apparently abundant and of high quality.
San Lorenzo River and Tribs	Spawning habitat quality varies throughout watershed. In general, spawning conditions are considered to be sub-optimal in the San Lorenzo River. Lower and middle San Lorenzo River have poor spawning conditions due to the input of high fine sediment loads from tributary streams. High quality spawning habitat occurs in localized patches in tributaries.	Juvenile production more limited by restricted rearing conditions resulting from low summer streamflow, shallow pool conditions, and the absence of good escape cover. In the middle and lower River, excessive fine sediment loads have resulted in high embeddedness in riffles and runs and a general loss of total habitat area. Rearing conditions remain adequate to support a high proportion of fast growing juveniles. In the upper River and tributaries, cooler temperatures and low primary productivity result in slow growing salmonids in the tribs. The dominant limiting factor for juvenile production is the presence of excessive sediment without enough large woody material to act as scour objects, thus reducing habitat depth and available escape cover.
Arana Gulch	Spawning habitat considered to be extremely poor. Substrate at the tails of pools where spawning would be likely is primarily comprised of silt and fine sand.	Rearing habitat generally limited due to shallow pool depths, lack of scour objects such as bedrock and large boulders.
Soquel Creek	Spawning habitat variable- extremely mobile streambed conditions result in low spawning success (washing away or burying spawning redds). High embeddedness in riffle and run habitat.	
Aptos Creek	Quantity and quality are good to very good for coho salmon.	Depth and shelter of pools, frequency of LWD, floodplain connectivity, and estuary function are poor for coho salmon.
Pajaro River and tributaries	Some favorable spawning areas in small portions of some tribs: upper Corralitos, Shingle Mill Gulch, and Rattlesnake Gulch.	Quality of habitat for juvenile rearing limited to portions of upper reaches of tribs: Corralitos, Shingle Mill Gulch, and Rattlesnake Gulch.

(Shapovalov and Taft 1954; Smith 1990; Bryant 1994; Titus *et al* 2000; Swanson Hydrology & Geomorphology & D.W. Alley and Associates 2002; Hagar, 2003; NMFS 2010).

4. Factors Responsible for Habitat Conditions in the Action Area

The main factors responsible for current salmon and steelhead habitat conditions in Santa Cruz County streams are described below and organized by the major factors responsible for current habitat conditions: sedimentation, water diversions, channelization, and loss of riparian vegetation and wood from streams. Impacts on estuaries and lagoons are also described.

a. Water Diversions

Water diversions and resulting decreases in stream flow are the most significant limiting factor for fisheries in the action area (NMFS 2010). Depletion and diversion of natural flows have altered natural hydrological cycles, and subsequent flows, in most streams inhabited by CCC and S-CCC steelhead and CCC coho salmon in Santa Cruz County. Alley (1998, 1999, 2000a, 2000b, 2002) documented many physical changes to salmonid habitats due to changes in streamflow in the San Lorenzo River. Reduction of flows negatively affect salmonid habitat by loss of usable habitats due to dewatering and blockage, stranding of fish resulting from rapid flow fluctuations; migration delays, entrainment of juveniles into unscreened or poorly screened diversions, and increased lethal and sublethal effects resulting from increased water temperatures (Bergren and Filardo 1993, Chapman and Bjornn 1968). Reduced flows degrade or diminish fish habitats via increased deposition of fine sediments in spawning gravels, decreased recruitment of new spawning gravels, and encroachment of riparian and non-endemic vegetation into spawning and rearing areas.

In the action area, Soquel Creek is listed as fully appropriated by the State Water Resources Control Board as is the San Lorenzo River during the summer. The stream diversions in Soquel Creek are so numerous that reaches are dry during the summer, thus completely eliminating historic salmonid rearing habitats (Alley, D.W. Alley and Associates, personal communication 2003). Much of Corralitos Creek is dry due to diversions in summer, and stream flows are almost non-existent in the anadromous reaches of Laguna and Liddell Creek during the summer low flow period due to municipal and agricultural water diversions (Ambrose, NMFS, personal observations 2001-2004). Over-pumping of the aquifers in the lower Pajaro Basin has resulted in extensive dewatering of Corralitos Creek which is probably the more productive steelhead tributary in the Pajaro River watershed.

Stream flows are almost non-existent in the anadromous reaches of Laguna and Liddell Creek during the summer low flow period due to municipal and agricultural water diversions. Natural variations of flow in the San Lorenzo River watershed cause wide fluctuations in the amount of fish habitat available from year to year. During dry years, average available rearing habitat is reduced by more than 50 percent. Stream diversions, as of 1978 (Santa Cruz County Planning Department, 1979), were estimated to further reduce available rearing habitat during dry years by approximately 20 percent. Additional water is being diverted for human population expansion in the San Lorenzo River area. Ground water within the Lompico Aquifer in the San Lorenzo Valley is overdrafted by as much as 450 percent (Haynes, San Lorenzo Valley Water Management Agency, personal communication 2001) and ground water levels have dropped as low as 90 feet below historic levels (Denise Duffy & Associates, Inc. 1999). San Lorenzo River is adjudicated during the summer months.

The precise amounts of water currently diverted, either directly or through groundwater drafting, are unknown. The information available indicates that water diversions are likely responsible for stream flow reductions resulting in degradation or loss of salmonid habitat in most watersheds in the county.

b. Sedimentation

Most of the studies on instream sediment in the action area have focused on the San Lorenzo River (Santa Cruz County Planning Department 1979, D. W. Kelley and Associates 1981, SWRCB 1982, Coats *et al.* 1982, Balance Hydrolics 1998, Santa Cruz Water Resources Program 2001, Swanson Hydrology & Geomorphology 2001) due in part to its large size relative to other County streams and the number of adverse instream impacts. Aquatic habitats in the San Lorenzo River have deteriorated considerably from historic conditions (Santa Cruz Planning Department 1979) due to increased rates of sediment input (Swanson Hydrology 2001) into the river. The high rates of sediment input have impaired salmonid spawning, feeding, and rearing habitats by burying spawning gravels, disrupting invertebrate (salmonid food) production, and filling in pools needed by salmonids for thermal and predator refuge. Sediment is considered by many fisheries experts to be the primary limiting factor to salmonid production in the San Lorenzo River (Alley *et al.* 2004).

In 1979, the County of Santa Cruz implemented the San Lorenzo River Watershed Plan (Plan) to assist in setting priorities for erosion control and protection of aquatic habitat in the San Lorenzo River and its tributaries. In addition to adoption of the Plan, the County adopted four other ordinances directly addressing erosion control, sedimentation, and slope stability at the County level.[18] Since the Plan's implementation in 1979, stream conditions have not substantially improved (Balance Hydrolgocis, Inc. 1998). The most compelling data available are from the Zayante and Bean Creek subwatersheds.[19] In these subwatersheds, the current streambed material is composed of finer bed material than observed in 1979, with fewer clean spawning gravels or cobbles and boulders for summer rearing of young fish. These results suggest actual conditions in the San Lorenzo River are worse than they were in 1979 for salmonids despite the County's various ordinances.

Similar degradation of habitat has occurred in the Pajaro River. Present land use practices continue to degrade water quality of the Pajaro River and many of its tributaries. The mainstem Pajaro River once supported spawning and rearing habitats (Snyder 1913) for S-CCC steelhead. Most spawning and rearing habitats are gone or degraded due to agricultural runoff throughout the watershed, high sedimentation rates in the upper watershed from gravel mining and urbanization, and in-channel erosion within the lower watershed from levee maintenance actions. Sedimentation from these activities has changed the streambed into a primarily sand dominated

[18] These ordinances are: the Santa Cruz County Erosion Control Ordinance; the Santa Cruz County Riparian Corridor and Wetlands Protection Ordinance; the Santa Cruz Sensitive Habitats Protection Ordinance; and Grading Regulations.

[19] One of the last streams where CCC coho salmon were observed prior to their extripation in the San Lorenzo River was Zayante Creek in 1981 (Smith 1982). Zayante and Bean creeks are not heavily urbanized and possess some of the better riparian habitat conditions observed in the San Lorenzo River watershed (J. Ambrose, NMFS, personal observations 2000-2005).

system no longer capable of supporting essential life functions for S-CCC steelhead.

Production from irrigated crops located on highly erodible lands in the lower Pajaro River and Watsonville Slough Complex have accelerated erosion, resulting in excessive sedimentation and associated transport of potentially toxic pesticide residues (AMBAG 1999) that can exceed water quality objectives established to protect aquatic life (RCDSCC 2002). Runoff from croplands directed to aged, failing, and poorly maintained infrastructure has caused severe erosion problems throughout the lower watershed (RCDSCC 2002). Sediment from runoff has buried larger substrates associated with typical riffle habitats (AMBAG 1999) important for steelhead feeding.

Reduction in sedimentation by implementing conservation practices under the Program from 2005-2009 improved water quality conditions and reduced deposition of fine sediment to spawning and rearing locations. The majority of conservation practices in 2005-2009 focused on upland sources of sediment by reducing sediment loading and chronic point-source contributions of sediment to waterbodies. Approximately 1,000 tons per acre per year (T/A/Y) of sediment, primarily in the San Lorenzo River watershed, was prevented from entering waterways and 6,900 T/A/Y of sediment was prevented from entering waterways in the Pajaro River watershed.

c. Channelization

Channelization is one of the largest impacts of urbanization (Mount 1995). Most aspects of channelization disrupt the equilibrium of a river; where a stream is straightened, the stream power will increase, often leading to channel and bank scouring as the stream attempts to reestablish meandering or braided patterns (Mount 1995). The ecological consequences of channelization include: loss, reduction, or alteration of habitat complexity, streamside or bank cover, and pool habitat; and elimination of spawning, rearing, and feeding areas for fish (Brookes 1988). The removal of riparian vegetation associated with channelization directly affects both aquatic and terrestrial communities through increased water temperatures and loss of a local source of energy input (Mount 1995).

