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

July 23, 2012

In response refer to:
2012/02129

Lieutenant Colonel John K. Baker
District Engineer
U.S. Department of the Army
San Francisco District, Corps of Engineers
1455 Market Street
San Francisco, California 94103-1398

Dear Colonel Baker:

Thank you for your letter of March 22, 2012, requesting formal consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 *et seq.*), for the California American Water Company's (CAW) proposed Carmel River Reroute and San Clemente Dam Removal (CRRDR) Project located at the San Clemente Dam Reservoir on the Carmel River, near the town of Carmel Valley, Monterey County, California.

The enclosed biological opinion is based on our review of CAW's project and describes NMFS' analysis of the potential effects on threatened South-Central California Coast (S-CCC) steelhead (*Oncorhynchus mykiss*) Distinct Population Segment and their designated critical habitat in accordance with section 7 of the ESA. Threatened steelhead are present in the project's area, and the Carmel River is designated critical habitat for the species. In this opinion (Enclosure 1), NMFS concludes that the proposed project will not jeopardize the continued existence of S-CCC steelhead, nor adversely modify or destroy their critical habitat. However, NMFS expects activities occurring during construction of this project are likely to result in take of S-CCC steelhead, and therefore, an incidental take statement is enclosed with this biological opinion.

NMFS has also evaluated the proposed action for potential adverse effects to Essential Fish Habitat (EFH) pursuant to section 305(b)(2) of the Magnuson Stevens Fishery Conservation and Management Act (MSA). Based on our review (Enclosure 2), NMFS concludes that the proposed action would result in adverse effects to EFH for various life stages of species managed under the Pacific Groundfish Fishery Management Plan (various rockfish, flatfish, roundfish and sharks) and the Coastal Pelagic Fishery Management Plan (Northern anchovy and Pacific sardine) under the MSA. The proposed action contains measures to avoid, minimize, mitigate, or otherwise offset some potential adverse effects to EFH. Therefore, no additional EFH Conservation Recommendations have been provided by NMFS, as adverse effects to EFH are expected to be adequately minimized or compensated.

Please contact Jacqueline Pearson Meyer at (707) 575-6057, or by e-mail Jacqueline.Pearson-Meyer@noaa.gov if you have any questions regarding this ESA consultation, or Korie Schaeffer for EFH questions at 707-575-6087; Korie.Schaeffer@noaa.gov, or if you require additional information.

Sincerely,

Rodney R McInnis

Rodney R. McInnis
Regional Administrator

Enclosures

cc: Chris Yates, NMFS, Long Beach
Holly Costa, USACE, San Francisco
Margaret Paul, CDFG
Chad Mitcham, USFWS
Copy to Administrative File: 151422SWR2012SR00254

Enclosure 1

BIOLOGICAL OPINION

ACTION AGENCY:	U.S. Army Corps of Engineers, San Francisco District
ACTION:	The Carmel River Reroute and San Clemente Dam Removal Project at the San Clemente Dam on the Carmel River.
CONSULTATION CONDUCTED BY:	National Oceanic and Atmospheric Administration's National Marine Fisheries Service, Southwest Region, North Central Coast Office
TRACKING NUMBER:	2012/02129
DATE ISSUED:	**July 23, 2012**

I. CONSULTATION HISTORY

The California Department of Water Resources (DWR) Division of Safety of Dams (DSOD) issued a safety order for the San Clemente Dam (SCD) structure in the early 1990s after determining that the structure could potentially fail in the event of either the maximum credible earthquake (MCE) or the probable maximum flood (PMF). As a result, California American Water (CAW) developed the San Clemente Dam Drawdown Project as a means of incorporating interim safety measures to reduce the risk of downstream flooding in the event of dam failure until permanent safety measures could be taken to either buttress or remove the dam. NMFS completed several Endangered Species Act (ESA) section 7 consultations for the San Clemente Dam Drawdown Project between 2003 and 2007.

After DWR issued the safety order, DWR and CAW spent many years determining how to make the SCD seismically safe. CAW's preferred project was to strengthen the dam with concrete and leave it in place. The Proposed Project, Dam Strengthening, would have resolved the public safety issues and would have improved upstream fish passage through construction of a new fish ladder. However, both up- and downstream fish passage would have continued to be heavily impaired by the dam, and the dam would continue to disrupt sediment transport and ecological connectivity in the river ecosystem. During the EIR/EIS process, the National Oceanic and Atmospheric Administration's (NOAA's) National Marine Fisheries Service (NMFS) provided comments and technical assistance to develop a safety project that would also minimize these impacts to listed South Central California Coast (S-CCC) steelhead (*Oncorhynchus mykiss*). At this time, the California State Coastal Conservancy (SCC), the lead agency for the State of California, NMFS, and the Planning and Conservation League Foundation worked with CAW to develop a feasible approach that would meet dam safety objectives while minimizing impacts to steelhead. This approach, the Carmel River Reroute and San Clemente Dam Removal Project

(CRRDR), became the project proposal in March of 2011. In December 2007, DWR certified the Final EIR/EIS, and in February 2008, DWR indicated that the dam safety issue could be addressed through implementation of the CRRDR project.

Over the past several years, CAW has engaged in discussions with NMFS regarding the CRRDR project. A summary of the discussions is provided here:

- NMFS staff, Joyce Ambrosius, has participated as a member of the CRRDR Project Management Team since 2006, to develop the project for construction and ensure impacts to steelhead and critical habitat were addressed.

- NMFS received the Draft San Clemente Dam Seismic Safety Project EIR/EIS for the proposed action in April 2006, and NMFS provided comments on the Draft EIR/EIS on June 30, 2006. NMFS' comments stressed the preferred Strengthening Project could result in jeopardy if pursued. NMFS recommended removing the dam and supported the CRRDR project.

- A project scoping meeting was held in August 2008 and a design-build meeting was held in December 2008 with various agencies, including NMFS, to discuss project design criteria.

- Technical Review Team meetings held on March 6, June 10, June 16, and September 9, 2011 were attended by NMFS staff Joyce Ambrosius (NMFS, Protected Resources Division) and Brian Cluer (NMFS, Habitat Conservation Division). The Technical Review Team was comprised of experts in various fields, *i.e.,* geomorphology, hydrology, fish biology, dam removal, and geology, to identify necessary criteria for the construction of the project related riparian vegetation and channel restoration, with a focus on fish passage and other critical habitat improvements for steelhead and California Red-legged frogs.

- A draft Biological Assessment (BA) was received by NMFS in October 2011. A final BA was provided to NMFS via electronic mail (e-mail) on January 27, 2012, the same time CAW gave their 404 application to the Corps in order to provide NMFS the BA earlier. The Habitat Mitigation and Monitoring Plan was provided to NMFS via e-mail on April 5, 2012.

- NMFS received a letter from the Corps on March 26, 2012, requesting formal consultation for the project. The letter documented the Corps determination of may adversely affect S-CCC steelhead for the CRRDR Project.

II. DESCRIPTION OF THE PROPOSED ACTION

The Federal action involves the Corps granting a permit, pursuant to Section 404 of the Clean Water Act (33 U.S.C. Section 1344), to CAW. The applicants request permit authorization to remove two obsolete dams, the San Clemente Dam (SCD) and Old Carmel River Dam (OCRD) located on the Carmel River. Both dams are obsolete as water supply sources, and removal of the dams will permanently remove seismic risks of dam failure. The broader project goal is to remove SCD and OCRD and restore a variety of habitats, including restoration of fish passage for S-CCC steelhead (*Oncorhynchus mykiss*) within the river ecosystem. Overall, the CRRDR project is intended to improve water quality, sediment transfer, fish passage, and aquatic habitat, and to restore natural character and function to the water bodies and upland habitats both within the project footprint and on a watershed level. Restoration activities are expected to enhance habitat communities to ones that are structurally diverse, possess species richness, and provide the habitat components to support breeding, foraging, rearing, and dispersal requirements of target wildlife species, especially listed species such as South-Central California Coast (S-CCC) steelhead and the California Red-legged Frog (*Rana draytonii)*

The CRRDR Project is scheduled to occur for an approximate duration of 40 months, over four or five construction seasons, expected to commence August 2012. In-channel construction will occur between May 15 and October 31 (weather permitting) during each of the anticipated construction years. The CAW currently owns the majority of land in and around the project area. After project completion, it is CAW's intent to convey the property to the United States Department of Interior Bureau of Land Management (BLM). NMFS considers this transfer of ownership to be an interdependent or interrelated activity. This transfer of ownership is intended to protect and preserve the open space in perpetuity. There are no other interdependent or interrelated activities associated with this project.

A. Proposed Project Overview

The reservoir behind the SCD is almost full of accumulated sediment and no longer a useful water source for CAW. Therefore, the CRRDR project proposes to realign the Carmel River and bypass the majority of accumulated sediment in the reservoir through rerouting of the mainstem. This will occur prior to removal of the dam. To accomplish this, a Reroute Channel will be constructed to direct all flows from the mainstem of the Carmel River upstream of the reservoir into an adjacent tributary, San Clemente Creek, in order to create a Combined Flow Reach (see Figure 1). The Reroute Channel will be excavated through the drainage divide that exists approximately 3,000 feet upstream of SCD between the mainstem of the Carmel River and San Clemente Creek. This will require excavation and placement of approximately 300,000 to 350,000 cubic yards (cy) of material. Upstream of the Reroute Channel, and the Combined Flow Reach, both the Upper Carmel River and Upper San Clemente Creek, will be partially excavated and restored in order to transition to existing upstream river channel grades. The new Combined Flow Reach between the Reroute Channel and the present dam location will be restored with a focus on steelhead passage. A portion of the accumulated sediment in the Upper Carmel River Reach and all of the accumulated sediment in the San Clemente Creek arm of the reservoir will be excavated and relocated to the sediment in the abandoned Carmel River arm, and then stabilized in place to form the Sediment Stockpile (about 550,000 to 700,000 cy of sediment).

To maintain the new alignment of the river, a Diversion Dike will be constructed from the excavated sediment of the Reroute Channel to guide the Carmel River flow through the Reroute Channel into the San Clemente Creek. This will also prevent flow from entering the upstream end of the Sediment Stockpile (abandoned reservoir). The Diversion Dike construction will require movement of approximately 100,000 to 150,000 cy of material. In addition, a Stabilized

Sediment Slope (about 120,000 to 170,000 cy) will be constructed at the downstream end of the abandoned Carmel River arm to retain sediments in the Sediment Stockpile area.