In many Santa Cruz County streams, extensive channelization practices have occurred. For example, the Pajaro River and its Santa Cruz County tributaries have been impacted by flood control projects which have channelized many stream reaches. The lower 12 miles of the Pajaro River were straightened, shortened, and confined between levees due to a Corps flood control project authorized in 1948. The flood control project, and associated maintenance, resulted in habitat simplification, increased summer water temperatures, and a smolt out-migration barrier at Murphy's Crossing. Many of the lower tributaries *(e.g.,* Hughes Creek, Coward Creek) flow through areas dominated by agriculture and are relegated to the status of agricultural ditches. Channelization has occurred to such an extent in Tynan, Coward, and Thompson creeks that no suitable salmonid habitat remains in the lower portions of these watersheds (RCDSCC 2002).

d. Loss of Riparian Vegetation and Wood from Streams

Modifications to riparian corridors have reduced salmonid carrying capacity. Wood in and over streams creates cover from predators, and large woody debris often result in the localized scour

of deep pools that provide salmonids thermal refuge and hiding places from predators. The loss of riparian vegetation removes cover for fish over streams, and reduces the amount of wood that enters stream channels from tree death, windthrow, and bank erosion. The result is a reduction in a streams carrying capacity for juvenile fish, particularly coho salmon. Practices, including but not limited to logging, agriculture, and urban development, dating back to the early 1900's, have altered and degraded much of the riparian and instream habitat conditions along coastal streams in California, Oregon, and Washington (McMahon and Hartman 1988). In the CCC coho salmon ESU, watersheds that have increased agricultural and/or urban development also have depressed populations of coho salmon (NMFS 2010) in large part due to the removal or reduction of large wood elements in stream channels and floodplains. Thompson (2008) notes that steelhead juveniles are prevalent in association with large wood elements in interior basin watersheds and coho salmon productivity increases with complex channel structural elements, namely wood (National Research Council 1996; Justice 2007).

Many of the streams in Santa Cruz County have reduced riparian complexity, and most have gaps in the riparian corridor. A recent assessment of watershed conditions in the San Lorenzo River indicates that the lower and middle San Lorenzo River had between 11 and 20.5 percent gaps (per stream length) in the riparian corridor, respectively (Alley *et al.* 2004). The reduction in riparian cover widespread, evident in the Pajaro River, as low-lying areas have been cleared for urban and agricultural development (Fall Creek Engineering 2002).

The Program's first five years (2005-2009), resulted in 75 acres of habitat restored, with 28 acres restored along the lower reaches of Soquel Creek. Additionally, approximately 20 miles of salmonid habitat was improved in Santa Cruz County by increasing channel complexity, cover habitat, and spawning and rearing habitat by implementing Fish Stream Improvement conservation practices and removing obstructions.

e. Lagoon and Estuaries

The Pajaro River lagoon is contaminated from agricultural runoff and is 303(d) listed, pursuant to the Clean Water Act, for a variety of toxic substances by the State Water Quality Control Board. The San Lorenzo River lagoon has been reduced in size due to urban encroachment by the City of Santa Cruz and channelization practices. Illegal breaching of the San Lorenzo River results in periodic partial dewatering of the lagoon which is expected to flush rearing steelhead out into the ocean prior to their osmoregulatory transformation, resulting in their death. Many of the northern streams of Santa Cruz County no longer have lagoons due to the alignment of Highway 1 and railroad grades. The highway and railroad were constructed so as to eliminate the lagoons on Molino, San Vicente, and Liddell creeks. The hydrologic regimes for the Scott and Waddell lagoons are likely impaired due to the current alignment of the Highway 1 bridges. The lagoons of Laguna Creek and the San Lorenzo River are impaired from a lack of freshwater inflow resulting in increased salinity levels. The alteration and subsequent degradation of critical habitat in almost every lagoon in the action area has likely reduced salmonid carrying capacity in the County.

C. Previous Section 7 Consultations in the Action Area

On July 17, 1997, August 9, 1999, August 19, 2002, and January 11, 2006, NMFS completed informal consultations with the Corps (San Francisco District) for San Lorenzo River Channel Maintenance activities.

On December 11, 2003, NMFS issued a biological opinion to the Corps (Sacramento District) for their construction of the San Lorenzo River Bank Stabilization Project. The Incidental Take Statement for this project anticipated 43 juvenile steelhead would be captured and relocated, with a three percent mortality associated with capture and relocation activities.

On May 5, 2005, NMFS issued a biological opinion to the Corps (San Francisco District) for their construction of the San Lorenzo River Gravity Outlet Valve Replacement Project and Channel Maintenance Activities in the City of Sant Cruz, Santa Cruz County, by the City of Santa Cruz Public Works Department. In the biological opinion, NMFS concluded repair work to the gravity outlets and channel maintenance activities would not jeopardize listed salmonids or adversely modify their critical habitats. The Incidental Take Statement for this project anticipated no more than 6 juvenile steelhead would be captured and relocated, with three percent mortality associated with capture and relocation activities. The EFH consultation for Pacific salmon determined that EFH would only be temporarily adversely affected, and in this case, only one EFH recommendation was necessary.

On October 10, 2010, NMFS issued a biological opinion to the Corps (San Francisco District) for their repair of a water main by Soquel Creek Water District. In the biological opinion, NMFS concluded that the water main repair project would not jeopardize listed salmonids or adversely modify their critical habitats. The Incidental Take Statement for this project anticipated 33 juvenile steelhead would be captured and relocated, with a three percent mortality associated with capture and relocation activities. The EFH consultation for Pacific salmon determined that EFH would only be temporarily adversely affected, and in this case, only one EFH recommendation was necessary.

On July 18, 2006, NMFS re-issued a biological opinion to NRCS to implement conservation practices in Santa Cruz County. In the biological opinion, NMFS concluded that the Countywide Partners in Restoration Permit Program would not jeopardize listed salmonids or adversely modify their critical habitats. The Incidental Take Statement anticipated 2,664 CCC steelhead, 1,332 S-CCC steelhead, and 158 coho salmon would be captured and relocated. A five-year Evaluation of the Santa Cruz Countywide Partners in Restoration Permit Coordination Program report (Table 5) described the outcomes of the program, the number of projects implemented, the volumes of sediment retained, and the number of miles of salmonid habitat improved in Santa Cruz County. The implementation of the 2005-2009 Program resulted in 73 projects that improved approximately 20 miles of salmonid habitat and reduced 7,900 tons of sediment entering the streams during the lifetime of the Program. The changes in the Program are likely to continue to improve channel complexity and watershed condition. As mentioned previously, the status of CCC coho have continued to decline despite implementation of the Program from 2005-2009.

Table 5. Summary of Practices Implemented Under the Program from 2005-2009

	Practice	**# of sites practice implemented**	**Acres Restored**	**Total Annual Yards Sediment Saved**	**Miles of Salmonid Habitat Improved**
1	Access Road Improvement (560)	14	-	775	-
2	Critical Area Planting (342)	16	-	-	-
3	Diversion (362)	0	-	-	-
4	Filter Strip (393)	0	-	-	-
5	Fish Stream Improvement (395)	6	-	-	19
6	Grade Stabilization Structure (410)	1	0.1	20	-
7	Grassed Waterway (412)	3	2	600	-
8	Obstruction Removal	3	-	-	0.05
9	Pipeline (516)	0	-	-	-
10	Restoration and management of Declining Habitats (643)	12	87.3	-	-
11	Sediment Basins (350) [with or without water control (638)]	4	0.77	148	-
12	Streambank Protection (580)	5	0.2	6026	-
13	Stream Channel Stabilization (584)	0	-	-	-
14	Structure for Water Control (587)	9	252	-	-
15	Underground Outlet (620)	0	-	-	-

Section 10(a)(1)(A) research and enhancement permits and research under exemptions granted under section 4(d) of the ESA could potentially occur in Santa Cruz County in the future. Based on NOAA's Authorizations and Permits for Protected Species (APPS) website[20], there are currently twelve active section 10(a)(1)(A) research and enhancement permits issued that authorize research on salmonids in Santa Cruz County including: Permit 1105 issued to Hagar Environmental; Permit 13843 issued to D.W. Alley & Associates; Permit 13866 issued to Santa Cruz County; Permit 14516 issued to San Jose State University; Permit 14862 issued to California Department of Parks and Recreation; Permit 14922 issued to D.W. Alley & Associates; Permit 15034 issued to County of Santa Cruz; Permit 15824 issued to County of Santa Cruz; Permit 15974 issued to County of Santa Cruz; Permit 16015 issued to D.W. Alley & Associates; Permit 16033 issued to California Department of Parks & Recreation; and Permit 16318 issued to Hagar Environmental Science.

[20] https://apps.nmfs.noaa.gov/search/search.cfm

VI. EFFECTS OF THE PROPOSED ACTION

The purpose of this section is to identify the direct and indirect effects of the proposed action, and any interrelated or interdependent activities, on threatened CCC and S-CCC steelhead , CCC coho salmon, and designated critical habitat. Our approach was based on knowledge and review of the ecological literature concerning the effects of loss and alteration of habitat elements important to salmonids, including the PCEs of critical habitat. This information was used to gauge the likely effects of the proposed project via an exposure and response framework that focuses on what stressors (physical, chemical, or biotic), directly or indirectly caused by the proposed action, that salmonids and their critical habitat are likely to be exposed to. Next, we evaluate the likely response of salmonids and their critical habitat to these stressors in terms of changes to salmonid survival, growth and reproduction, and changes to the ability of PCEs to support the conservation value of critical habitat. Data to quantitatively determine the precise effects of the proposed action on these species and their critical habitat are sometimes limited or not available. Where this occurs, the assessment of effects focuses mostly on qualitative identification.

The Program is expected to implement five conservation practices per year (three instream projects and two upland sediment detention basins).[21] The purpose of many of these practices is to improve habitat for listed salmonids. However, there is the potential for adverse effects to listed salmonids and temporary adverse effects to their habitat, including critical habitat

Potential impacts NMFS identified to CCC coho salmon, CCC and S-CCC steelhead and their habitat from the proposed Program are described below. Specific impacts associated with each practice are summarized in Table 8 and are followed by a general discussion of potential impacts organized by activities.

Table 8. Summary of Potential Adverse Effects to Listed Species and Critical Habitat

Conservation Practice	Potential Positive Impacts on Salmonids and/or Salmonid Habitat	Potential for Adverse Effects to Salmonids and/or Salmonid Critical Habitat
1. Wetland Management (657, 659, 356, 587, 644)	Improvement of wetlands and restoration of wetlands on currently farmed or developed lands may result in improved water quality conditions for receiving waters.	No adverse effects anticipated.
2. Upland Wildlife Habitat Management (645, 382, 614, 516	This practice focuses on creation, restoration, and/or enhancement of upland habitat for wildlife species (*i.e* Ohlone Tiger Beetle). This practice may be used to install shelter, cover, and food, establish vegetation for	No anticipated adverse impacts.

[21] The estimate for conservation practices is based on project need, landowner demand, and previous experience in the Santa Cruz County watersheds. The number of projects in the Program may vary over its lifetime yet the maximums described above are limited by the capacity of RCDSCC for project management and implementation.

Conservation Practice	Potential Positive Impacts on Salmonids and/or Salmonid Habitat	Potential for Adverse Effects to Salmonids and/or Salmonid Critical Habitat
	shelter, food, and enable movement, and for manipulating vegetation to sustain optimal habitat conditions for upland species. The practice, if implemented in fish-bearing watersheds could result in greater run-off infiltration rates, reduced runoff velocity, and reduced sheet erosion or rilling. This would benefit salmonid habitat via reduced sediment delivery.	
3. Critical Area Planting (342, 612, 422, 391)	Stabilizes soil, reduces damage from sediment and runoff to downstream areas, improves riparian habitat; can improve vegetative canopy. Decreases yield of sediment and attached substances; traps sediments to improve downstream water quality.	No adverse effects anticipated. .
4. Sediment Basins (with or without water control) (350)	Decreases yield of sediment and attached substances; traps sediments to improve downstream water quality.	No adverse effects anticipated.
5. Grade Stabilization Structure (for use in gullies during the dry season) (410)	Decreases yield of sediment and attached substances.	No adverse effects anticipated.
6. Grassed Waterway (412	Decreases yield of sediment and attached substances; traps sediments to improve downstream water quality.	No adverse effects anticipated.
7. Underground Outlet (620	Practice may be associated with sediment basins. Decreases yield of sediment and attached substances; reduced erosion to improve downstream water quality.	No adverse effects anticipated.
8. Restoration and Management of Rare and Declining Habitats	Removal of exotic invasives and replacement with native vegetation improves overall habitat quality. Could result in an increase in water quantity in summer low-flow periods (*e.g.*, removal of *Arundo donax*).	Modification of logjams, increased turbidity during construction, and temporary dewatering of channels could result in temporary adverse effects to critical habitat as well as harm of individual fish. Dewatering and relocation of fish could stress fish and result in mortality.
9. Stream Habitat Improvement and Management	Improvements include the creation of pools and backwaters or modifications to the stream channel to improve fish passage to upstream spawning and	Modification of logjams, increased turbidity during construction, and temporary dewatering of channels could result in temporary adverse effects to

Conservation Practice	Potential Positive Impacts on Salmonids and/or Salmonid Habitat	Potential for Adverse Effects to Salmonids and/or Salmonid Critical Habitat
(395)	rearing habitats. Restoration of access to stream areas currently blocked by flashboard dams and other structures.	critical habitat as well as stress to individuals and mortality from relocation activities. .
10. Stream Crossing (578)	This practice will not benefit salmonids.	Potential for mortality during dewatering and relocation activities. Habitat disturbance until practice is fully installed. Temporary increases in sedimentation during construction.
11. Obstruction Removal (500)	Removes objects such as trash, abandoned automobiles and appliances, and other objects that degrade the salmonid habitat and/or water quality.	Potential for mortality during dewatering and relocation activities. Temporary increases in turbidity during construction and disturbance of riparian habitat. Potential for release of trapped fluids (from cars) during removal.
12. Streambank Protection (58	Stabilizes soil, reduces damage from sediment and runoff to downstream areas, improves riparian habitat; can improve vegetative canopy.	Potential for mortality during dewatering and relocation activities. Potential for adverse effects to critical habitat by removal of earthen banks and replacement with rock rip-rap or other bank hardening materials. This should result in permanent loss of habitat and affect watershed processes. Habitat disturbance until practice is fully installed. Temporary increases in sedimentation during construction.
13. Stream Channel Stabilization (584	Decreases yield of sediment and attached substances; improves downstream water quality.	Potential for mortality during dewatering and relocation activities. Some permanent loss of habitat function via loss of natural channel morphology processes. Habitat disturbance until practice is fully installed. Temporary increases in sedimentation during construction
14. Structure for Water Control (587	This practice will reduce chronic bank erosion from road and drainage culverts.	Temporary increases in sedimentation during construction leading to increased turbidity which could potentially adversely affect juvenile salmonids.
15. Access Roads (Improvement) (560	Decreases yield of sediment and attached substances; traps sediments to improve downstream water quality.	Temporary increases in sedimentation during construction.

Conservation practices 1-7 from Table 8 above are either upslope or do not occur in salmonid bearing streams and are anticipated to improve overall salmonid habitat conditions by reducing sedimentation. Due to their location in non-salmonid habitat, the limited number of projects per year, and their minimal adverse impacts on the environment, NMFS expects that practices 1-7, individually or in combination with the other practices in this proposed Program, are unlikely to

result in adverse effects to listed salmonids or their critical habitat. For example, even though the installation of a grade stabilization structure in a gully during the dry season may increase sediment entry to the gully via disturbed ground when fall/winter rains occur, the overall contribution of sediment from the gully to salmonid waters downstream will be reduced because the stabilization structure will prevent far more sediment from moving downstream from erosion within the gully.

NMFS' analysis of conservation practices 8-15 (Table 8) identified the following adverse effects to listed salmonids and critical habitat: 1) loss of instream cover and riparian shade, 2) dewatering of stream reaches and fish relocation activities, 3) turbidity and sedimentation, 4) toxic chemicals, and 5) changes to channel morphology.

A. Loss of Instream Cover and Riparian Shade

Under the program, logjams may be modified or removed a maximum of two times per year if they pose an immediate threat of destabilizing a bank. Modification of logjams has the undesirable effects of removing large woody debris from the stream habitat. Large wood is a critical habitat constituent for both steelhead and coho salmon. It performs many functions including providing refugia for salmonids, provide locations for deposition of spawning gravel, and act as obstructions to flow, causing local scour that influences channel morphology, contributing to the creation of pools and bars, function as natural grade control, all of which are important habitat constituents for salmonids.

Removal of streamside vegetation may be required for installation of some of the practices covered under the program but the potential adverse effects would be short-term. The RCDSCC propose to replace vegetation and monitor the revegetated areas to ensure success. In addition, it's anticipated that many of the areas where these practices will be installed have already been degraded (*e.g.*, failing slopes, already lacking vegetation), thus necessitating installation of such measures proposed under the Program. The program will include removal of invasive, non-native plant species, which would ultimately improve streamside habitat and replant critical areas with native plants. Revegetation with native riparian trees and shrubs is expected to improve water quality by increasing canopy cover, stabilizing streambanks, and filtering fine sediment from entering the stream, once revegetation reaches maturity. Revegetation is expected to reach maturity between 5-10 years after implementation and will not significantly impair PCEs of salmonid critical habitat because vegetation is expected to rehabilitate and increase the composition of native versus non-native species.

B. Dewatering Stream Reaches and Fish Relocation Activities

Projects that are *Tier III* or *IV* are expected to divert surface water to isolate a construction area. Stream flow diversions are expected to reduce and alter aquatic habitat conditions, including affecting macroinvertebrates (salmonid prey items). Dewatering could harm individual rearing juvenile coho salmon and steelhead by concentrating or stranding them in residual wetted areas before they are relocated (Cushman 1985). Rearing coho salmon and steelhead could be killed or injured if crushed during diversion and construction activities, though mortality is expected to be minimal due to relocation efforts prior to installation of the diversion. Fish that avoid capture

in the project(s) work area will likely die during dewatering activities due to desiccation or thermal stress.

NMFS anticipates temporary changes in stream flow within and downstream of individual project sites during dewatering activities. Where they occur, fluctuations in flow are anticipated to be small, gradual, and short-term. Stream flow in the vicinity of individual project sites should be the same as free-flowing conditions, except during dewatering. Stream flow diversion and dewatering are expected to temporarily reduce or alter aquatic habitat. NMFS anticipates that only a small reach of stream habitat (maximum stream length <300 feet) at each project site will be dewatered for in-channel excavation activities, representing a very minor portion of habitat currently utilized by coho salmon and steelhead in Santa Cruz County. The Program implemented approximately less than 30 percent of projects requiring dewatering from 2005-2009. NMFS anticipates that the Program may follow the same trend in number of projects requiring dewatering to implement project activities and resulted in two mortalities during the life of the Program[22].

Benthic (*i.e.*, bottom dwelling) aquatic macroinvertebrates within the construction site may be killed or their abundance reduced when creek habitat is dewatered (Cushman 1985), although large numbers of stream-dwelling invertebrates are not expected within many of the action areas due to the benthic characteristics at each site (*i.e.*, little cobble/gravel substrate and a high percentage of fine sediment). However small, this effect will be temporary since construction activities will be relatively short-lived, and rapid recolonization (about one to two months) of disturbed areas by macroinvertebrates is expected following rewatering (Cushman 1985; Thomas 1985; Harvey 1986). In addition, the effect of lost macroinvertebrate production on juvenile salmonids is likely negligible, since food from upstream sources (via drift) would be available downstream of the dewatered areas (any upstream flow is diverted around the construction site). Projects focused on improving instream habitat conditions may enhance benthic macroinvertebrate production over time by increasing suitable substrate availability for macroinvertebrates and reducing percentage of fine sediment.

NMFS recognizes that inter-annual variation in steelhead abundance may occur within the action area. Fish relocation activities will occur during the summer low-flow period after emigrating smolts have left, and before adults have immigrated to proposed Project sites. Therefore, NMFS expects that rearing juveniles will be present in the action area and affected by relocation activities. NMFS anticipates a very low number of coho salmon to be present during the proposed action because of the relative low abundance of coho in the ESU.