Habitat restoration and re-vegetation will be performed for the Upper Carmel River Reach, Reroute Channel and slopes, Combined Flow Reach, Diversion Dike, Stabilized Sediment Slope, and Sediment Stockpile. The restoration will include transitioning to the limit of construction, impact, and/or existing undisturbed vegetation areas. When all of the site components are in place, the SCD will be removed, entailing removal of 7,000 cy of material. In addition, the OCRD, located approximately 1,700 feet downstream of SCD, will be removed as part of the project (1,500 cy of material). Temporary access roads will also be required for equipment access during construction. Completion of the project will result in the restoration of approximately 5,900 linear feet (lf) of the river channel, and between 45 to 55 acres of riverine habitat and vegetation (URS 2012). The project’s major components and activities are provided below (more detailed descriptions follow):

- Construction/Improvement of Access Roads and Staging Areas
- Excavation of the Reroute Channel
- Construction of the Diversion Dike
- Stabilization of the Sediment Slope
- Sediment Stockpile
- Combined Flow Reach
- Carmel River Channel Restoration
- SCD Removal
- OCRD Removal
- Habitat Restoration and Revegetation

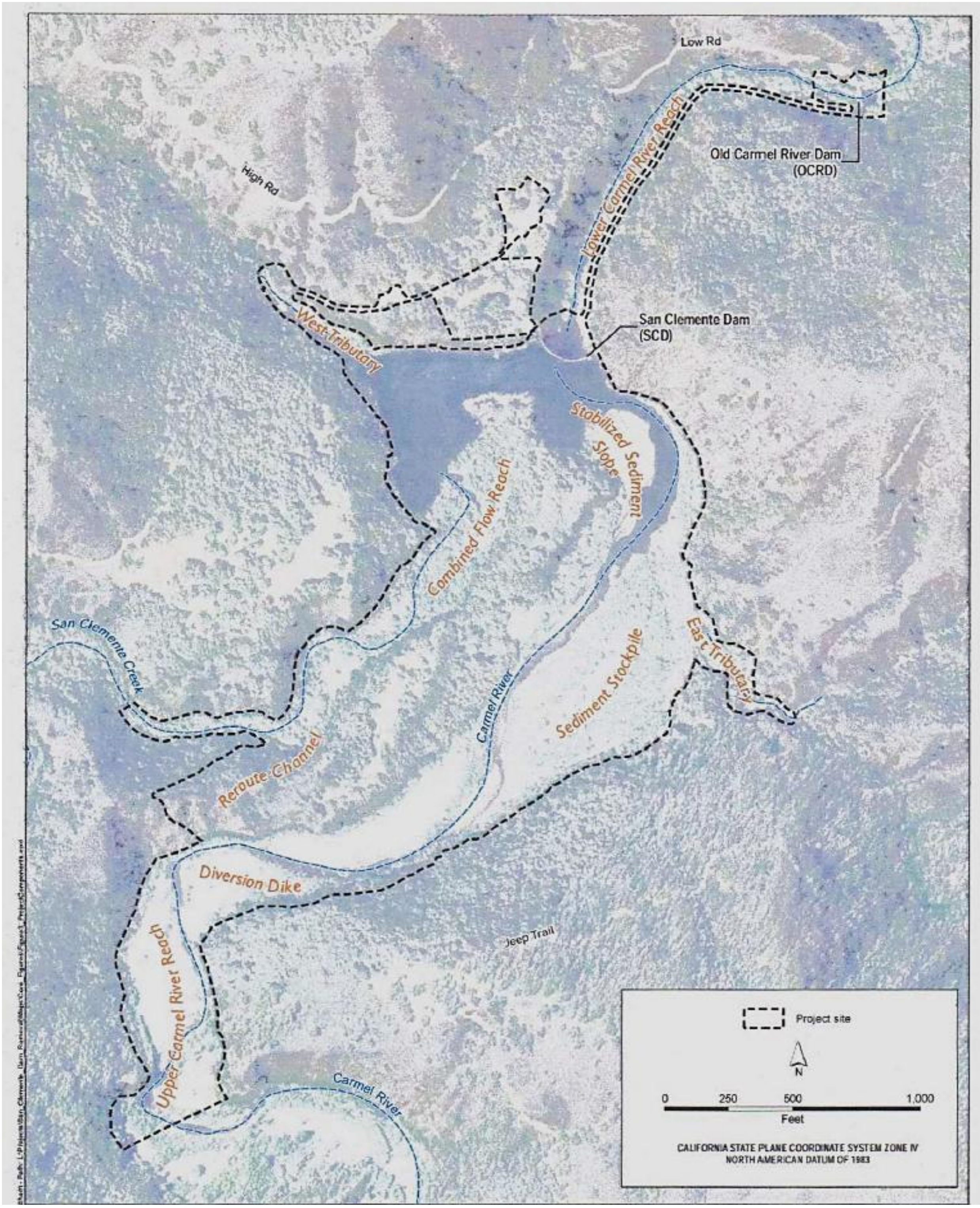

Figure 1. Carmel River Reroute and San Clemente Dam Removal Project (URS 2011).

B. Project Construction Activities and Components

1. <u>Design-Build Nature of Project</u>

The project will be constructed by a design-build (D-B) process where contractor(s) are selected through a competitive procurement process led by CAW. The nature of this D-B project means that preliminary field studies, environmental reports, and permit applications in all disciplines were conducted and submitted at earlier phases of the engineering design process than would be the case for a standard design-bid-build project. For this reason, the description of the exact means and methods for constructing the project's elements will be further developed as the design work proceeds. Although the detailed means and methods for accomplishing certain project steps are not available at this time, the preliminary design package defines the design guidelines and performance specifications that the D-B contractor will be required to meet. These design guidelines and performance specifications will require achievement of environmental standards and goals for protection of air and water quality, special-status species, habitats, plant communities, and others, but will not prescribe particular approaches that the contractor must use to attain them. Those decisions will be left to the D-B contractor. However, the D-B nature of this project does not preclude NMFS from completing thorough analyses on the projects' expected short-term and long-term effects to S-CCC steelhead and their critical habitat. The general type and sequence of construction activities is known, as well as the environmental standards and goals that the project must meet. This information is sufficient for NMFS to make reasonable assumptions regarding the anticipated effects on ESA-listed species and critical habitat from the project.

2. <u>Construction Duration and Sequence of Activities</u>

As stated previously, the duration of the construction activities for the proposed project are estimated to be approximately 40 months, occurring over four or five (CY1-CY5) construction seasons (see Table 1). In-channel construction will occur between May 15 and October 31 (weather permitting) during each of the anticipated construction years. Although the general order of activities should not vary significantly from what is described below, the selected D-B Contractor will develop a detailed construction plan and schedule based on its final design and the means and methods it will use to meet the project performance specifications, including work windows, avoidance and minimization measures, and other environmental protections.

Construction of the access roads could begin in late summer of the first construction year (CY1) if the relevant project permits are received by August 3. Otherwise, the D-B contractor will construct the roads starting as soon as permits are in place, likely in spring of the second year (CY2). After the access roads are complete, the D-B contractor could conduct field investigations (test pits, borings, *et cetera* [etc.]) and build the temporary river diversion system. After the river diversion system is operational, diversion and reservoir drawdown will begin, followed by earth movement (for the Combined Flow Reach, Reroute Channel, Diversion Dike, and Sediment Stockpile) and possibly partial dam removal. As the earth-moving progresses, channel improvement and restoration, and stockpile and slope restoration will either be completed in stages or all at once during one construction season. After the site earthwork and restoration are complete, the remainder of SCD will be removed and OCRD demolished. Table 1 shows a construction schedule that includes flexibility for some components of the project.

Table 1. Summary of Construction Activities by Season (URS 2012).

CY*	Description	Major Construction Components
CY1	Preparations and access only	Access road improvements (if permitting is complete)
CY2	First full construction season	Access road improvements (if not completed in CY1), field investigations, vegetation clearing, install temporary water diversion systems, and potentially install dewatering wells
CY3	Second full construction season	Divert Carmel River and San Clemente Creek, install dewatering wells, cut the Reroute Channel, build the Diversion Dike, excavate part of the sediment and place in the Sediment Stockpile, build the Stabilized Sediment Slope, potentially remove a portion of SCD, install irrigation for some plantings, undertake some of the restoration plantings
CY4	Third full construction season	Divert Carmel River and San Clemente Creek, finish sediment excavation, finish channel restoration, complete SCD removal, remove OCRD, install remaining irrigation for plantings, complete restoration plantings
CY5	Possible partial construction season	Removal of OCRD may not be possible until this season

*CY = Construction Year.

3. Construction Access

Access to the site during construction will require construction and improvement of access roads and staging areas. These activities will include additional site clearing components to prepare areas for construction. Access roads and accompanying staging areas will be constructed beginning in the late summer and fall of CY1 and will be finished during CY2, which is the first full construction season.

a. Access Roads

The primary access route will be off of Cachagua Road along an existing private dirt road, referred to as the "Jeep Trail". The Jeep Trail Road will extend to a section of road that will be constructed referred to as the "Reservoir Access Road". This road will provide access from the east, through the upstream area of the reservoir. A 12,000-foot long portion of the Jeep Trail will be improved by widening the current 12-foot width to 18 feet.   Drainage will be improved along the roadway by outsloping (sloping towards the outer edge) the road surface and through installation of culverts along the alignment at approximately 400-foot-intervals. The road will be surfaced with several inches of base rock, with isolated sections of asphalt pavement, as required by the slope and other conditions. The additional footprint around the existing Jeep Trail will be approximately 8.1 acres. Depending on the type of construction traffic accessing the site, the route to the Jeep Trail will be either via the northern end of Cachagua Road (3 miles) or via Tassajara Road to the southern end of Cachagua Road (8.3 miles). Tassajara Road and the northern end of Cachagua Road are both located off of Carmel Valley Road (see Figure 2).

The Reservoir Access Road will be a 3,000-foot road located off of the Jeep Trail and will extend down to the SCD reservoir area. The road will be 18 feet wide, with 3-foot shoulders on each side with a maximum grade of approximately 12 percent (%) and surfaced with base rock. Drainage along the roadway will also be provided by outsloping and installing culverts. The Reservoir Access Road will have a footprint of approximately 3.4 acres. Construction along the Jeep Trail and Reservoir Access Road will both require ground disturbance and removal of trees, shrubs, and other vegetation.

Secondary, limited access to SCD will be from San Clemente Drive off of Carmel Valley Road. Once San Clemente Drive enters CAW property, two options are available to reach SCD. These access options are referred to as the Low Road and the High Road. San Clemente Drive runs from the north, along Carmel Valley Road through the Sleepy Hollow subdivision, southwest, onto CAW property. There is a locked gate there that controls access to SCD. Beyond the gate, San Clemente Drive continues 0.6 miles to the intersection of the Low Road and the High Road. The Low Road continues along the Carmel River and leads to a one-lane bridge across the river, then climbs the northwest valley slope to reach the top of SCD. The High Road crosses the Carmel River at a ford over half a mile downstream of OCRD, and continues in a southerly direction with east-west switchbacks to reach the top of SCD. The base of SCD can also be accessed by way of an extension off of the Low Road at OCRD, referred to as the Plunge Pool Road. Heavy construction equipment will not use San Clemente Drive, the Low Road, or the High Road to access SCD. Rather, smaller construction equipment (*e.g.*, pickups and 1-ton trucks) will occasionally use these roads. Heavy construction equipment will access OCRD for demolition activities using the Plunge Pool Access Road from upstream after SCD is removed or possibly the Low Road from SCD down to OCRD prior to removal of SCD. The existing Plunge Pool Road will require relatively minor removal of vegetation and grading to be made passable by construction equipment.

In addition, a section of Cachagua Road to the north of the intersection with the Jeep Trail may be slightly modified in order to be used for vehicles bringing construction personnel to the site and for highway-legal dump trucks and similarly-sized vehicles that will haul aggregates and other construction materials to the site from Carmel Valley Road (Figure 2). Also, tree branch pruning will likely be necessary at the intersection of Carmel Valley Road and Cachagua Road. The section of Cachagua Road to the south of the intersection with the Jeep Trail is generally less winding but has five curves that will make it difficult for tractor trailers pulling lowboys to negotiate through. These five curves will likely require widening to allow for passage of the larger equipment. Additionally, this section of Cachagua Road has a load-restricted one-lane bridge (Bridge # 529) that will need temporary or permanent improvements to handle construction equipment loads. The current design calls for three bridge footings of 100 square feet each to be placed into the streambed to support nine columns (three per footing) to add strength to the bridge. Pile driving will not be used for construction of Bridge #529 improvements. During geo-archeological investigations near the bridge, bedrock was identified outside of the channel at a depth of five to seven feet. The design assumes that this bedrock depth continues within the channel of Cachagua Creek, and therefore, little excavation will be required to reach bedrock. Construction of Bridge #529 will involve dewatering all or a portion of the stream channel and bypassing flows downstream of the work area. A cofferdam will be installed to accomplish this. Afterwards, the channel area beneath the bridge will be excavated to bedrock to pour the concrete spread footings. The footings will be connected to existing piers of the bridge. If possible to only dewater a portion of the creek, the water will be diverted from the wetted to the dewatered side of the creek when the footing has cured and set. Fish will be rescued and relocated during flow diversion and dewatering if necessary.

b. Staging Areas

During construction and improvement of the roads, several small staging areas will be created along the Jeep Trail and the Reservoir Access Road for stockpiling materials, vehicles and equipment. A total of 12 staging areas are planned for the project. Seven of these areas are at or along the Jeep Trail or Reservoir Access Road and will be built during CY1 or CY2. Of the remaining areas, three will be on the ridge between the Carmel River arm and the San Clemente Creek arm, and one will be near the left abutment adjacent to the top of SCD. The last of the 12 will be at OCRD. The ridge staging areas and the SCD staging area will be built during CY2 or CY3, as needed. If the staging area for OCRD is not built during CY4, it will be the only one constructed during CY5. These staging areas are described below.