There is always a potential for injury or mortality when relocating juvenile salmonids. Fish collecting gear, whether passive (Hubert 1996) or active (Hayes *et al.* 1996) has some associated risk to fish, including stress, disease transmission, injury, or death. The 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. Since 2004, data on fish

[22] The Program from 2005-2009 relocated a total of 302 steelhead with only 2 mortalities. Conservation practices implemented from 2005-2009 with dewatering events included Fish Stream Improvement (395), Obstruction Removal, Stream Channel Stabilization (584), and Structure for Water Control (587) of which 18 projects were implemented for the previous issuance of the Program.

relocation activities associated with DFG habitat restoration projects show that most mortality rates associated with individual fish relocation sites are well below three percent and the mean annual mortality rates are below one percent for steelhead (Collins 2004, 2005; DFG 2006, 2007, 2008, 2009, 2010).

To estimate the amount of fish captured, relocated, or killed, for each ESU or DPS, a formula was developed (see Appendix B) to assess the total amount anticipated for the life of the Program based on density (D) of each ESU or DPS, amount (A) of stream length disturbed (includes dewatered area, downstream area, and area where captured fish are released), and number of projects (P) that would be implemented over the life of the Program that could affect each ESU or DPS. Mortality was calculated using number of projects (P) that would be implemented over the life of the Program that could affect each ESU or DPS, the density (D) of each ESU or DPS, and multiplying by 3% percent. Using the formula of N=A*P*D (see Appendix B) and recent population estimates in the *Environmental Baseline,* NMFS anticipates the following number of juvenile salmonids will be relocated from the various project locations based on an estimated average of 300 feet being dewatered per project:

- Number of juvenile S-CCC steelhead estimated to be relocated in the project areas over the 10 year life of the Program is 1,242 fish for the life of the project or 124 fish each year.

- Number of juvenile CCC steelhead estimated to be relocated in the project areas over the life of the Program is 2,709 fish for the life of the project or 271 fish each year.

- No CCC coho salmon mortalities were reported from implementation of the 2005-2009 BO (NMFS 2006). NMFS is concerned with the extremely low numbers of juvenile coho salmon present in the project area. Therefore, RCDSCC, in consultation with NMFS determined no more than 100 juveniles can be relocated during the life of this Program or 10 fish each year. No adults will be captured or harmed.

Using the formula M=0.03*A*P*D (see appendix B), NMFS anticipates the following number of juvenile salmonids will be killed from the various project activities being dewatered per project:

- Number of juvenile S-CCC steelhead estimated to be killed in the project areas over the 10 year life of the Program is 25 fish for the life of the project or 3 fish each year.

- Number of juvenile CCC steelhead estimated to be relocated in the project areas over the life of the Program is 55 fish for the life of the project or 6 fish each year.

- CCC coho are at extremely low numbers in the project area and therefore application of the formula does not apply. Therefore, NMFS determined, based on the most recent population estimates, no more than 2 juveniles may be killed during the life of the Program.

Although sites selected for relocating fish should have ample habitat, in some instances relocated fish may endure short-term stress from crowding at the relocation sites. Relocated fish may also face increased competition for available resources such as food and habitat. Some of the fish released at the relocation sites may choose not to remain in these areas and may move either upstream or downstream to areas that have more habitat availability and a lower density of fish. Because relocated fish will have the opportunity to quickly relocate into adjacent areas, thereby minimizing competition and crowding stress, NMFS does not believe capture and relocation activities will substantially reduce the fitness of individual fish.

C. Turbidity and sedimentation

Construction or maintenance activities associated with the practices covered under this Program may result in temporary increases in turbidity levels in the stream. In general, these activities would not result in significant increases in turbidity levels beyond the naturally occurring, background conditions. As mentioned in the environmental baseline, an estimated 7,900 T/A/Yr was retained from entering waterways from 2005-2009. *Tier I* projects such as wetland management, critical area planting, etc. will be implemented from April 15 to October 31, are upslope and disconnected to salmonid bearing streams and it is unlikely that precipitation events will generate enough power to transport sediment into salmonid streams. Some conservation practices under the Program may require dewatering. Dewatering, if necessary, will enable project construction to occur in dry work areas. Contouring of the creek bed and bank may lead to increased sediment runoff into the streams during subsequent winter storms. Installation of siltation fencing is expected to reduce the amount of sediment immediately entering the creek during construction. Following construction, re-vegetation of exposed soils and the placement of mulch and other erosion control materials are expected to minimize subsequent erosion at the work site.

Activities that disturb channel banks and/or dewater sections of stream similar to those in the Program may cause temporary increases in turbidity (reviewed in Furniss *et al.* 1991; Reeves *et al.* 1991; and Spence *et al.* 1996). Short-term increases in turbidity will occur during proposed dewatering activities and construction and removal of cofferdams. Sediment may affect salmonids by a variety of ways. High concentrations of suspended sediment can disrupt normal feeding behavior and efficiency (Cordone and Kelly 1961; Bjornn *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 reduce dissolved oxygen in the water column, result in reduced respiratory functions, reduce tolerance to diseases, and can also 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 will cause salmonids to disperse from established territories (Waters 1995), which can displace fish into less suitable habitat and/or increase competition and predation, decreasing chances of survival. Increased sediment deposition can fill pools and reduce the amount of cover available to fish, decreasing the survival of juveniles (Alexander and Hansen 1986). Sediment can also fill interstitial spaces in gravel redds, preventing circulation of oxygenated water and encapsulating eggs within the redds (Fudge *et al.* 2008).

Much of the research discussed in the previous paragraph focused on turbidity levels considerably higher than those expected to result from the proposed construction activities in the Program. NMFS expects that temporary increases in turbidity will be insignificant because conservation practices implemented under the Program following winter storm events will minimize turbidity to levels considerably less than the turbidity threshold commonly cited as beginning to cause minor behavioral changes (Henley *et al.* 2000), and always less than turbidity levels necessary to injure or kill salmonids.

Impacts associated with degraded water quality from increased turbidity levels will likely be limited to behavioral effects, such as temporarily vacating preferred habitat or temporarily reduced feeding efficiency. These behavioral changes are not likely to reduce the survival chances of individual steelhead or coho salmon. Where turbidity effects exist, they will be minimized by fish relocation activities and specific project design considerations, such as construction dewatering, best management practice implementation, *etc*.

The potential for temporary increases in turbidity associated with construction activities would be minimized by the use of erosion control measures described in Table 2 Conditions for Erosion Control. Diverting water around the work site or dewatering the area will minimize potential increases in turbidity. These temporary adverse effects are anticipated to be short-term. Long-term, NMFS expects the Program will reduce chronic and significant sedimentation to stream habitats in the project area.

Conservation practices will likely improve water quality conditions, particularly turbidity, as those conservation practices are focused at reducing sedimentation to watercourses. As mentioned in the environmental baseline, an estimated 7,900 T/A/Yr was retained from entering waterways from 2005-2009.

D. Toxic chemicals

Equipment refueling, fluid leakage, and maintenance activities within and near the stream channel pose some risk of contamination and potential adverse effects. In addition to toxic chemicals associated with construction equipment, water that comes into contact with automotive fluids from cars used as rip rap could adversely affect water quality and cause harm to listed salmonids. Petroleum based chemicals, such as oil and gas could be released from removal of cars used as rip rap. These chemicals have likely leached into the soil substrate for the past several decades and affected water quality conditions. NMFS anticipates that few chemicals remain in association with cars used as rip rap. The small amounts that may remain will likely have insignificant impacts on listed salmonids and their critical habitat if released during the removal of car bodies from stream beds or banks because the multiple measures in the sections entitled, *Measures to Minimize Disturbance From Instream Construction* and *Measures to Minimize Degradation of Water Quality* within Part IX of the CDFG Manual address and minimize this risk.

E. Changes to Channel Morphology

The installation of rock or wood in the stream, (*i.e*., for the purposes of stabilizing the toe of a bank) could increase the "hardness" of a bank. Increased hardness of the bank increases bank velocities, reduces sediment retention and gravel assortment, and can reduce riparian composition and recruitment. Increasing bank velocities can affect over-wintering habitat for juveniles and passage opportunities for upstream migrating adults by reducing slow-water refugia during high-flow periods. Modifying sediment retention and gravel assortment can affect suitable substrate needed for spawning adults and cover and feeding opportunities for juveniles. Reduction in riparian composition and recruitment can affect stream temperature, water quality, streambank stability, and forage. However, even with these potential impacts, implementation of the Program over the next 10 years is expected to improve habitat conditions in the action area by providing complex physical habitat components (See **F. Beneficial Effects of the Program**). These include suitable spawning substrates, structural elements such as boulders and/or large wood where appropriate, resting pools, overhead cover, and diverse riparian plant communities. The effects of bank hardening are expected to be relatively small compared to the benefits from other associated program elements described above and also much smaller than the distribution of critical habitat in the watershed.

F. Beneficial Effects of the Program

Under the Program, projects would be implemented that are designed to be beneficial to salmonid habitat. The removal or modification of known barriers to allow for salmonid migration would allow steelhead and coho salmon to reach potentially higher quality spawning and rearing habitats upstream of the barriers which they were previously unable to reach. In addition, erosion control and streambank stabilization projects would reduce the amount of fine sediment entering streams that would otherwise clog and bury spawning gravels and redds. The practices of the Program are aimed at improving fish habitat. The quality of habitat would also be improved through the installation of structures such as large wood and boulders that create refuge habitat for juvenile and overwintering steelhead and coho salmon.

Instream habitat structures and improvement projects will provide predator escape and resting cover, increase spawning habitat, improve upstream and downstream migration corridors, improve pool to riffle ratios, and add habitat complexity and diversity. Some structures will be designed to reduce sedimentation, protect unstable banks, stabilize existing slides, provide shade, and create scour pools. Stream bank stabilization projects will reduce sedimentation from watershed and bank erosion, decreasing turbidity levels, and improving water quality for salmonids over the long-term. Riparian restoration projects will improve shade and cover, protecting rearing juveniles, reducing stream temperatures, and improving 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 the reduction of excessive nitrogen, phosphorous, and sediment loads in the streams (Line *et al.* 2000, Brenner and Brenner 1998).

NMFS used RCDSCC's simple model of instream sediment prevented by the program to predict the potential beneficial effects on water quality of projects implemented under the Program.

According to the model results, projects implemented under the proposed program will prevent more than 1,000 cubic yards (approximately 1,350 tons) of sediment delivered to critical habitat. Assumptions of the model are listed below:

Assumptions of the model:

1. The estimate of five conservation projects per year (three instream projects and two upland sediment detention basins) is based on NRCS field office assessments of project need, landowner demand, and previous experience in the Santa Cruz County watersheds.

2. Instream projects are estimated to reduce soil loss by 22 cubic yards the first year they are installed (RCDSCC 2010). This is based on NRCS' evaluation of topography, hydrology, and erodibility of soil in likely project areas. The estimated average area of destabilized soil is 2000 square feet. Untreated, these acres will typically incise between one and six inches per year. An average of 3.5 inches per year across the destabilized area is used to estimate the prevented soil loss.

3. Estimates of sediment detained in upland basins are related to capacity of basins, which are designed for the 25-year storm event. The average capacity of a basin is 10,800 cubic feet, or 400 cubic yards. The estimate for the average reduction in sediment release the first year a basin is in place is one quarter of the basin capacity or 100 cubic yards.

4. The benefits of projects in their second and subsequent years are estimated at 80% of the benefits obtained in the first year. As projects come to fruition, the net benefits between subsequent years decline, with the greatest benefits achieved in the first year by reversing downward trends in habitat conditions and plateauing within a number of years after implementation.[23] Thus, a project resulting in a benefit of 22 cubic yards in the first year is expected to result in a benefit of 17.6 cubic yards for each subsequent year.

5. Estimates for short term, construction related impacts are based on destabilized soil surface areas described in 2 and 3 above. For stream related work, an estimate of ¼ inch of soil loss is used for the first winter, resulting in a potential disturbance of five cubic yards per project. Potential soil loss from upland detention basins is estimated at four cubic yards per project. The estimated aggregate negative impact of project work is nine cubic yards each year, with no long-term impact.

[23] Depending upon project type, scope, and effectiveness, outcomes of the conservation practice are difficult to project. NMFS anticipates that many of the conservation practices will be effective at meeting its objective within ten years of implementation or sooner.

VII. CUMULATIVE EFFECTS

Cumulative effects are defined in 50 CFR § 402.02 as "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". 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.

NMFS does not anticipate any cumulative effects in the action area other than those ongoing actions already described in the Environmental Baseline above and climate change. For example, due to the high productivity of agricultural lands in Santa Cruz County, it's anticipated that agricultural production will remain at approximately current levels over the life of the program (the total acres of agricultural land have remained the same since 1990 at about 42,000 acres) (Applied Survey Research 2002). Over the life of the proposed program, NMFS anticipates population increases and development pressures will affect land use and growth in Santa Cruz County. The population of Santa Cruz County increased by 11,200 people between 1998 and 2002, from 249,000 to 260,200, an increase in size comparable to the current population of the City of Capitola (10,150 people) or the City of Scotts Valley (11,600 people). Santa Cruz County total population was estimated as 262,382 (U.S. Census Bureau, 2010), and is projected to reach 370,600 by 2020. Development and growth in Santa Cruz County may be constrained somewhat in the short term by county policies in place to restrict growth to urban enclaves in order to maintain rural and protected areas within the County.

Given current baseline conditions and trends, NMFS expects habitat conditions will continue to degrade. Increased population growth and water supply demands will further reduce sufficient surface flows for salmonids in Santa Cruz County. Expansion of the urban growth boundary may alter hydraulic cycles, increase encroachment into riparian areas, and further impact impaired waterways in the action area. In the long term, climate change may produce temperature and precipitation changes that may adversely affect salmonid habitat in the action area.

VIII. INTEGRATION AND SYNTHESIS OF EFFECTS

The Program will likely adversely affect CCC coho salmon, CCC and S-CCC steelhead, and their critical habitat. The number of adversely affected fish will likely be small, considering virtually no juvenile coho salmon and few steelhead are expected within the action area due to currently degraded rearing habitat conditions and a construction schedule that avoids adult and smolt migration periods. Therefore, NMFS expects few juvenile coho salmon or steelhead are likely to be encountered during the implementation of the Program. Furthermore, mortality rates during relocation and dewatering activities are likely below three percent, so the risk of mortality to any encountered juvenile salmonid is low. Less than 3 percent of steelhead that are relocated during the Program are expected to be killed and a total of two juvenile coho salmon are expected to be killed.

CCC coho salmon populations, particularly South of San Francisco Bay, are of high concern due to low population levels. The relocation activities resulting in mortality to two juvenile coho

salmon will likely occur in the streams where coho salmon persist in Santa Cruz County. Scott, San Vicente, and Waddell creeks are in the best overall condition (due to water quality and quantity, intact riparian habitats, lagoons, *etc.).* The relatively high quality of instream habitat conditions in these streams help ensure juvenile coho salmon are distributed throughout these watersheds as opposed to being concentrated in a relatively small area (*i.e*., pools), potentially exposing the entire creek juvenile population to adverse effects from electrofishing.

Capture and relocation of juvenile individuals, while undesirable, is generally considered preferable to capture and relocation of adults due to the life history characteristics of salmonids. Salmonid adults produce thousands of fertilized eggs per spawning pair. Although coho salmon juvenile numbers are low in the action area, most will be unaffected by RCDSCC's Program. Some of the coho salmon juveniles in the action area are likely to survive to return as adults, which are likely to spawn and produce thousands of eggs, more of which are likely to survive to become juveniles, smolts, and adults because of the Program's restoration efforts. The result is likely to be not only a minimal impact on the population's life history cycle, but also an increase in coho salmon numbers in the future for those projects that address this species' limiting factors.

The CCC and S-CCC steelhead DPS are listed as threatened. Throughout the CCC steelhead DPS stream and estuary habitats have been significantly impacted by multiple anthropogenic activities (*i.e.*, logging, urban development, agriculture, dams, stream channelization, and poor lagoon management). These have contributed to substantial declines in the abundance of CCC and S-CCC steelhead in many of these watersheds (Good *et al.* 2005, Spence *et al.* 2008, NMFS 2011). The extensive loss of historic habitat and the ongoing impacts of channelization and migration impediments, steelhead abundance in the watershed is likely lower than historic levels.

After reviewing the information available, NMFS anticipates only a small number of juvenile CCC steelhead (no more than 2,709 individuals total) may be relocated by the Program, and no more than 81 individuals will perish. Similarly, NMFS anticipates only a small number of juvenile S-CCC steelhead (no more than 1242 individuals total) may be relocated by the Program, and no more than 37 individuals will perish. This is due to the low expected abundance of steelhead, the relocation efforts prior construction, and the low injury and mortality rates expected from fish relocation methods. Based on the time of year that the Program will be implemented (*i.e*., summer low-flow), NMFS believes that the number of juvenile steelhead potentially affected by the Program would likely be minimal and would represent a small fraction of the total number of juveniles in Santa Cruz County.

NMFS believes the effects of turbidity increases and flow conditions from Program activities will not have any long-term adverse impacts to the PCEs of salmonid habitat. NMFS anticipates short-term and minor increases in turbidity will occur during fish relocation activities. Proposed BMPs will control sediment and pollutants from other Program activities sufficiently to avoid adverse effects to listed fish species or critical habitat. No permanent adverse changes in stream flow are anticipated. The disturbed area represents a very small portion of the overall watersheds in Santa Cruz County, and will become available to coho salmon and steelhead again once the project is complete. As described above, other Program impacts to critical habitat are also minimal, and the value of critical habitat within the action area is expected to improve over the long term, even with the Cumulative Effects noted above, due to the Programs efforts.

IX. CONCLUSION

After reviewing the best available scientific and commercial data, the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is NMFS' biological opinion that the Partners in Restoration Program is not likely to jeopardize the continued existence of endangered CCC coho salmon, threatened CCC steelhead, or threatened S-CCC steelhead.

After reviewing the best available scientific and commercial data, the current status of critical habitat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is NMFS' biological opinion that the proposed Partners in Restoration Program in Santa Cruz County, California is not likely to adversely modify or destroy designated critical habitat for CCC coho salmon or S-CCC and CCC steelhead.

X. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without 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 NMFS as an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not the purpose of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are nondiscretionary, and must be undertaken by the Corps and their applicant RCDSCC for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activities covered by this incidental take statement. If the Corps and their applicant RCDSCC (1) fail to assume and implement the terms and conditions, or (2) fail to require their designees to adhere to the terms and conditions of the incidental take statement, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps must report the progress of the action and its impact on the species to NMFS as specified in the incidental take statement. (50 CFR §402.14(I)(3)).

A. Amount of Take

NMFS anticipates the following levels of fish capture for relocation and fish injury/mortalities at the juvenile lifestage from the proposed action over the ten year life of the Program (Tables 9 and 10)

Table 9. Estimated capture of salmonid juveniles for each ESU or DPS in Santa Cruz County covered under the Program.

ESU/DPS	Capture (N) Estimate for 10-year Life of the Program	Capture Estimate per Year (N/10)
CCC Coho salmon	2	0[24]
CCC Steelhead	2709	271
S-CCC Steelhead	1242	124

Table 10. Estimated mortality Associated with capture and relocation of salmonids (mortality associated with electrofishing, seining, moving fish, *etc*.).

DPS	mortality estimate for 10-year life of Program	mortality Estimate per year (***M***/10)	mortality Estimate per project (***M***/P)
CCC Steelhead	81.3	8.1	4*
SCCC Steelhead	37.3	2.5	3*

*note: numbers are rounded to nearest whole number.

The level of anticipated take outlined in Table 9 and 10 will occur over a ten-year period. Anticipated take will be exceeded if the annual amounts above are exceeded for the juvenile life stage. If adults, eggs, alevins, or smolts are harmed, injured, harassed, or killed, take will be exceeded.