Staging Areas on Jeep Trail and Reservoir Access Road. One staging area is proposed at the origin of the Jeep Trail at Cachagua Road. Six other staging areas are proposed along the Jeep Trail and Reservoir Access Road. These proposed access road staging areas have been chosen and sized to minimize the amount of tree clearing needed. These staging areas will provide storage of vegetative debris cleared, topsoil stripped and earthwork cut during road construction, and will also provide temporary storage of aggregate base rock before placement. The contractor staging area at the intersection of the Jeep Trail and Cachagua Road on Monterey Peninsula Regional Parks District (MPRPD) property will be approximately 0.4 acre. This staging area will provide an area for the off-loading of heavy construction equipment and an area within which trucks could turn around. Earthwork and tree removal will be required, and the area will be surfaced as required with base rock. After project completion, the MPRPD will utilize the staging area as a parking and access area.

Staging Areas within Reservoir Area. Proposed staging areas within the reservoir area will be limited to the three areas along the ridge between the Carmel River and San Clemente Creek. Additional temporary staging areas may be located in the sediment stockpile area once construction has begun; however, these are not listed here because they will be located within the disturbed sediment stockpile footprint of the project site and do not increase the total disturbance area. All staging areas within the reservoir area will be restored as part of the overall project restoration plan.

Staging Area near Left Abutment of SCD. A staging area will be sited within the vicinity of SCD’s left abutment. This staging area could be used as a location for a water treatment system and contractor’s office trailers, and used during the demolition of SCD.

Staging Area for Removal of Old Carmel River Dam. The staging of the work for the removal of OCRD will be performed from the Low Road or Plunge Pool Road or within the limits of upstream and downstream impacts, as discussed in the section on OCRD removal below.

c. Site Clearing

There are two different types of site clearing that will occur for the project, along the access roads and within the reservoir area itself. Clearing along the access roads will occur in CY1 or CY2 depending on permitting. Clearing the reservoir area will likely begin late in CY2 and be completed during CY3. Clearing of the access roads will ideally be performed within the time frame of August 1 to March 1 to accommodate nesting migratory birds.

Clearing in the work area within the limits of the reservoir behind SCD will occur following completion of the Reservoir Access Road, potentially starting in August of CY2. Approximately 46 acres of existing vegetation will be cleared. Another 1.0 acre will be cleared near OCRD, for a total of approximately 47 acres. Trees that are removed, and of sufficient size, will be retained for use as large woody debris (LWD) elements during river channel improvements. The remaining vegetative debris will be mulched and stockpiled for use in habitat restoration.

In addition to clearing vegetation from the site, several existing structures may need to be removed or demolished during the site clearing or construction phases of the project. These structures include a Quonset hut (used as the chemical building for SCD), the residence located near SCD, associated utility systems, a second cottage (located near the downstream filtration plant), and a water supply pipeline along the Low Road.

4. <u>Geotechnical Investigations</u>

The project will require additional geotechnical investigations. These will include core and soil borings, test pits, and pump tests. These will likely occur as soon as the access road improvements are complete in summer of CY2. Core borings will be done to support the design of the Reroute Channel cut, understand the stability of the low saddle area, understand the conditions on the terrace at the Diversion Dike left abutment, and to further characterize the rock conditions below the Diversion Dike and Stabilized Sediment Slope. Soil borings are anticipated to support the design of the Diversion Dike and the Stabilized Sediment Slope. Soil borings will also help to understand the soil conditions of the alluvium and the level of the bedrock below the 1921 surface (pre-SCD riverbed surface) along San Clemente Creek, and at the proposed water diversion cofferdam locations. Test pits will likely be needed to evaluate the size and abundance of boulder material on the ridge terraces. Pump tests in the sediment along San Clemente Creek and the Carmel River will be performed in order to design the sediment dewatering system.

5. <u>Flow Diversion at the Reservoir</u>

Prior to any earthwork activity, flows from the Carmel River and San Clemente Creek will need to be diverted around the SCD during each full construction season. The diversion systems will be installed during CY2 and used through CY4. Two bypass systems will be installed, the first will be constructed to divert the mainstem of the Carmel River around SCD, and the second will be installed to divert San Clemente Creek around the SCD until the Reroute Channel and Combined Flow Reach are completed. As stated above, the diversion systems will be installed after the access roads are constructed. They will remain in place until dam removal is complete. Each temporary water diversion system will consist of a cofferdam, pipeline, and intake and discharge structures. The dam will be penetrated at an appropriate elevation for the Carmel River and San Clemente Creek diversion pipelines. Until SCD is fully removed, the discharge point for the diversion will be into the plunge pool downstream of the dam. An energy dissipation structure at the end of the pipeline will be used to dissipate flow energy to prevent erosion at the discharge point. Once the diversion pipelines are in place, the SCD reservoir will be dewatered. Fish rescue and relocation will occur prior to flows being diverted around the reservoir. At the end of the in-water work season, prior to water refilling the reservoir, a net will be placed across the channel upstream of the point of diversion to exclude fish from entering the reservoir. The net will remain in place until water quality (*e.g.,* water and turbidity levels) is suitable for fish.

Winterization of the diversion facilities will include blocking flows from entering the diversion pipes by placing bulkheads at the pipe intakes and removing bulkheads from the cofferdam, which will allow fish passage via the river channel as currently occurs during the winter season. More detail on all fish exclusion, trapping, rescue and relocation methods are discussed below in the *Avoidance, Minimization Measures and Monitoring* section of this document. A complete Water Diversion Plan will be provided to NMFS for approval prior to a diversion system being constructed (CY2). The plan will provide additional details on measures to provide fish passage, winterization plans, and the eventual removal or sealing of water diversion systems.

a. Cofferdams

As described above, cofferdams will be used for the diversion systems in order to control and direct water into the pipelines. The cofferdams will create a small backwater area for the intake structures and diversion pipelines as well as provide an area for fish trapping during CY3 and CY4. The cofferdams could be designed with a bulkhead section that will be removed for fish passage during periods when flows are not being diverted (winter-spring). Other methods to provide for fish passage may be considered by the D-B contractor. Regardless, fish passage will be provided at the end of each construction season (for seasonal steelhead migration periods) when flow is no longer diverted around the project area.

The sediment at the cofferdam location is likely underlain by highly porous alluvium, consisting of gravel, cobbles, and boulders that formed the river channel prior to construction of SCD. A sheet pile cofferdam will be able to penetrate through the sediment but will not be able to penetrate through the pre-dam alluvium. Therefore, use of a vibratory pile driver will be necessary to install the sheet piles. If sheet piles are not extended to the bedrock beneath the pre-dam alluvium, then river water from upstream of the cofferdam could seep underneath and into the work area. The D-B contractor could handle this issue in various ways. The first possibility for addressing seepage of river water under the cofferdam would be to place a dewatering system just downstream of the cofferdam. In this option, a line of dewatering wells or well points would be installed just downstream of the cofferdams into the pre-dam alluvium to control the seepage under the sheet pile. Water pumped from the wells would be discharged directly into the diversion pipeline depending on water quality. Another possibility would be to use an excavator to remove the larger materials from the pre-dam alluvium in the cofferdam location which would allow the sheet pile to be driven down to bedrock, minimizing water under-seepage. Dewatering wells for this option would not be required. Again, all dewatering and diversion activities will take place once fish have been relocated from the area.

b. Pipelines

The diversion pipelines will be sized to carry peak flows between May 15 and October 31 safely in most years, though the exact specifications are still being developed. Since fish will be excluded, or rescued and relocated from areas where flow diversion will occur, the pipelines will not be designed to allow for fish passage through the pipes. In order to regulate water temperatures, the pipelines will be covered or treated to minimize heating of the water that is being conveyed downstream. The pipelines will be trenched into the sediment at the upstream end and benched into or anchored as needed to the valley walls. Installation of the pipelines where they are trenched in the sediment may require controlling recharging of groundwater in the sediment by temporarily diverting flows through smaller pipelines laid along the existing river channel and creek channel until the pipe trenches have been backfilled. The pipeline for the Carmel River diversion will start above the project area at the location of the installed Carmel River intake structure and run approximately 0.8 miles along the right side of the river to the plunge pool below SCD.

For the San Clemente Creek water diversion, the pipeline will begin above the project area at the location of the installed San Clemente Creek intake structure and run approximately 0.6 miles along the left side of the creek to the plunge pool below SCD.

c. Intake Structures

The intake structures for the pipelines will be a short distance upstream of the cofferdams in order to provide the ability to rescue fish at the start of diversions, and allow closure of the cofferdam bulkhead during this time. Intake structures for the diversions, especially for the Carmel River, will be sited in the channel close enough to the cofferdams to reach the water they retain, but far enough upstream of them that they will be outside of the influence that the water wells (used for sediment dewatering downstream closer to SCD might have on surface water during low-flow periods of the construction season. The intake structure will include a steel plate that will provide for connection of the diversion pipeline on the downstream side and will include a slide gate on the upstream side of the pipe to prevent flows from entering the pipeline when diversion is not occurring (*i.e.*, during winter and early spring).

A rotary screw trap or fyke nets will be used to trap downstream migrating steelhead in Carmel River and San Clemente Creek during the diversion season beginning on May 15 of each construction season. Prior to May 15 each year, a floating barrier fence (log boom) will be placed across the channel and a rotary screw trap will be installed upstream of the diversion. The barrier fence will capture large debris moving downstream before it reached the rotary screw trap.

d. Outlet Structures

The water diversion system outlets will include a control structure with a large gate valve suitable to control Carmel River flows through the pipelines during CY3 and CY4. The valves will be capable of being opened or closed as needed to control the flow rate. As stated previously, fish are expected to be relocated prior to water flowing through the diversion pipe, so maintaining flow criteria for fish passage through the diversion is not proposed for this project.

e. Removal of Diversions

At the end of CY4 or the last full construction season, the diversion system will be dismantled and removed where it is above the finished grade and filled with controlled low-strength material or cellular concrete and capped at each end prior to being buried underneath the Sediment Stockpile and Diversion Dike.

f. Flow Diversion and Dewatering for River Reaches in Other Construction Areas

For removal of SCD, once flow is diverted around the reservoir, water levels will be reduced in the plunge pool by pumping.

Removal of the OCRD will also require a small diversion system, and dewatering to complete activities. A short (maximum of one day) period of pumped flow diversion and associated fish rescue and relocation measures will be taken. This will be described further in the OCRD removal section below.

As described above, the bridge located over Cachagua Creek, Bridge #529, may require dewatering to install the three new bridge support footings. If water is present during construction, cofferdams will be built to divert water around the work area and isolate the construction area. Fish rescue and relocation will occur prior to complete dewatering at the site. Regardless of the presence or absence of water in the channel, pumping will be required to remove groundwater from the excavations during construction of the bridge footings.

6. <u>Dewatering the Reservoir and Sediments</u>

Dewatering for the CRRDR Project will include two types of dewatering: dewatering the reservoir and dewatering the sediment behind the dam before excavation. Both types are discussed in the following paragraphs.

a. Dewatering the Reservoir.

The current practices for drawing down the reservoir each year are the basis for the construction dewatering plan. Generally, it takes 4 weeks to lower the reservoir from the spillway crest elevation of 525 feet to 515 feet elevation. This typically occurs between May 31 and July, or as soon as flows into the reservoir are less than 30 cubic feet per second (cfs). The rate of lowering of the reservoir is restricted by NMFS to about 0.5 feet per day to maintain water quality (NMFS 2007a). During CY2, the reservoir will potentially be dewatered to 506 feet through a new hole installed in the dam face to facilitate construction of the diversion systems. During CY3 and CY4, a second dewatering system may be used to speed dewatering of the reservoir and increase days available for construction. The reservoir will be dewatered either by opening lower valves that already exist in the dam or by pumping. Water from dewatering the reservoir may also be used for construction or irrigation needs. Reservoir water will be pumped through a chemical treatment system or settling tanks, if needed, to meet water quality requirements before being discharged downstream.

As the reservoir is dewatered, steelhead and CRLF will be rescued from the drying areas. All rescued steelhead and CRLF will be transported and released into NMFS and USFWS-approved habitat, respectively. The details of these efforts are described in the *Avoidance, Minimization Measures and Monitoring* section and will be provided in final Special Status Species Rescue and Relocation Plans to NMFS for approval prior to CY2.

b. Dewatering the Sediment

Dewatering the sediment will begin after diversion of the Carmel River and San Clemente Creek, lowering (dewatering) of the reservoir, and installation of the sediment dewatering system have all occurred. Potential sediment dewatering strategies could involve the use of dewatering wells spaced regularly along the Carmel River arm in the location of the future Stabilized Sediment Slope and along the San Clemente Creek arm. A sump on the upstream side of the dam created by a sheet pile structure near the location of the outlet gates could also be used in combination with dewatering wells. The sump will be progressively excavated in 15-foot increments to facilitate collection of sediment pore water. Additional wells will be sited near the location of the top of the proposed Stabilized Sediment Slope in order to control any water that could seep from the unexcavated sediment of the Carmel River arm into the Stabilized Sediment Slope work area.

From the sump, the water will be pumped and either discharged directly into the Carmel River downstream of the dam or treated before discharge, depending on water quality. Water drawn from dewatering wells may have high concentrations of iron, and water seeping into the excavations may be turbid. If necessary, a water treatment system will be constructed to treat the water drawn from the dewatering wells and filter the turbid water pumped from the sumps. The treated water could either be discharged to Carmel River or reused for construction purposes (*e.g.,* dust control). All water released back into the river will be monitored for water quality. A final Water Quality Monitoring Plan will be provided to and approved by the appropriate agencies before any dewatering activities begin.

Once dewatered, sediment and other material will be excavated from the Stabilized Sediment Slope foundation, the Combined Flow Reach, the Upper Carmel River Reach, and the Upper San Clemente Creek Reach. After removal of sediment from the Combined Flow Reach and Upper San Clemente Creek Reach, additional effort will be required to remove as much sediment from the exposed valley walls as is practicable. Sediment removal would likely be performed using an excavator, possibly with a flat-blade bucket, to carefully scrape the sediment from the pre-dam surface. There may be temporary haul roads built in the work areas to move the sediment and material to the Sediment Stockpile Area. This process will likely take several months each season.

7. <u>Reroute Channel</u>

The Reroute Channel will be located at the southwest end of the ridge separating the Carmel River and San Clemente Creek, as shown on Figure 1. The purpose of the Reroute Channel is to direct water from the mainstem of the Carmel River upstream of the reservoir into the Combined Flow Reach. The design of the channel will also meet other project objectives associated with flood levels, fish passage, and sediment transport. The Reroute Channel will be constructed during the third year of construction (CY3).

The Reroute Channel design geometry calls for slopes of two horizontal to one vertical (2H:1V) in the bedrock overburden, a 10-foot-wide bench at the top of the bedrock, with average 1H:1V slopes in the bedrock extending to the bottom of the excavation. The Reroute Channel will be approximately 400 feet long and will have upstream and downstream widths of 165 feet and 110 feet, respectively. The depth of the excavation below the existing ground surface at the top of the ridge will typically be on the order of 140 feet. The highest cut slope will be about 200 feet high. The Reroute Channel will be excavated to match the existing bedrock elevation at the downstream junction with the Combined Flow Reach and will slope upstream at a grade of 0.75% (URS 2012).

Construction of the Reroute Channel will start with the removal and stockpiling of the mantle of overburden and terrace deposits from the slopes. Excavation of the channel will be performed through a combination of ripping and blasting. The rock slopes of the channel will be evaluated and stabilized as necessary during the excavation. Excavated rock materials will be pushed to the bottom, and any boulders of 1-foot diameter or greater will be separated and retained for use in erosion protection, channel improvements and for the Combined Flow Reach. Material generated from the excavation of the Reroute Channel will also be used as a source of rockfill and erosion protection for the Diversion Dike and for a rockfill buttress to stabilize the Stabilized Sediment Slope. Excess materials from the excavation will be disposed in the Sediment Stockpile. If needed, blasting mats, temporary walls, or similar devices will be installed to prevent rock fall and blasting debris from entering an area of flowing water.

8. <u>Diversion Dike</u>

The Diversion Dike will be constructed at the upstream end of the Reroute Channel. The Diversion Dike will direct Carmel River flows into the Reroute Channel and will prevent river flows from entering the Sediment Stockpile area. It will be constructed during CY3. The planned location for the Diversion Dike is on a loose sand foundation that will be unstable during seismic shaking. Therefore, the foundation of the Diversion Dike will be stabilized by either excavating the liquefiable sediment from the dike foundation and replacing it with compacted rockfill or by improving the strength of the liquefiable materials using in-situ soil treatment techniques (stone columns, deep soil-cement mix, cement-bentonite shear walls, or vibro-compaction [URS and Interfluve 2011]). In addition to the foundation improvement, a cement-bentonite cutoff wall will be constructed across the Carmel River valley under the Diversion Dike to control loss of flows from the Carmel River due to seepage into the sediment under the dike. The cutoff wall will extend 30 to 40 feet through the sediment and pre-dam alluvium into bedrock. Construction of the wall could potentially occur concurrently with the foundation improvement. After completion of the cutoff wall, rockfill excavated from the Reroute Channel will be placed and compacted to form the Diversion Dike. The conceptual design for the Diversion Dike has a crest width of 20 feet and a crest length of approximately 350 feet.

The dike axis will match the alignment of the Reroute Channel and create a more natural landform that closes off the abandoned Carmel River arm. The crest elevation of the Diversion Dike will be approximately 569 feet, which is close to that of the existing ridge between the

Carmel River and San Clemente Creek. Additional fill, and nine to twelve inches of topsoil will be placed on the Diversion Dike to allow for habitat restoration. The upper end of the Diversion Dike will be graded to transition into the Sediment Stockpile area to the east and northeast. The proposed dike section will be protected against erosion from flood flows in the Carmel River using rip-rap obtained from the Reroute Channel. Additional rip-rap will be brought in to the site if a sufficient volume of riprap-sized materials are not available from the excavation. The erosion protection and the outer portion of the rockfill will have finer sediment materials sluiced into the voids before being covered with the nine to twelve inches of topsoil.

9. Sediment Stockpile

The Sediment Stockpile, to be constructed during CY3 and CY4, will replace the current Carmel River channel downstream of the Diversion Dike. The Sediment Stockpile's primary purpose is to permanently store excavated material from the Reroute Channel, the San Clemente Creek reach, and the Stabilized Sediment Slope. During construction, rockfill materials could be spread across the Sediment Stockpile area and covered with excavated sediment. The Sediment Stockpile will have an average area of about 10 acres during construction, which is sufficient area to allow for the drying of the wet sediment before compaction.

The conceptual design for surface grading is intended to support a diversity of natural habitats, including a ridge that extends from the Diversion Dike to the northeast and runs parallel with the two adjacent ridges to the east and west. This results in a graded ridge with two dominant slopes with aspect ratios suitable to ensure the long-term survival of native upland plant communities. The two smaller valleys created by the graded ridge will direct water to create a system of seasonal ponds, wetlands, and drainages.

10. Stabilized Sediment Slope

The Stabilized Sediment Slope will be located downstream of the Sediment Stockpile, thereby preventing mobilization of material placed there. The Stabilized Sediment Slope surface will accommodate drainage from the Sediment Stockpile and from the East Tributary (Figure 1) into the Carmel River. Work on the Stabilized Sediment Slope will take place during CY3. The Stabilized Sediment Slope will be in the existing Carmel River arm, which consists of loose sands and silts that are highly susceptible to liquefaction during seismic shaking and erosion. Because of this, stabilization of the Stabilized Sediment Slope will be necessary to mitigate the weak strength of the sediment. Stabilization will be provided through a shallow longitudinal slope and incorporation of engineered strengthening. The Stabilized Sediment Slope will be reinforced by over-excavating and constructing a buttress at the base of the slope or by strengthening the soil mass of the slope using in situ soil treatment methods, such as stone columns, deep soil-cement mix, cement bentonite shear walls, or vibro-compaction. Non-point source flows from the East Tributary and from the Sediment Stockpile area will be conveyed over the Stabilized Sediment Slope in a channel (the East Tributary Conveyance) that will be designed to convey up to the 100-year storm without significant erosion, meandering, or piping. Design of this feature will include measures to prevent any structural damage to the Stabilized Sediment Slope.

The proposed restored habitat for the Stabilized Sediment Slope includes upland species on the gently sloping and drier slopes, transitioning through habitats of coast live oak forest, California sycamore woodland, and mulefat scrub adjacent to the East Tributary.

11. River Channel Improvement and Restoration

Carmel River channel improvement and restoration for the project will extend from the upstream end of the Upper Carmel River Reach through the Reroute Channel and Combined Flow Reach, to below the plunge pool. Channel improvement and restoration will also extend upstream into the Upper San Clemente Creek Reach and potentially upstream into the West Tributary. If this occurs, the transition into the West Tributary will be graded to the 1921 gradient. Channel improvements and restorations will likely occur during CY3 and CY4. The restoration of the river channels will be done in order to provide suitable fish passage and sediment transport in the river, as well as restore a more natural hydrology.

The Combined Flow Reach and Upper San Clemente Creek Reach will have an approximate average channel gradient of 2.5% (based on the pre-SCD construction, 1921 gradient). The Reroute Channel will have a gradient of approximately 0.75% to provide more suitable fish passage and sediment transport in the river. The channel gradient in the upper Carmel River Reach is expected to reach a stable grade at approximately 0.3 to 0.7%. A mixture of step-pool and plane bed morphologies is planned for the Combined Flow Reach, and pool-riffle morphology is planned for the Reroute Channel and the Upper Carmel River Reach. Large boulders will form the nucleus of the step-crests in each step-pool; smaller materials (small boulders, cobbles, and large gravel) will plug the spaces between the boulders. Channel improvement and restoration work will follow sediment removal as the 1921 subgrade elevation is exposed. The following sections provide details of specific construction for each improvement and restoration activity planned per reach. These details are based on the present level of design development, and may be modified as the channel design progresses. Any changes to the detail will meet the project's restoration goals and necessary criteria for steelhead habitat. For a detailed description of fish passage criteria and design elements of the combined flow reach, see Appendix D of the BA provided for the project (URS 2012).

a. Reroute Channel

During construction of the Reroute Channel, bedrock will be excavated to the design subgrade for channel configuration. It is anticipated that this excavation would be relatively level but with an irregular surface across the width of the bedrock excavation. The downstream end of the reroute channel will match the bedrock elevation of the Combined Flow Reach. The Reroute Channel will then be reconstructed over the bedrock subgrade. This reconstruction will include fill with appropriately sized alluvium (small boulders, cobble, gravel, and sand) to form the channel bed, with a buffer of alluvium that will extend beneath the overbanks on either side of the channel. These banks will be filled with valley fill materials (which is a "dirty" mix of alluvial materials, capped with soil) to form the floodplain. This channel restoration will also include habitat features for steelhead, CRLF and LWD for floodplain roughness. The channel banks will then be constructed using biodegradable fabric, encapsulated soil lifts or similar approaches, supplemented with embedded LWD at select locations. Revegetation will complete the reconstruction of the channel segment.

b. Combined Flow Reach

This 2,600-foot-long reach will extend from the new confluence of the Carmel River and San Clemente Creek at the outlet of the Reroute Channel to just downstream of the existing SCD plunge pool (URS 2012). In general, channel excavation will be through the accumulated sediment to a surface that is competent to serve as the foundation for channel construction (near the 1921 riverbed topography). The target excavation extent will be based on the design subgrade; however, this target may be adjusted in the field based on the following considerations:

> 1) Materials at the design subgrade elevations are found to be not competent to serve as the foundation for channel construction, necessitating over-excavation.
>
> 2) Bedrock is encountered at an elevation higher than the design subgrade, and it is determined that the channel design should be adjusted instead of excavating the bedrock.