B. Effect of Take

Within this biological opinion, NMFS determined this level of anticipated take is not likely to result in jeopardy to the species.

[24] Only 2 juvenile coho will be captured for relocation during the life of the Program. After 2 juvenile coho are captured at any time during the life of the Program, the Program will not have authorization to take more juvenile coho for the remaining duration of the Program.

C. Reasonable and Prudent Measures

The following Reasonable and Prudent Measures are necessary and appropriate to minimize the impact on listed species caused by take of listed species resulting from completion of the proposed action.

NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize take of CCC coho, CCC and S-CCC steelhead:

1. Undertake measures to ensure that harm and mortality to salmonids resulting from fish relocation and dewatering activities is low.

2. Undertake measures to minimize harm to salmonids resulting from construction of the project(s).

3. Undertake measures to minimize harm to salmonids from degradation of aquatic habitat and stream water quality.

4. Prepare and submit a report to document the effects of construction and relocation activities and performance of the Program.

D. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Corps and its permittee must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and define the reporting and monitoring requirements. These terms and conditions are nondiscretionary.

1. <u>The following terms and conditions implement reasonable and prudent measure 1</u>:

   a. The Corps and its permittee shall retain qualified biologists with expertise in the areas of anadromous salmonid biology, including handling, collecting, and relocating salmonids; salmonid/habitat relationships; and biological monitoring of salmonids. The Corps and permittees shall ensure that all biologists working on these projects are qualified to conduct fish collections in a manner which minimizes all potential risks to steelhead. Electrofishing, if used, shall be performed by a qualified biologist and conducted according to *NMFS Guidelines for Electrofishing Waters Containing Salmonids Listed under the Endangered Species Act*, June 2000. See: http://www.nwr.noaa.gov/ESA-Salmon-Regulations-Permits/4d-Rules/upload/electro2000.pdf.

   b. The biologists shall monitor the construction sites during placement and removal of cofferdams, channel diversions, and access ramps to ensure that any adverse effects to salmonids are minimized. The biologists shall be on site during all dewatering events to capture, handle, and safely relocate steelhead. The Corps, permitee, or the biologist shall notify NMFS biologist Devin Best at (707) 578-8553 or

Devin.Best@noaa.gov one week prior to capture activities in order to provide an opportunity for NMFS staff to observe the activities.

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

d. If any salmonids are found dead or injured, the biologist shall contact NMFS biologist Devin Best by phone immediately at (707) 578-8553 or the NMFS Santa Rosa Area Office at 707-575-6050. The purpose of the contact is to review the activities resulting in take and to determine if additional protective measures are required. All salmonid mortalities shall be retained, placed in an appropriately-sized sealable plastic bag, labeled with the date and location of collection, fork length, and be frozen as soon as possible. Frozen samples shall be retained by the biologist until specific instructions are provided by NMFS. The biologist may not transfer biological samples to anyone other than the NMFS Santa Rosa Area Office without obtaining prior written approval from the NMFS Santa Rosa Area Office, Supervisor of the Protected Resources Division. Any such transfer will be subject to such conditions as NMFS deems appropriate.

2. <u>The following terms and conditions implement reasonable and prudent measure 2</u>:

a. The Corps and permittees shall allow any NMFS employee(s) or any other person(s) designated by NMFS, to accompany field personnel to visit the project sites, at any time and without advanced notice, during activities described in this biological opinion.

b. A biologist shall monitor inchannel activities and performance of sediment control or detention devices for the purpose of identifying and reconciling any condition that could adversely affect salmonids or their habitat. The Corps and the applicant will rectify conditions that adversely affect salmonids or their habitat in a timely manner, if they occur.

c. Contractors must have a supply of erosion control materials, and fuel and hydraulic fluid spill containment supplies onsite to facilitate a quick response to unanticipated storm events, or fuel or hydraulic fluid spill emergencies.

d. Construction equipment used within the creek channel will be checked each day prior to work within the creek channel (top of bank to top of bank) and, if necessary, action will be taken to prevent fluid leaks. If leaks occur during work in the channel (top of

bank to top of bank), the Corps, the permit holders, or their contractor will contain the spill and remove the affected soils.

e. All pumps used to divert live stream flow, outside the dewatered work area, will be screened and maintained throughout the construction period to comply with NMFS' Fish Screening Criteria for Anadromous Salmonids. See: http://swr.nmfs.noaa.gov/hcd/fishscrn.pdf.

3. <u>The following terms and conditions implement reasonable and prudent measure 3</u>:

a. The Corps and its permittee shall ensure that fill material for cofferdams will be fully confined with the use of plastic sheeting, sheetpiles, sandbags, or with other non-porous containment methods, such that sediment does not come in contact with stream flow or in direct contact with the natural streambed. Alternatively, clean gravel or clean crushed stone may be used without plastic sheeting, sandbags, *etc*. All loose fill material for cofferdams or access ramps shall be completely removed from the channel by October 15, and the creek must be returned to a natural grade and substrate condition.

b. Once construction is completed, all temporary, construction related, project-introduced material (pipe, gravel, cofferdam, *etc*.) must be removed. Excess materials will be disposed of at an appropriate upland site.

4. <u>The following term and condition implements reasonable and prudent measure 4</u>:

a. The Corps and permitee shall provide a written report to NMFS by January 31 of the year following construction of the project. The report shall be submitted to NMFS Santa Rosa Area Office, Attention: Supervisor of Protected Resources Division, 777 Sonoma Avenue, Room 325, Santa Rosa, California, 95404-6528. The report shall contain, at a minimum, the following information:

i. Construction related activities -- The report shall include the conservation practice, dates construction began and was completed; a discussion of any unanticipated effects or unanticipated levels of effects on salmonids, a description of any and all measures taken to minimize those unanticipated effects and a statement as to whether or not the unanticipated effects had any effect on ESA-listed fish; the number of salmonids killed or injured during the project action; and photographs taken before, during, and after the activity from photo reference points.

ii. Fish Relocation -- The report shall include a description of the location from which fish were removed and the release site including photographs; the date and time of the relocation effort; a description of the equipment and methods used to collect, hold, and transport salmonids; if an electrofisher was used for fish collection, a copy of the logbook must be included; the number of fish relocated by species; the number of fish injured or killed by species and a brief narrative of the circumstances

surrounding ESA-listed fish injuries or mortalities; and a description of any problems which may have arisen during the relocation activities and a statement as to whether or not the activities had any unforeseen effects.

b. The Corps and permittee shall provide a written report to NMFS by January 31 of the year following Program completion (*i.e*. January, 2022). The report shall be submitted to NMFS Santa Rosa Area Office, Attention: Supervisor of Protected Resources Division, 777 Sonoma Avenue, Room 325, Santa Rosa, California, 95404-6528. The report shall contain, at a minimum, the following information:

i. Program Summary -- The report shall summarize all conservation practices implemented from 2011-2021. The report shall document the number and type of conservation practices, the year implemented, the acres restored, the tons-per-acre-per-year of sediment retained, the miles of salmonid habitat improved and any other benefits the Program to habitat enhancement. The report shall include a map of the location(s), type, and year implemented of each conservation practice. The report shall assess and evaluate the implementation of the Program for improving salmonid populations and habitat conditions in Santa Cruz County by documenting trends in water quality, species abundance and distribution, and habitat complexity.

a. Photo monitoring – Projects implemented under the Program will be monitored for effectiveness at achieving conservation practice goals and objectives. Photo documentation pre- and post-project will be conducted for each *Tier III* and *IV* project for a period of five years following completion of construction. Photo documentation of *Tier I* and *II* projects will occur pre- and post-construction, and once more within the life of the Program (2022).

b. Habitat monitoring – The Program will monitor changes in habitat conditions. Any, and all, qualitative data such as bank stability index, vegetative cover, habitat typing, channel profile, or other relevant survey data will be conducted and summarized in the report.

ii. The report shall evaluate the effectiveness and efficiency of the tiered approach for project complexity and notification. The report will identify any inconsistencies, drawbacks, and/or improvements

XI. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to

minimize or avoid adverse effects of a proposed action on a listed species or critical habitat, to help implement recovery plans, or to develop information.

1. NMFS recommends the Corps work with NMFS to develop a long-range planning approach that seeks to minimize and avoid the impacts of Corps permitted projects on listed salmonids.

2. The Corps should identify and prioritize any maintenance and construction projects which, if implemented, can improve ESA-listed salmonids migration or in-stream environmental conditions.

XII. REINITIATION NOTICE

This concludes formal consultation on the actions outlined in the Santa Cruz Partners in Restoration Program. Reinitiation of formal consultation is required where discretionary federal involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered in this opinion; (3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action (50 CFR 402.16). In instances where the amount or extent of incidental take is exceeded, formal consultation shall be reinitiated immediately.