Where space permits, a floodplain will be created that includes LWD and habitat features for CRLF. Native materials from the overbanks will be supplemented as needed with valley fill materials to form this floodplain. As described in previous sections, the LWD will be obtained from cleared trees during site preparation and access road construction. After excavation, channel construction will proceed with construction of boulder-based features (*e.g.*, step pools) and placement of alluvium (small boulders, cobble, gravel, and sand) around the boulders to constitute the streambed. As with the Reroute Channel, channel banks will then be constructed using biodegradable fabric, encapsulated soil lift, or similar approaches. The streambed and banks will be supplemented with embedded LWD in appropriate locations. Revegetation will then complete construction of the channel segment.

c. Upper Carmel River Reach

In the project design, the inlet elevation of the Reroute Channel is lower than the elevation of the existing grade in the Upper Carmel Reach. Therefore, up to 1,000 feet of grading will be necessary to transition between the Reroute Channel and the Upper Carmel river floodplain.

d. Upper San Clemente Creek Reach

The conceptual approach for this reach consists of excavating the existing accumulated sediment down to a surface that is composed of materials that are appropriate for the anticipated hydraulic performance (stability and fish passage objectives) of the channel segment. The target surface for excavation is anticipated to be the 1921 topography, but adjustments may be made in the field based on initial excavation results.

12. San Clemente Dam Removal

The following section describes the extent of the proposed removal of the dam, which could occur in one step during CY4 or in two steps during CY3 and CY4. The description that follows describes both dam removal possibilities.

The SCD will be removed in its entirety. The dam will be demolished along with the appurtenant buildings, the fish ladder, attached pipelines and valves, electrical facilities, and any other facilities associated with the dam. Demolition during a single construction season (CY4) will likely use a combination of wire sawing and hydraulic hoe-ram methods. Any reinforcing steel will be separated from the concrete and transported off-site for disposal. The concrete will be hauled from the dam to the Sediment Stockpile for burial.

Demolition of the dam will be sequenced such that the elevation of the sediment remaining in San Clemente Creek and any unstabilized sediment in the Sediment Stockpile will be lower than the demolished level of the dam. The SCD could also be partially removed during CY3 so long as the crest elevation of the dam is greater than the elevation of the sediment remaining in San Clemente Creek and any unstabilized sediment in the Sediment Stockpile. Partial dam demolition will likely need to use wire-sawing methods in CY3 to maintain the integrity of SCD because the dam will still need to hold a reservoir and allow overflow spilling during the winter months. The upper sections of the fish ladder will be removed during partial demolition and a new temporary connection will be constructed from the reservoir to the fish ladder to allow for winter fish passage. The outlet gate located at the 495 feet elevation could be made operable to aid in lowering the reservoir during CY4. Removal of the remainder of the dam during CY4 will be done in a manner similar to that described for removal of the dam in a single construction season. Prior to the beginning of the demolition of SCD in either construction year, fish removal and exclusion from upstream of SCD and the downstream plunge pool will occur.

13. Old Carmel River Dam Removal

OCRD will be demolished to its bedrock foundation. This demolition will likely be completed after all other construction-related activities are complete, in CY4 or during a partial construction season in CY5. The masonry dam, bridge piers, concrete block wall, and fish ladder will be demolished, using hoe-ram breaking or similar techniques. A large volume of this material (down to approximately elevation 432 feet) will be removed from the OCRD site and disposed of in the Sediment Stockpile area. Metal, asphalt and other miscellaneous bridge materials will be disposed of at an approved off-site facility. After removal of the dam, remaining alluvial materials will be graded to provide fish passage, and to re-create a more natural streambed.

The dam removal will involve demolishing the dam in two sections sequentially, while temporarily re-routing the active channel within the existing river bed away from each section as demolition proceeds. If needed, temporary platforms, fencing, walls, or similar devices will be installed to prevent construction debris from entering the flowing water of Carmel River. First, the sediment and alluvium immediately upstream of the OCRD will be removed and stockpiled outside of the active flow area (for future placement in the plunge pool on the downstream side of the dam). The excavated bench will then be used as access for demolishing the masonry dam to the level of the bench using an excavator with a hydraulic hammer (hoe-ram) attachment working down through the sediment. The broken-up masonry dam will then be removed from the sediment and alluvium down to the existing channel grade using an excavator. The buried portion of the rubble will be left in place as alluvium with the exception that a 20-foot wide section in the center of the dam will be removed down to bedrock and restored to existing channel grade using the deposited sediment materials. This is intended to allow the channel to migrate and reshape under natural processes in the future, so the remaining rubble will not become a fish passage barrier. Upon completion of removal of the northern half of the dam, the flow in the Carmel River will be shifted to the north side of the channel so that the southern half of the dam could be demolished and removed using the same techniques as for the northern half.

In order to provide sufficient access for equipment, a short diversion pipe will be installed to convey the active flow through the access bench. A short (one day or less) period of pumped flow diversion and associated fish rescue mitigation measures may be required during installation of the diversion pipe and associated sluiceway modifications. The northern half of the remaining dam will then be demolished down to bedrock without disturbing the flow through the existing low flow channel along the southern portion of the stream bed.

Long-term bridge access across the Carmel River at OCRD will no longer be needed, given plans (under a separate project) to construct a new bridge near the Sleepy Hollow ford location at the intersection of the Low Road and the High Road. Thus, the bridge and its associated structural components (piers, deck, beams, and railings) will be completely removed and disposed of offsite at an approved disposal facility. Once the SCD is removed, regular access for maintenance, etc. will not be necessary, thus it is assumed that long-term vehicular access past this point and to SCD plunge pool area will not be required. Therefore, the concrete block retaining wall at the right abutment that supports the outer portion of the existing access road will no longer be needed and will be removed.

14. Habitat Restoration

Habitat restoration activities will be completed to the extent possible and practicable at the end of each construction season. The activities associated with habitat restoration will include establishing and/or restoring wetland, riverine, riparian, and upland habitats throughout the site. Approximately three acres of wetlands will be established or re-established within the Combined Flow Reach and on the Sediment Stockpile/Stabilized Sediment Slope to achieve no net loss of wetlands and to provide habitat for fish and wildlife including steelhead and CRLF. Riparian vegetation will be restored or enhanced along the Combined Flow Reach, east and west tributaries, Upper Carmel River, and Upper San Clemente Creek. Upland vegetation, including oak woodland and chaparral scrub, will be established on the Sediment Stockpile and Stabilized Sediment Slope. Elements of the planned restoration include plant seed collection, plant cultivation, vegetation planting, irrigation system installation, and maintenance. Habitat restoration will begin in CY3 which includes installation of irrigation systems. The majority of restoration activities are expected to occur in CY4, continuing into CY5 if necessary. Once restoration activities are completed, a five-year maintenance period will follow. Vegetation re-establishment will be supported by routine irrigation and maintenance. The following sections describe the steps and components of the various habitat restoration efforts that will be implemented as part of the project design. The avoidance, minimization measures, and monitoring requirements that will be implemented are discussed in a separate section below, with complete details provided in the Habitat Mitigation and Monitoring Plan (HMMP)(URS 2012).

a. Seed Collection and Plant Cultivation

Seed collection and plant cultivation will be performed before other site preparation activities. Appropriate vegetation is currently present in the action area and vicinity to obtain source plants. Sourcing propagules from the Carmel River Watershed and its adjacent areas will result in vegetation that is genetically adapted to the local environment and will encourage biodiversity in the larger ecosystem of the Carmel Valley. Nurseries will then be contracted to grow plant material and process seed mixes for the project.

b. Site Preparation

Topsoil Salvaging and On-site Vegetation Beneficial Reuse. The project area has fine-particle and nutrient-rich top soils that are adapted to sustain plant life within the areas to be graded and excavated. Topsoil and sediment soil will be removed from excavations and graded areas. The existing vegetation to be removed will be recycled and used for soil conditioning, except for diseased trees, such as trees with sudden oak death or oak root fungus (*Armillaria mellea*). If diseased vegetation is encountered, it will be disposed of off-site according to accepted protocols. Vegetation and organic matter removed will be used within the project footprint. Large removed trees will be used as large woody materials in the restored river reaches and floodplain to provide habitat for wildlife. Smaller woody debris will be chipped and composted.

Soil Preparation and Weed Control. Soil preparation, including soil decompaction and weed management, will be conducted to optimize planting conditions. Soil decompaction incorporates recycled organic matter into planting area soil throughout the riparian planting locations. After excavation and sediment relocation activities, many planting areas will likely have compacted soil that will benefit from decompaction, in order to enhance nutrient intake, soil moisture and air content. Weed control will be executed before planting activities commence, as necessary. No synthetic fertilizer or herbicides will be applied. Instead, integrated pest management practices will be applied to the maximum extent possible.

c. Irrigation System

An irrigation system will be installed to provide water to the newly planted vegetation for the establishment periods, described in the HMMP. The irrigation system will be an above ground system with overhead sprinklers in riparian areas and a drip irrigation system in upland areas. The system is expected to use river and/or well water for the water supply. If river water is used, limits on amounts diverted will be established that will not impact aquatic species. The details of the irrigation system will be developed by the D-B contractor, though the system is expected to have remote control valves with local battery or solar-powered automatic control systems.

d. Hydroseeding and Shrub and Tree Planting

Hydroseeding will be used to spread seed mix, water, mulch, compost, binder, and other ingredients onto planting areas. Hydroseeding will commence after the irrigation system is fully operational so that the seed can be watered immediately. The planting of shrubs and trees will take place after site preparation, layout, and irrigation are completed. In sites with no rock slope protection, container plants will be planted in dug or augured holes. At sites with rock slope protection, cardboard tubes will be installed into the soil and extend through the rock into subsoil for planting of trees and shrubs. In addition, willow cuttings will be placed in gaps between rocks in soil. Plants will be protected from browsing animals by fences designed for the types of herbivores that are present on-site. Fencing specifics will be developed by the D-B contractor and as required by the regulatory agencies.

e. Warranty and Plant Establishment Period

Plant establishment and growth will be monitored after the project is completed. The warranty and plant establishment period will be the responsibility of the contractor conducting the revegetation. The warranty period will be a minimum of 12 months. During that period, plant growth and overall vegetation health will be closely monitored. Plants that die during the warranty period will be replaced, as appropriate, by the planting contractor. Either in-kind or substitutions will be allowed on approval. The establishment period will begin simultaneously within the warranty period. The establishment period will also include watering to ensure that the plants are appropriately irrigated. Other activities, such as weeding and the removal of non-native plants, inspections, record keeping, and quarterly reporting, will also be undertaken.

15. <u>Avoidance, Minimization Measures and Monitoring</u>

Avoidance and minimization measures will be implemented during each construction year to reduce the project's impacts to special status species and respective habitats. These measures are grouped by type, including those to be implemented during flow diversion, dewatering, fish rescue and relocation, to protect water quality, and to ensure appropriate biological and compliance monitoring and reporting is conducted. All aquatic species (*e.g.,* steelhead, CRLF, crayfish, bullfrogs) will initially be collected and relocated prior to flow diversion and dewatering. Steelhead and other native species will be transported and released into appropriate habitat in the Carmel River below SCD. Rescued CRLF will be relocated to habitat approved by USFWS. Bullfrogs and other non-native species will be eradicated. Rescues and relocation from downstream of the diversion intakes in the reservoir area will be performed during the transitioning of flows from downstream into the reservoir to the diversion pipes. Pipe weirs, fyke nets, or other trapping methods, as well as seining and electrofishing may be employed to capture fish and other aquatic animals. The method of fish trapping, rescue and relocation will be determined by the D-B contractor. However, the Steelhead Rescue and Relocation Plan will be submitted to NMFS for approval before the first year of fish rescues are performed. Similarly, a USFWS-approved CRLF Rescue and Relocation Plan will be provided before CRLF rescues are performed. The details of these and other measures to avoid or minimize impacts on fish (*e.g.,* fish rescue, flow velocity control) are discussed below.

a. Fish Exclusion, Rescue and Relocation During Flow Diversion and Dewatering

Prior to installation of the water diversion systems, and dewatering the reservoir or affected reaches, a fish rescue and relocation plan will be submitted to NMFS for approval. Fish passage through the water diversion facilities will not be provided during each construction season when water diversions are in place. Instead, fish will be trapped upstream of the diversion during the years it is in place (likely CY2-CY4). Trapping duration will vary depending on rainfall and flow rates. Fish trapping stations will be installed upstream of the diversion points to capture downstream migrating fish.