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XIV. APPENDIX A

Figure 1. Central California Coast steelhead distribution and populations

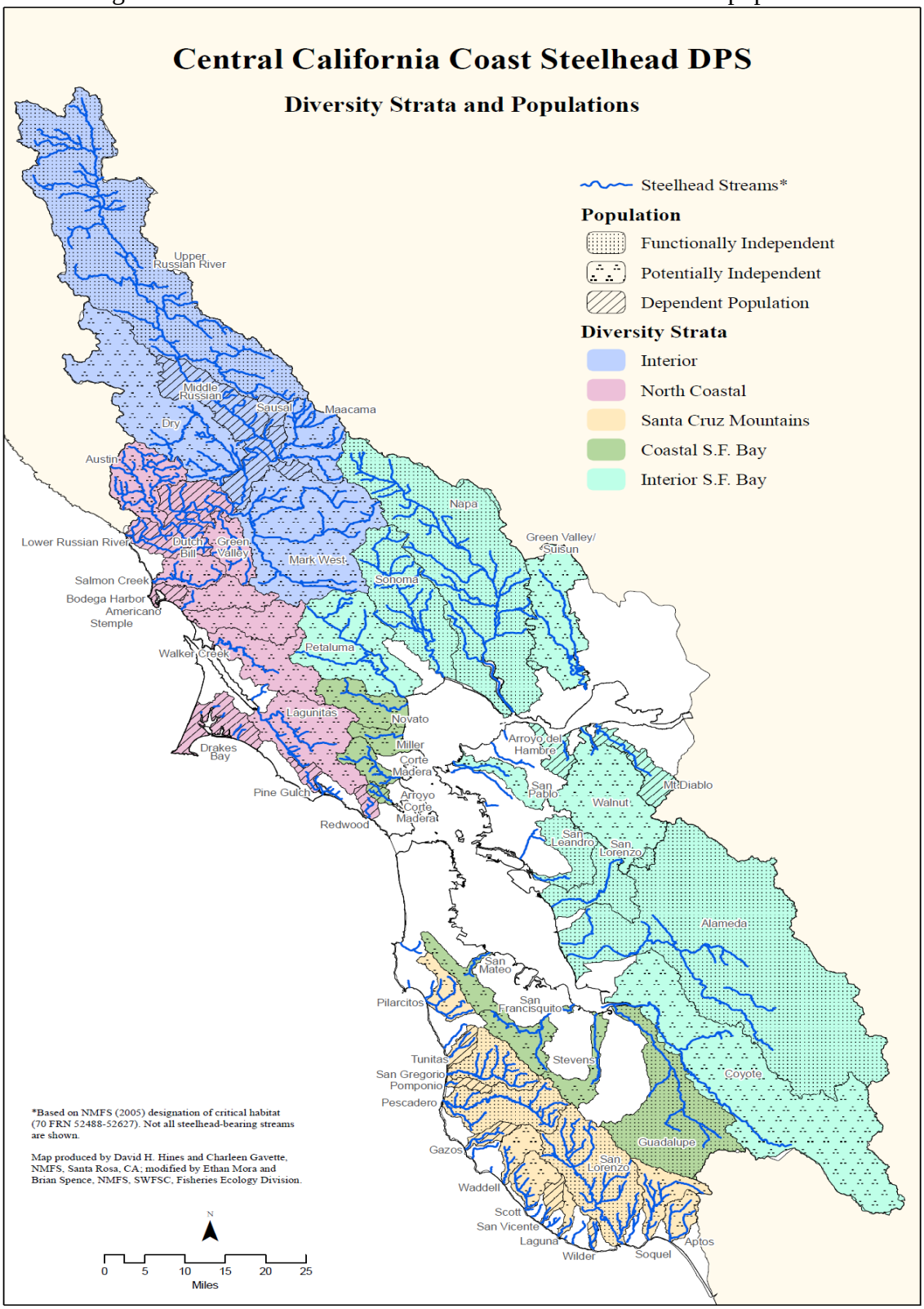
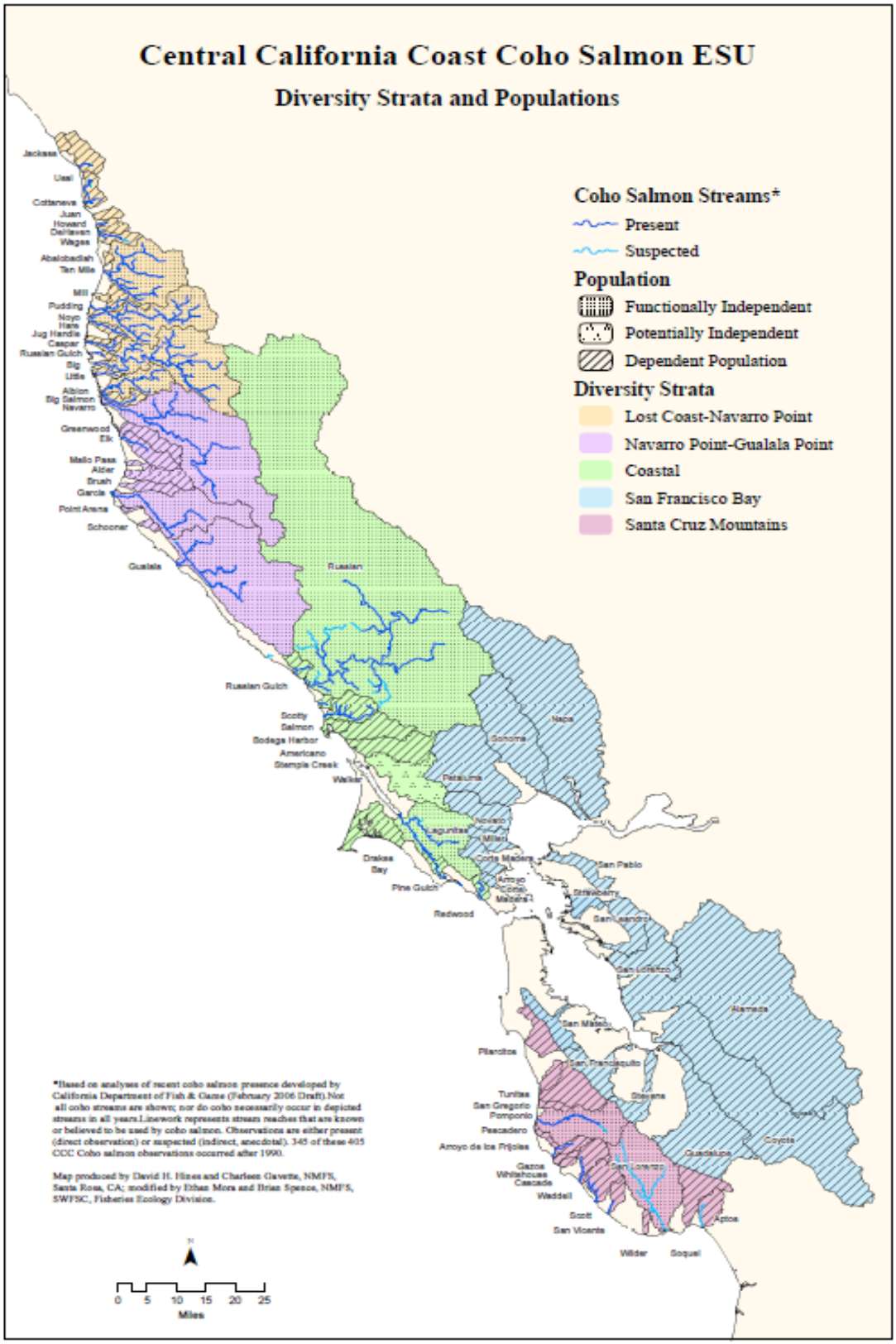


Figure 2. Central California Coast coho salmon distribution and populations



XV. APPENDIX B

A. Population estimates for *Santa Cruz Countywide Partners in Restoration Permit Coordination Program* (Program) biological opinion 2011-2021

The biological opinion was based on NOAA's National Marine Fisheries Service's (NMFS) review of the U.S. Army Corps of Engineers (the Corps) proposal to permit the Program in Santa Cruz County, California. Population estimates are presented by Evolutionarily Significant Unit (ESU) and Distinct Population Segment (DPS) and by watershed.

B. Assumptions and Constraints in the Population Estimates

A variety of information sources are available regarding historic and current salmonid abundance in the action area (Shapovalov and Taft 1954, Lollock 1968, Smith 1982, Smith 1990, Smith 1992, Smith 1993, Smith 1996, Smith 1999, Smith 2001a, Smith 2001b, Alley 1998, Alley 1999, Alley 2000a, Alley 2000b, Alley 2002, ESA 2003, H. T. Harvey and Associates 2003, Spence and Williams 2011). In 1982, Smith documented habitat conditions and fish populations at selected representative locations on 34 rivers and creeks in Santa Cruz County (Smith 1982). Since the last formal review (Good *et al.* 2005) all evidence indicates conditions have worsened for populations in the ESU (Spence and Williams 2011). The 2011 Status Review for Coho Salmon (Spence and Williams 2011) indicate that conditions have worsened for the CCC coho salmon ESU.

Information within the biological assessment (BA) contains the best available information regarding status and numbers of Central California Coast (CCC) ESU coho salmon *(Oncorhynchus kisutch),* CCC DPS steelhead *(O. mykiss),* and South-Central California Coast (S-CCC) DPS steelhead *(O. mykiss)* in the action area. The project proponent worked closely with NMFS to obtain and calculate fisheries densities for all streams with populations of listed salmonids in Santa Cruz County. The methodology for estimating take of listed salmonids follows the approach developed in the prior biological assessment for the Program, which covered the Program from 2005-2009. The length of available habitat for the ESU/DPS or the distribution of salmonids in each fish-bearing stream where density estimates were available was calculated. Available habitat was multiplied with recent fisheries density information in an attempt to estimate the juvenile salmonid population in the action area. Extrapolation of the salmonid populations was necessary as inventorying the actual population through field work was cost and time prohibitive. It was assumed the habitats across the action area were generally homogeneous, while in reality the habitats are heterogeneous. It was necessary to assume homogeneity in order to extrapolate estimates of population abundance across the action area rather than conduct additional field studies. NMFS believes the extrapolation resulted in an over-estimation of salmonid fisheries populations in the action area. A few key modifications have been made to the methodology based on the levels of take recorded over the past 5 years.

The first modification is focused solely on estimating take of coho salmon. For the previous Program BA/BO (2005), coho salmon take estimates were developed in parallel with the steelhead estimates and were roughly based on historic density estimates of juvenile coho salmon in affected streams. During the past 5 years, coho salmon observations and resulting density

estimates are significantly lower than the 0.21 fish/feet estimated from historic data, indicating that coho salmon are on the brink of extirpation throughout the southern portion of their range (*i.e.*, in Santa Cruz County). In addition, survey data suggest that coho salmon, are not distributed equally across a stream, but are instead found in small pockets of suitable habitat (*i.e.*, deep pools) within the larger stream setting- thus making density data somewhat useless for estimating take of coho salmon. Also, while the previous BO allowed for take of up to 31.5 coho salmon a year and a total of 157 over the 5-year duration, zero coho salmon were taken under the previous BO.