As stated previously, prior to May 15 each year, a floating barrier fence (*e.g.*, log boom) will be placed across the reservoir in the river channel and a rotary screw trap will be installed downstream of the fence. The rotary screw trap will be used to collect fish. The ideal velocity for fish collection at rotary screw traps is between 5 and 6.5 feet per second (f/s). Based upon a maximum estimated flow of 150 cfs, the channel dimensions to achieve maximum efficiency of the trap is between 6 and 8 feet wide and 4 feet deep. When river flows drop to a point that the rotary screw trap will not capture fish effectively, fyke nets will be used, as have been done for previous years' reservoir drawdown activities.

Fish relocation will occur within all areas that will be dewatered. The methods for fish trapping and rescue from the Carmel River and San Clemente Creek will follow the methods as established in the Biological Assessment for the San Clemente Reservoir Drawdown 2007-2012 (Entrix 2012) and the biological opinion issued for drawdown activities (SCD Drawdown)(NMFS 2007a). Fish rescues will occur in the Carmel River and San Clemente Creek channels between the diversion point and reservoir. Block nets will be set near the mouth of each stream to prevent fish from moving downstream into the reservoir. These fish will be captured in traps. Additional nets will be set across the reservoir to prevent fish from moving out of the reservoir back upstream into the diverted stream reaches. The fish located in the reservoir will be rescued and relocated during dewatering of the reservoir. All fish exclusion, rescue and relocation efforts will be conducted by qualified biologists and done utilizing block nets, seines and dip nets. Backpack electrofishing units may also be used if river bottom topography makes use of nets ineffective. During fish relocation efforts, standard protocols will be implemented to reduce the potential for injury and stress to the fish, such as those presented in the "California Salmonid Stream Habitat Restoration Manual" (CDFG 2010). Electrofishing, if used, will be performed by a qualified biologist and conducted in accordance with *NMFS Guidelines for Electrofishing Waters Containing Salmonids Listed under the Endangered Species Act*, June 2000. Captured fish will be temporarily held in aerated coolers for transport. Fish will not be kept in coolers with predatory species, and will be sorted according to size to avoid predation upon rescued fish during holding and transport. Rescued fish will be transported downstream and released into the Carmel River near the Carmel Valley Filter Plant or moved to the Sleepy Hollow Steelhead Rearing Facility (SHSRF) if the downstream release sites are already at maximum capacity. As with the current drawdown activities for SCD, traps will not be removed until a five-day running average of 10 fish or less are caught at either of the trap sites, or no fish are caught in the San Clemente or Carmel River traps for three consecutive days. Once all fish are rescued from the channels, all flow will be directed into the bypass pipes.

b. Measures to Ensure Good Water Quality

Water quality will be monitored in the reservoir during dewatering, following the methods and requirements outlined in the 2007 biological opinion for SCD Drawdown activities. Biological monitors will be onsite during dewatering and any fish found to be within dewatered or shallow water areas will be rescued immediately to avoid water quality-induced stress. Turbidity, water temperature, and dissolved oxygen (DO) levels could be affected by releasing reservoir water downstream to the river channel. Therefore the measures described below will be implemented to ensure good water quality.

Turbidity will be managed by moderating the rate of dewatering or if necessary, a mobile filter plant will be used to treat highly turbid water before releasing into the river. When the reservoir reaches the 510-foot elevation, if additional dewatering is needed the lower level valve may then be opened to continue dewatering the reservoir to the targeted elevations of 506-508 feet.

To minimize temperature impacts to water quality, reservoir dewatering will be timed (to the extent feasible) to occur when water temperatures in work areas are low. This entails dewatering during the cool part of the seasonal work window (early in the season usually beginning May 15) and during nights and mornings. As the water level lowers and water surface temperature rises, surface releases will be switched to release from well points. To reduce the temperature of water being diverted through pipes, diversion pipes will be placed in shaded locations, buried under a sand layer, and covered with burlap or shade cloth. Or, if the pipe can't be shaded or buried it may be painted white. River temperatures downstream of the dam are not expected to increase by more than 1 to 2 degrees Fahrenheit (ºF) over water temperature upstream of the sheet pile water diversion system using these methods.

The DO criteria will also be consistent with NMFS' 2007 biological opinion, at 5.0 mg/L, if possible. Aerators may be used in the reservoir during dewatering to help maintain adequate DO levels. Water will be aerated as it leaves the diversion pipes or a mechanical aerator will be used prior to releasing water into the river. Additionally, during reservoir drawdown, mechanisms will be employed to aerate water as it descends from the dam into the river, and any water pumped from reservoir or released from well points will be aerated as well prior to discharge into the river.

Sediment dewatering will occur after the reservoir has been emptied. Water from well points in the reservoir will be treated to reduce turbidity and temperature, and increase DO levels prior to release downstream. If needed, the water will be aerated and cooled prior to release into the river.

During project construction, an alternative water supply, such as groundwater pumped from nearby wells, will be made available for use at the SHSRF if periods of excessive turbidity or sediment levels occur in the Carmel River, and if their new water supply pump is not finished. In addition, a Storm Water Pollution Prevention Plan (SWPPP) will be developed, and submitted for approval to the Regional Water Quality Control Board, and implemented. The SWPPP will define the BMPs for avoiding and minimizing water quality affects. The SWPPP also will contain provisions for monitoring and reporting. A Spill Prevention, Control, and

Countermeasure Plan (SPCC) will also be developed and implemented as specified in the MMRP.

c. Access Route Improvements Best Management Practices

Access road improvements will be done in such a manner as to limit tree and limb removal, and measures will be implemented to prevent roadfill from entering the river and streams. All disturbed streamside banks and other areas will be revegetated. Where blasting of rock is necessary, blasting mats and temporary walls will be implemented to prevent rock fall and debris from entering the river. Additionally, Best Management Practices (BMPs) will be implemented to minimize sedimentation and turbidity. Some of these will include the placement of roadfill on fabric or rubber liner, facing roadfill with boulders or rip-rap sized too large for river to move during flood flows. Erosion control and road drainage measures will be incorporated to eliminate or make discountable, aquatic impacts due to sedimentation and turbidity. In the event of forecasted heavy precipitation, all temporary erosion control devices will be inspected and repaired if necessary to withstand heavy rainfall.

d. Success Criteria and Biological and Environmental Monitoring

Biological and environmental monitors will be on-site during each construction season to monitor compliance with water quality, fish rescue and relocation plans, BMPs, and other conditions of permits and agreements pertaining to the proposed action. A written daily log and a photo log will be kept by the monitor to describe monitoring activities, remedial actions, non-compliance, and other issues and actions taken. These logs will be kept onsite and will be made available for review by agency personnel. Monthly reports will also be provided to permitting agencies and those listed in the MMRP.

Success Criteria and Monitoring. In addition to dam removal, this project proposes considerable restoration of the Carmel River system including both instream and riparian habitat. As described in the HMMP (URS 2012), final success criteria will be followed to assess vegetation establishment, hydrologic function of the restored river reaches, and special-status species habitat enhancement success. For vegetation, if the success criteria are not met, replacement plantings or other adaptive management actions will be implemented until the site meets success criteria. For S-CCC steelhead habitat, the project's success criteria are instream areas providing unobstructed fish passage, forage, cover, step-pools, and resting pools.

After CY5, monitoring to ensure success criteria will begin and continue for a minimum period of five years. Monitoring of restored vegetation, upland, riparian and wetland habitats will occur during every year for the first three years, and one more season in year five. If success criteria are not met after year five, then measures will be taken to address any deficiencies. The regulatory agencies (*e.g.,* NMFS, CDFG, USFWS) will make the final determination of whether or not success criteria has been achieved, or sufficient contingency plans have been implemented. If the project's success criteria have not been met by year five, another visual assessment will be conducted in year 10 to ensure the restoration goals of the project have been met. Similarly, fish passage assessments and instream flow monitoring in the restored areas will occur for the first three years and then again in year five for a total of four years monitoring post-construction. After year five, if the success criteria for S-CCC steelhead passage and habitat are not met then CAW will notify NMFS and CDFG and seek their advice. NMFS may direct CAW to take measures to correct any of the areas failing to meet the success criteria. CAW will implement such measures as directed by NMFS.

B. 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). For the Carmel River Reroute and San Clemente Dam Removal Project, the action area includes the entire project footprint where construction activities will occur (Figure 2), and all areas in the Carmel River and associated tributaries extending from the Los Padres Dam at RM 24.8 to the mouth of the Carmel River at the lagoon, with its confluence to the Pacific Ocean; as these areas will continue to experience effects once construction is complete. The action area includes the SCD and associated building and residence, the reservoir behind SCD, OCRD (and river channel immediately upstream and downstream). Construction will take place in the Carmel River mainstem from approximately 3,100 feet upstream of SCD, and another 2,600 feet upstream of SCD in San Clemente Creek, down to 300 feet below SCD including the river confluence extending approximately 1,000 and 500 feet into portions of two small seasonal tributaries, the East and West tributaries, respectively. The area also includes the upland ridge between the Carmel River arm and the San Clemente Creek arm of the reservoir and small portions of the riparian corridors and uplands bordering the streams. Additionally, rerouting the Carmel River will affect the hydrology and bed load of the reaches immediately upstream of the reservoir. Outside of areas where riparian vegetation will be modified, the lateral extent of the action area includes the river channel up to the ordinary high water line.

The project area also includes the existing paved and unpaved roads that will be improved or constructed to allow construction-related equipment to reach the project work site. It also includes parts of the landscape and slopes around these road alignments that may be converted into staging areas, graded to control erosion or runoff, or to stabilize the road bed. Although these areas are included in the action area, in many cases they are miles from the SCD. The alignments, locations, and other details of these roads are mentioned here only to highlight their inclusion in the project area. The areas of these road improvements and the associated staging areas are not included in the 80.6 acres listed above. The combined footprint acreage of these other areas is 20.0 acres.

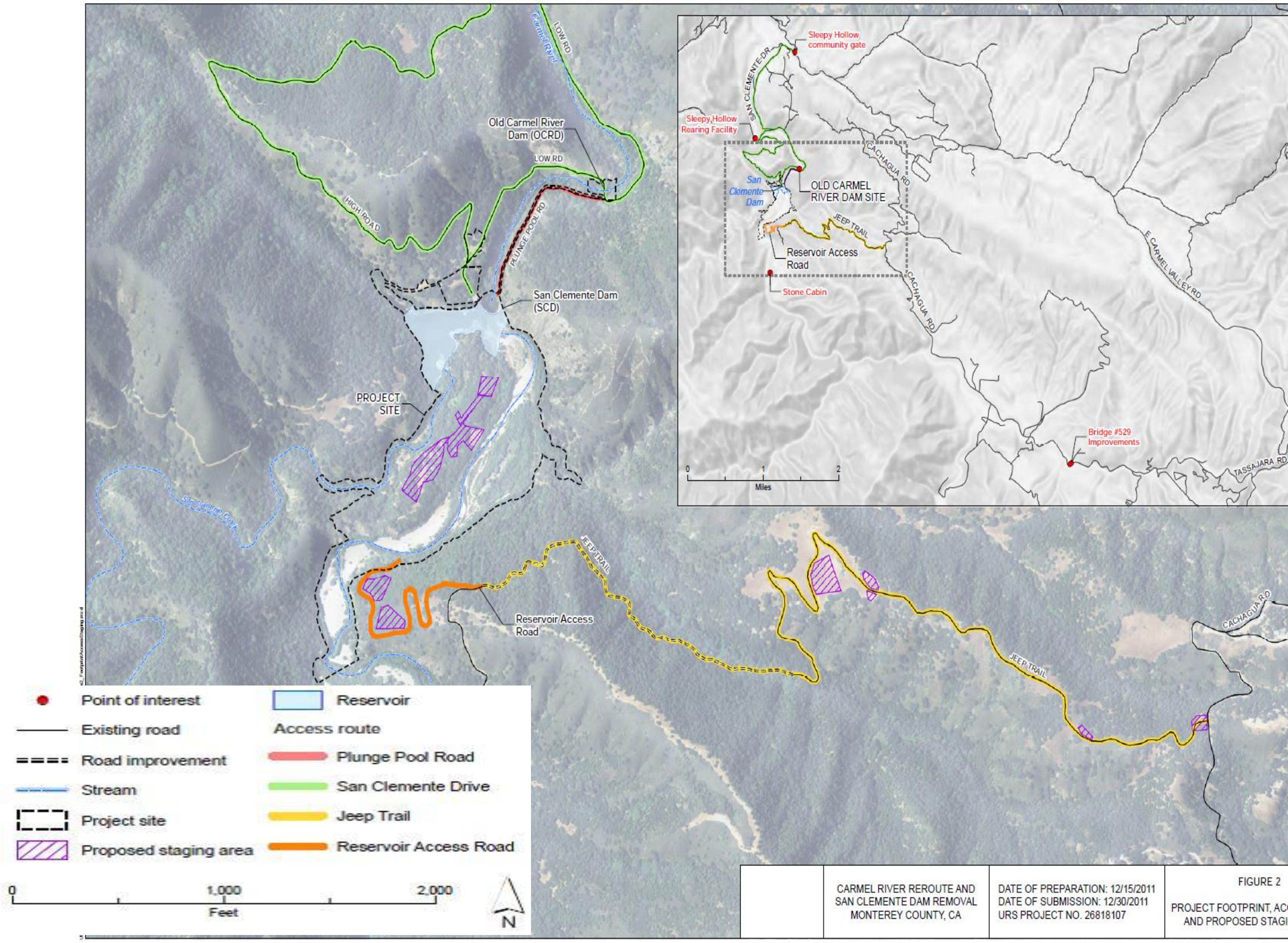

Figure 2. Carmel River Reroute and San Clemente Dam Removal Project Action Area (URS 2011).

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 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 likelihood 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 use 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 S-CCC steelhead DPS.

B. Adverse Modification Determination

This biological opinion does not rely on the regulatory definition of destruction or adverse modification of critical habitat at 50 CFR 402.02, which was invalidated by the 9th Circuit Court of Appeals in 2004. 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 S-CCC steelhead DPS in terms of primary constituent elements (PCEs – sites for salmonid spawning, rearing, and migration), the factors responsible for that condition, and the resulting 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 S-CCC steelhead DPS 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's 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 for this project, and project meeting notes. Information was also provided in meetings, e-mail messages, site visits, and telephone conversations between 2000 and 2012. 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. A complete administrative record of this consultation is on file at NMFS' North Central Coast Office (Administrative Record Number 151422-SWR-2012-SR00254).

IV. STATUS OF THE SPECIES AND CRITICAL HABITAT

This biological opinion analyzes the effects of the Carmel River Reroute and San Clemente Dam Removal Project on the following Pacific salmonids and critical habitat:

- **S-CCC steelhead DPS**
  Threatened (January 5, 2006; 71 FR 5248)
  Critical habitat (September 2, 2005; 70 FR 52488).

The S-CCC steelhead DPS includes all naturally spawned steelhead populations in streams from the Pajaro River watershed (inclusive) to, but not including, the Santa Maria River, (71 FR 5248) in northern Santa Barbara County, California. There are no artificially propagated steelhead stocks within the range of the S-CCC steelhead DPS.

A. Species Life History and Population Dynamics

Steelhead are anadromous fish, spending time in both fresh- and saltwater. Steelhead possess a complex life history requiring successful completion and transition through various life stages in marine and freshwater environments (*e.g.*, spawning and outmigration, egg-to-fry emergence, juvenile rearing, smolt outmigration and ocean survival). Eggs (laid in gravel nests called redds), alevins (gravel dwelling hatchlings), fry (juveniles newly emerged from stream gravels), and young juveniles all rear in freshwater until they become large enough to migrate to the ocean to finish rearing and maturing to adults. Eggs incubate and emerge in about three weeks (depending on water temperature), and the alevins remain in small spaces between gravels before entering the stream water column. Steelhead fry rear in edgewater habitats and move gradually into pools and riffles as they grow larger. 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, Shirvell 1990). Steelhead, however, tend to use riffles and other habitats not typically associated with instream cover during summer rearing more than other salmonids. Young steelhead feed on a wide variety of aquatic and terrestrial insects, and emerging fry are sometimes preyed upon by older juveniles. Rearing steelhead juveniles prefer water temperatures of 7-14 ˚C (Barnhart 1986, Bjornn and Reiser 1991). They can survive in water up to 27 ˚C with saturated DO conditions and a plentiful food supply. Fluctuating diurnal water temperatures also aid in survivability of salmonids (Busby *et al.* 1996).

Although variation occurs in coastal California, juveniles usually spend one to two years in freshwater, then smolt and migrate to the ocean, using an estuary for acclimation to saltwater and as a migration corridor. They usually spend one to three years in the ocean (usually two years in the Pacific southwest) (Barnhart 1986), where they mature into adults before returning to their natal stream to spawn. Steelhead may spawn one to four times over their life. The maximum lifespan of a steelhead is approximately nine years (Moyle 2002).

Studies of coastal *O. mykiss* populations in central and southern California reveal three principal life-history groups, which NMFS has designated as fluvial-anadromous, lagoon-anadromous, and freshwater resident[1] (Smith 1990, Bond 2006, Boughton *et al*. 2007). Both anadromous groups classify as winter steelhead, in that adults migrate during the winter rainy season. Lagoon-anadromous fish spend either their first or second summer as juveniles in a seasonal lagoon at the mouth of a stream (Boughton *et al*. 2006).

B. Status of S-CCC Steelhead DPS

In this opinion, NMFS assesses four population viability parameters to help us understand the status of S-CCC steelhead DPS 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). While there is insufficient information to evaluate these population viability parameters in a thorough quantitative sense, NMFS has used existing information to determine the general condition of the S-CCC steelhead DPS and factors responsible for the current status of S-CCC steelhead 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.

Populations of S-CCC steelhead throughout the DPS have exhibited a long-term negative trend since the mid-1960s. In the mid-1960s, total spawning populations were estimated at 17,750 individuals (Good *et al*. 2005). Available information shows S-CCC steelhead population abundance continued to decline from the 1970s to the 1990s (Busby *et al*. 1996) and more recent data indicate this trend continues (Good *et al*. 2005). Current S-CCC steelhead run-sizes in the five largest systems in the DPS (Pajaro River, Salinas River, Carmel River, Little Sur River, and Big Sur River) are likely greatly reduced from 4,750 adults in 1965 (DFG 1965) to less than 500 returning adult fish in 1996. More recent estimates for total run-size do not exist for the S-CCC

1 Freshwater residents or "rainbow trout" are not included in the DPS.

steelhead DPS (Good *et al.* 2005).

Recent analyses conducted by NMFS (NMFS 2006, Boughton *et al.* 2007, Williams *et al*. 2011) indicate the S-CCC steelhead DPS consists of 12 discrete sub-populations which represent localized groups of interbreeding individuals, and none of these sub-populations currently meet the definition of viable. Most of these sub-populations can be characterized by low population abundance, variable or negative population growth rates, and reduced spatial structure and diversity. The sub-populations in the Pajaro River and Salinas River watersheds are in particularly poor condition (relative to watershed size) and exhibit a greater lack of viability than many of the coastal subpopulations.

Although steelhead are present in most streams in the S-CCC DPS (Good *et al*. 2005), their populations are small, fragmented, and unstable, or more vulnerable to stochastic events (NMFS 2006a). In addition, severe habitat degradation and the compromised genetic integrity of some populations pose a serious risk to the survival and recovery of the S-CCC steelhead DPS (Good *et al*. 2005). NMFS' 2005 status review concluded S-CCC steelhead remain "likely to become endangered in the foreseeable future" (Good *et al*. 2005). NMFS confirmed the listing of S-CCC steelhead as threatened under the ESA on January 5, 2006 (71 FR 834). Recent observations suggest the number of adult returns is fluctuating, sometimes below recent low numbers. In the 2008/09 and 2009/10 winters, adult returns in many streams within the DPS were considerably reduced relative to higher returns at the beginning of the decade. This was likely attributed largely to poor ocean conditions along the eastern Pacific Ocean (Lindley *et al.* 2009). However, during the winter of 2010/11, S-CCC steelhead adult returns appeared to rebound toward the low numbers seen at the beginning of the decade, due to an increase in adult returns counted at San Clemente Dam on the Carmel River[2], and a notable increase in the number of observed adults in Uvas Creek of the Pajaro Watershed (Jon Ambrose, NMFS, pers. comm. August 2011).

Further detailed information on this steelhead DPS is available in the NMFS' Status Review of West Coast Steelhead from Washington, Idaho, Oregon, and California (Busby *et al.* 1996), the NMFS' final rule for listing steelhead (62 FR 43937), and the NMFS' Status Review for Klamath Mountains Province Steelhead (Busby *et al.* 1996). Additional information is available from NMFS' Southwest Fisheries Science Center (SWFSC). The SWFSC has prepared several reports specifically for recovery planning that provide: 1) characterization of the S-CCC steelhead DPS historical population structure; 2) draft viability criteria for recovery; 3) assessment of threats; and 4) recommendations for recovery of the highest priority populations (NMFS 2006a; NMFS 2006b; NMFS 2007b). The most recent status update concludes that steelhead in the S-CCC steelhead DPS remain "likely to become endangered in the foreseeable future" (Williams *et al.* 2011), as new and additional information available since Good *et al.* (2005) does not appear to suggest a change in extinction risk. On December 7, 2011, NMFS chose to maintain the threatened status of the CCC steelhead DPS (76 FR 76386).

C. Status of Critical Habitat

In designating critical habitat, NMFS considers the following requirements of the species: 1) space for individual and population growth, and for normal behavior; 2) food, water, air, light,

[2] http://www.mpwmd.dst.ca.us/fishcounter/fishcounter.htm

minerals, or other nutritional or physiological requirements; 3) cover or shelter; 4) sites for spawning, reproduction, and rearing offspring; and, generally, 5) habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of this species (50 CFR 424.12(b)). In addition to these factors, NMFS also focuses on known physical and biological features PCEs within the designated area that are essential to the conservation of the species and that may require special management considerations or protection.

For the S-CCC steelhead DPS, approximately 1,832 miles of stream habitat, and 442 square miles of estuarine habitat are designated critical habitat (70 FR 52488). Critical habitat for the DPS has been designated in the following CALWATER Hydrologic Units: Pajaro River, Carmel River, Santa Lucia, Salinas, and Estero Bay. Tributaries in the Neponset, Soledad, and Upper Salinas Valley Hydrologic Sub-areas (HSA) were excluded from critical habitat and Department of Defense lands in the Paso Robles and Chorro HSAs were excluded.

NMFS developed a list of PCEs specific to salmon and steelhead and relevant to determining whether occupied stream reaches within an HSA fit the definition of "critical habitat." These PCEs include sites essential to support one or more of the life stages of the DPS (*i.e*., sites for spawning, rearing, migration, and foraging). These sites in turn contain physical or biological features essential to the conservation of the DPS (for example, spawning gravels, water quality and quantity, side channels, forage species). Specific PCEs and the essential features associated with them include, but are not limited to, the following:

1. Freshwater migration corridors free of obstruction and excessive predation with adequate water quantity to allow for juvenile and adult mobility; cover, shelter, and holding areas for juveniles and adults; and adequate water quality to allow for survival.

2. Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development.

3. Freshwater rearing sites with sufficient water quantity and floodplain connectivity to form and maintain physical habitat conditions and allow salmonid development and mobility; sufficient water quality to support growth and development; food and nutrient resources such as terrestrial and aquatic invertebrates and forage fish; and natural cover such as shade, submerged and overhanging large wood, log jams, beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

4. Estuarine areas that provide uncontaminated water and substrates; food and nutrient sources to support growth and development; and connected shallow water areas and wetlands to cover and shelter juveniles.

The coastal drainages used by the S-CCC steelhead DPS provide relatively higher amounts of the freshwater rearing PCE, maintain connectivity, and result in a wider distribution of the species in these drainages than in inland drainages. Inland drainages provide important freshwater migration, freshwater spawning, and freshwater rearing PCEs unique within the inland ecotype. However, most areas of critical habitat in both coastal and inland drainages have been degraded compared to conditions that once supported thriving populations of steelhead.