The second modification in estimating population densities focused on steelhead. The take estimates from the 2005 BA/BO estimated total incidental take of steelhead (both ESU's) at a total of 4,450 individuals over 5 years. Based on reporting from project activities permitted und the Program during that period, a total of 302 steelhead were relocated with only 2 mortalities. Steelhead population densities were modified to more accurately reflect current available information. In order to obtain average densities (D) for each DPS, we utilized existing information on density approximations contained in literature and other survey information available for the County's streams. In order to develop an average density for steelhead (fish/ft), we analyzed the best recent datasets available. For the CCC DPS this included density data through 2008 or 2009 for Waddle Creek, Scott Creek, San Lorenzo River, Soquel Creek, and Aptos Creek. For the SCCC DPS, juvenile density data for Corralitos Creek was used as a surrogate for the lower Pajaro and its tributaries. Due to the high level of productivity in Corralitos Creek, this estimate is likely to be a high over-estimate of densities throughout the watershed.

C. Estimated Number of Juvenile CCC Coho salmon Present in the Action Area

As mentioned previously, the 2005-2009 BO allowed for take of 31.5 coho salmon a year and a total of 157 over the 5-year duration. In the implementation of the BO, zero coho salmon were taken. Population estimates for Santa Cruz County for CCC coho salmon are at critically low levels. NMFS is extremely concerned and in an effort to continue to support the recovery of CCC coho salmon through beneficial practices, has deemed no more than 100 coho salmon juveniles can be captured and relocated, and of those, no more than 2 can be inadvertently killed during the life of the Program.

D. Estimated Number of Juvenile CCC Steelhead Present in the Action Area

For many of the streams in the CCC steelhead DPS, the most current information available is from a study by Smith in 1982. Information from 2005-2009 was incorporated into the population densities estimates. More current information was available for Waddell, Scott, San Vicente, San Lorenzo, and Arana Gulch. To accurately reflect likely density levels in streams in the action area without more current information, the average density estimate for Scott Creek (0.43 steelhead per foot) was applied to all streams (other than Waddell, San Vicente, San Lorenzo and Arana Gulch) as a surrogate. This is the highest density estimate among the current estimates and, therefore, provides a realistic approximation of the largest number of fish potentially present in the action area. Scott Creek maintains some of the best available habitat conditions in the action area, and it is reasonable to assume the density estimates from Scott

Creek are greater than or equal to those watersheds where current information is unavailable. The use of average density also helps to account for heterogeneity in habitat conditions and differences in fish densities at specific sites.

1. Waddell: steelhead density (Table 1)

Table 1. *Estimates of average steelhead density per age class and estimated density (per 100 feet) for Waddell Creek from 2001-2009 (Smith 2001b, Smith 2009).*

	Density (per 100 ft)	
Date	Age 0+	Age ½+
Average 2001-2009	22.3	2.1
Average # fish per ft	**0.22 fish/ft**	**.02 fish/ft**

Combined: 0.24 fish/ft

2. Scott Creek: steelhead density (Table 2)

Table 2*. Estimates of average steelhead density per age class and estimated density (per 100 feet) for Scott Creek in 2001-2009.*

	Density (per 100 ft)	
Date	Age 0+	Age ½+
Average across years I. 2001-2009	39.3	6.8
Average # fish per ft	**0.39 fish/ft**	**0.07ish/ft**

Combined =0.46 fish/ft

3. San Lorenzo: steelhead density (Table 3)

Table *3. Estimates of average steelhead density of all juvenile age classes (per 100 feet) across all reaches in mainstem San Lorenzo River between 1997-2008 (D.W. Alley and Associates 2008) .*

	97	*98*	*99*	*00*	*01*	*02*	*03*	*04*	*05*	*06*	*07*	*08*
Average Across Reaches	87.2	51.6	25.4	16.0	21.1	45.2	32.2	28.4	18.2	7.8	14.8	33.5

Average across all years: 31.8 fish/100 ft = 0.32 fish/ft

4. San Lorenzo Tributaries: steelhead density (Table 4)

Table 4*. Estimates of average steelhead density for all juvenile age classes (per 100 feet) in all tributary streams of San Lorenzo River in 1997-2008 (D.W. Alley and Associates 2008).*

	97	*98*	*99*	*00*	*01*	*02*	*03*	*04*	*05*	*06*	*07*	*08*
Average Across Reaches	81.7	66.8	59.8	41.5	47.4	61.9	96.9	74.2	68.0	37.0	53.5	71.1

Average across all years: 62.7 fish/100 ft = 0 .63 fish/ft

5. Soquel Cr: steelhead density (Table 5)

***Table 5**. Estimates of average steelhead density for all juvenile age classes (per 100 feet) in Soquel Creek in 1997-2008 (D.W. Alley and Associates 2008).*

	97	*98*	*99*	*00*	*01*	*02*	*03*	*04*	*05*	*06*	*07*	*08*
Average Across Reaches	63.6	37.4	36.9	23.3	30.8	78.4	45.9	58.5	43.3	21.5	41.4	63.4

Average across all years: 45.5 fish/100 ft = 0.46 fish/ft

6. Aptos Cr: steelhead density (Table 6)

***Table 6.** Estimates of average steelhead density for all age classes of juvenile in Aptos Creek in 2006-2008 (D.W. Alley and Associates 2008).*

	2006	*2007*	*2008*
Average Across Reaches	31.63	38.63	57.18

Average across all years: 42.5 fish/100 ft = 0.43 fish/ft

E. Estimated Number of Juvenile S-CCC Steelhead Present in the Action Area

Sources of information regarding historic and current S-CCC steelhead abundance in the action area are more limited than is available for CCC steelhead. For all of the following streams listed for the S-CCC steelhead DPS, the most current information available was from Smith (1982)[25]. NMFS personnel familiar with the lower Pajaro River tributaries listed below (Ambrose, NMFS, personal observations 2002 - 2005) believe these streams no longer support steelhead densities observed by Smith (1982). In order to more accurately reflect current density levels, the overall Santa Cruz County estimate for CCC and SCCC steelhead was used (0.43 steelhead per foot for CCC and 0.46 steelhead per foot for SCCC) for each stream. This density estimate provides a realistic approximation of the largest number of fish potentially present in the S-CCC portion of the action area.

F. Estimated Number of Listed Juvenile Salmonids Present Per Project Location

The locations of the proposed practices are unknown, therefore to estimate the number of salmonids present at each project location RCDSCC built a number of assumptions into the calculations for population estimations. To estimate the number of juvenile fish affected by the proposed actions by the Program the following formula was used; N = (A * P * D), where:

N = Number of fish captured for relocation over the ten-year life of the Program (calculated for each Evolutionarily Significant Unit in Project Area)

[25] Smith (1982) reported densities of smolt sized steelhead for Corralitos Creek and Browns Valley Creek. The mean ± standard deviation (SD) density from nine survey stations in Corralitos Creek 5.3 ± 6.2 trout per meter. The mean ± SD density from two survey stations in Browns Valley Creek was 5.4 ± 4.9 trout per meter.

Variables:

A = (feet) Length of stream disturbed per project (includes dewatered area and area where captured fish are released)

Assumption A=**300** ft

~ 75-100 ft dewatered for a culvert replacement project

~ 50-200 ft dewatered for a bank stabilization project

~ Assume additional approximately 100 ft affected downstream and in any areas where the fish are released. The overall take estimate (N) also accounts for potential effects downstream hence the additional 100 ft for the length of stream affected by a project.

P = Number of projects that would be implemented over the life of the Program that could affect each DPS (assume 30[26] instream projects over the life of the program that would require dewatering below the limit of anadromy for steelhead). Projects are likely to be distributed fairly evenly across the County due to landowner access and interest. One way to do this is by looking at the overall distribution of each DPS and the percentage of the overall County area that these DPS occupy.

CCC Steelhead: 70%
S-CCC Steelhead: 30%

To "distribute the effects of projects" across the DPS, we multiply these percentages by the total number of projects to be implemented over the life of the program (30), to come up with a **P** specific to each DPS**:**

$P_{\text{CCC Steelhead}}$: 30 * .70 = 21
$P_{\text{SCCC Steelhead}}$: 30* .30 = 9

D = Average density of fish per feet length of stream

In order to obtain average densities (D) for each DPS, we utilized existing information on density approximations contained in literature and other survey information available for the County's streams. In order to develop an average density for steelhead (fish/ft), we analyzed the best recent datasets available. For the CCC DPS this included density data through 2008 or 2009 for Waddle Creek, Scott Creek, San Lorenzo River, Soquel Creek, and Aptos Creek. For the SCCC DPS, juvenile density data for Corralitos Creek was used as a surrogate for the lower Pajaro and its tributaries. Due to the high level of productivity in Corralitos Creek, this estimate is likely to be a high over-estimate of densities throughout the watershed.

***M*= Mortality** = The percentage of mortality of individuals as a result of capture and relocation of fish necessary in dewatering a work area.

To calculate the mortality associated with the dewatering activities for each DPS over the life of the Program (*i.e*., electrofishing, seining, etc.), the following modified equation was used:

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[26] Assuming a maximum of 3 projects per year times 10 years would equal 30 instream projects in the life of the Program.

M = mortality associated with dewatering activities per year/per DPS
a = length of the stream dewatered = assume 300 ft for a bank stabilization project. In the case of estimating mortality associated with dewatering and relocation of fish either via electrofishing or seine netting, we are only concerned with the actual area dewatered and not with downstream effects.

D= average density estimate described above for each DPS
P = Number of projects that would be implemented over the life of the Program that could affect each DPS (see above P for each DPS)
0.03 = "mortality multiplier[27]"

M = 0.03*a*P*D)
M = 0.03*300*P*D
M = 9*P*D

Table 7. **Summary of the Estimated Mortality Associated with Capture of Salmonids (mortality associated with electrofishing, seining, relocating fish, *etc*).**

DPS	Density Estimate (fish/ft)	mortality estimate for 10-year life of Program (***M* = 9*P*D**)	mortality Estimate per year (***M***/10)	mortality Estimate per project (***M***/P)
CCC Steelhead	0.43	81.3	8.1	4*
SCCC Steelhead	0.46	37.3	2.5	4*

*note: numbers are rounded up to whole numbers.

[27] Mortality multiplier is derived from 3% mortality rates during relocation activities (Collins 2004).