D. Factors Responsible for the Decline of S-CCC Steelhead DPS and Degradation of S-CCC Critical Habitat

Of the watersheds in the S-CCC steelhead DPS historically supporting steelhead, most continue to support runs, although run sizes are significantly reduced, or no longer exist in many sub-watersheds. A reduced population size causes each individual within the population to be more important and significantly increases the population's susceptibility to small or catastrophic events. Moreover, low population sizes compromise genetic integrity, posing serious risks to steelhead survival and recovery. The four largest watersheds (Pajaro, Salinas, Nacimiento/Arroyo Seco, and Carmel Rivers) have experienced declines in run sizes of 90% or more, and steelhead are extirpated from many of their subwatersheds primarily due to anthropogenic and environmental influences. Steelhead in this DPS have declined in large part as a result of anthropogenic influences associated with agriculture, mining, and urbanization activities that have resulted in the loss, degradation, simplification, and fragmentation of habitat (Hunt & Associates 2008), and to some degree disease and predation.

1. Anthropogenic Factors

Habitat destruction and fragmentation have been linked to increased rates of species extinction over recent decades (Davies *et al*. 2001). A major cause of the decline of steelhead is the loss or decrease in quality and function of the essential habitat features of PCEs. Most of this loss and degradation of habitat, including critical habitat, has resulted from anthropogenic watershed disturbances caused by water diversions, the influences of large dams, agricultural practices (including irrigation), ranching, recreation, urbanization, loss of estuarine habitat and wetland and riparian areas, roads, grazing, gravel mining, and logging. While individual components of this list of factors affecting steelhead and critical habitat have fluctuated in severity over the last 100 years, the general trend has been one of increasing and intractable pressure on aquatic resources. These factors have significantly altered steelhead habitat quantity and quality. Associated impacts of these factors include: alteration of stream bank and channel morphology; alteration of ambient stream water temperatures; degradation of water quality; elimination of spawning and rearing habitats; fragmentation of available habitats; elimination of downstream recruitment of spawning gravels and large woody debris; removal of riparian vegetation resulting in increased stream bank erosion; and increased sedimentation input into spawning and rearing areas resulting in the loss of channel complexity, pool habitat, suitable gravel substrate, and large woody debris.

a. Water Use

Water storage, withdrawal, conveyance, and diversions for agriculture, flood control, domestic, and hydropower purposes have greatly reduced or eliminated historically accessible habitat. Modification of natural flow regimes by dams and other water control structures have resulted in increased water temperatures, changes in fish community structures, depleted flow necessary for migration, spawning, rearing, flushing of sediments from spawning gravels, and reduced gravel recruitment. The substantial increase of impermeable surfaces as a result of urbanization (including roads) has also altered the natural flow regimes of rivers and streams, particularly in lower reaches. Depletion and storage of natural flows have altered natural hydrological cycles in many California rivers and streams in general, including streams providing habitat to the S-CCC steelhead DPS in particular. Alteration of stream flows has increased juvenile salmonid mortality for a variety of reasons including: impaired migration from insufficient flows or habitat blockages; loss of rearing habitat due to dewatering and blockage; stranding of fish 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, Bergren and Filardo 1993, 61 FR 56138). However, the greatest threats to the S-CCC steelhead DPS population are the degradation of habitats and loss of habitat by impassable dams. The SWFSC has identified re-establishing access to upper watersheds in the Pajaro and Salinas watersheds as one of the highest priorities for the recovery of the S-CCC steelhead DPS (NMFS 2006a, 2007).

b. Estuarine Habitat Loss

A significant percentage of estuarine habitats have been lost, particularly in the northern and southern portions of the S-CCC steelhead DPS where the majority of the wetland habitat historically occurred. The condition of these remaining wetland habitats is largely degraded, with many wetland areas at continued risk of loss or further degradation. Although many historically harmful practices have been halted, much of the historical damage remains to be addressed and the necessary restoration activities will likely require decades. Many of the land use activities described above have resulted in the loss of wetlands and degradation of estuaries in the larger river systems such as the Pajaro, Salinas, Carmel and Arroyo Grande Rivers, and many also apply to the smaller coastal systems such as Morro, San Luis Obispo, and Pismo Creeks (NMFS 2011).

c. Fishing Harvest

Steelhead populations traditionally supported an important recreational fishery throughout their range and likely increased the mortality of adults and juveniles. There are few good historical accounts of the abundance of steelhead harvested along the California coast (Jensen and Swartzell 1967). However, Shapovalov and Taft (1954) report that very few steelhead were caught by commercial salmon trollers at sea but considerable numbers were taken by sports anglers in Monterey Bay. There are also many anecdotal reports of recreational fishing and poaching of instream adults (Franklin 2005) which suggests a relatively high level of fishing pressure. Although such impacts may have contributed to the decline of some naturally small populations, NMFS does not consider it to be a principal cause for the decline of the S-CCC steelhead DPS (NMFS 2011). Some recreational angling for *O. mykiss* continues to be allowed in all coastal drainages in its range and also continues to occur in areas above currently impassible barriers. The CDFG also restricts angling on streams accessible to anadromous fish through their angling regulations, which includes daily restrictions and limited catch numbers along with catch and release fishing. This may relieve some of the negative pressures associated with angling on the population, however, it should be noted that even catch and release fishing can have adverse effects on listed fish. During periods of decreased habitat availability (*e.g.*, drought conditions or summer low flow when fish are concentrated in freshwater habitats); the impacts of recreational fishing or harassment on native anadromous stocks can increase (NMFS 2011).

Ocean harvest of steelhead is considered to be extremely rare and is an insignificant source of mortality for this DPS since both sport and commercial harvest of steelhead in the ocean is prohibited by CDFG (CDFG 2010a). Although high seas driftnet practices in the past likely resulted in incidental harvest of steelhead, the occurrence of this is thought to be limited to some local areas as steelhead are not a commercially targeted species (NMFS 2011).

d. Artificial Propagation

There are no steelhead hatcheries operating in or supplying hatchery reared steelhead to the DPS. However, there is an extensive stocking program of hatchery cultured and reared, non-anadromous *O. mykiss* which supports a put-and-take fishery that is stocked for removal by anglers. These stockings are now generally conducted in non-anadromous waters (though other non-native game species such as smallmouth bass (*Micropterus dolomieui*) and bullhead catfish (*Ameiurus sp*.) are stocked into anadromous waters by a variety of public and private entities). Nevertheless, hatchery origin non-anadromous fish may enter anadromous waters as a result of spillage over dams. Although these stockings are generally carried out in waters which do not support anadromous populations, the potential does exist for fish to escape into anadromous waters.

While some of these programs have succeeded in providing seasonal fishing opportunities, the impacts of these programs on native, naturally-reproducing steelhead stocks are not well understood. Competition, genetic introgression and disease transmission resulting from hatchery introductions could reduce the production and survival of native, naturally-reproducing steelhead (Araki *et al.* 2007, 2008, 2009); although, genetic research on southern California steelhead has not detected any substantial interbreeding of native steelhead with hatchery reared steelhead (Girman and Garza 2006, Garza and Clemento 2007, Clemento *et al.* 2009, Christie *et al.* 2011, Abadia-Cardoso *et al.* 2011). Additionally, collection of native steelhead for hatchery broodstock purposes can also harm small or dwindling natural populations. However, artificial propagation, if done to preserve individuals representing genetic resources that would otherwise be lost, or done to aid wild fish repopulation of streams, may also play an influential role in steelhead recovery. Such efforts can supplement, but are not a substitute for naturally-reproducing populations.

2. <u>Environmental Factors</u>

Variability in natural environmental conditions has both masked and exacerbated the problems associated with degraded and altered riverine and estuarine habitats. Floods and persistent drought conditions have periodically reduced naturally limited spawning, rearing, and migration habitats. Furthermore, El Nino events and periods of unfavorable ocean-climate conditions can threaten the survival of steelhead populations already reduced to low abundance levels due to the loss and degradation of freshwater and estuarine habitats. However, periods of favorable ocean productivity and high marine survival can temporarily offset poor habitat conditions elsewhere and result in dramatic increases in population abundance and productivity by increasing the size and correlated fecundity of returning adults (NMFS 2011). The threats from projected climate change are likely to exacerbate the effects of environmental variability on steelhead and its habitat in the future. Thus, increased environmental variability resulting from projected climate change is now recognized as a new and more serious factor that may threaten the recovery of the

S-CCC steelhead DPS (NMFS 2011).

a. 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 marine environmental factors 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 Niño year), when an oceanic warming trend began. These El Niño conditions, which occur every three to five years, negatively affect ocean productivity. For instance, Johnson (1988) noted increased adult mortality and decreased average size for Oregon Chinook salmon (*O. tshawytscha*) and coho salmon (*O. kisutch*) during the strong 1982-83 El Niño. Brood years of salmon and steelhead that were in the ocean during the 1983 El Niño event exhibited poor survival all along the Pacific coast of California (Garrison *et al*. 1994). Salmon populations have persisted over time, under pristine habitat conditions, through many cycles of poor ocean survival in the past. It is less certain how they will fare in periods of poor ocean survival when their freshwater, estuary, and nearshore marine habitats are degraded (Good *et al*. 2005).

b. Reduced Marine-Derived Nutrient Transport

Salmonids may play a critical role in sustaining the quality of habitats essential to the survival of their own species via the transfer of marine-derived nutrients (MDN) to freshwater systems. MDN are nutrients that accumulate in the bodies of salmonids while they are in the ocean and are then left in freshwater streams when salmonids die after spawning. Salmon carcasses decay or are eaten, transferring these nutrients from the ocean to watersheds. MDN has been shown to be vital for the growth of juvenile salmonids (Bilby *et al*. 1996, Bilby *et al*. 1998). The return of salmonids to rivers makes a significant contribution to the flora and fauna of both terrestrial and riverine ecosystems (Gresh *et al*. 2000).

Reduction of MDN in watersheds is a consequence of the past century of decline in salmon abundance (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.

c. Disease and Predation

Infectious disease is one of many factors that can influence adult and juvenile steelhead survival. Specific diseases such as bacterial kidney disease, Ceratomyxosis, Columnaris, Furunculosis, infectious hematopoietic necrosis, redmouth and black spot disease, Erythrocytic Inclusion Body Syndrome, and whirling disease among others are present and are known to affect steelhead and salmon. Very little current or historical information exists to quantify changes in infection levels and mortality rates attributable to these diseases for steelhead. Warm water temperatures, in some cases can contribute to the spread of infectious diseases. However, studies have shown that native fish tend to be less susceptible to pathogens than hatchery cultured and reared fish

(Buchanon *et al*. 1983).

Introductions of non-native aquatic species (including fishes and amphibians) and habitat modifications (*e.g.*, reservoirs, altered flow regimes, etc.) have resulted in increased predator populations in numerous river systems, thereby increasing the level of predation experienced by native salmonids (Busby *et al.* 1996). Non-native species, particularly fishes and amphibians such as large and smallmouth basses and bullfrogs have been introduced and spread widely. These species can prey upon rearing juvenile steelhead (and their conspecific resident forms), compete for living space, cover, and food, and act as vectors for non-native diseases. Artificially induced summer low-flow conditions may also benefit non-native species, exacerbate spread of diseases, and permit increased avian predation.

In previous status reviews for this species, NMFS did not conclude that disease and predation were significant factors responsible for the decline of steelhead in this DPS. However, small populations of steelhead such as those found in the S-CCC steelhead DPS may be more vulnerable to the effects of disease and/or predation particularly in combination with the synergistic effects of other threats. In addition, the effects of disease or predation may be heightened under conditions of periodic low flows or high temperatures which are characteristic of watersheds in this DPS.

E. Global Climate Change

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% 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% 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% to 200%) while other models show decreases of 15% to 30 % (Hayhoe *et al*. 2004). Many of these changes are likely to further degrade salmonid habitat by, for example, reducing stream flows during the summer and raising summer water temperatures. Estuaries may also experience changes detrimental to salmonids. Estuarine productivity is likely to change based on changes in freshwater flows, nutrient cycling, and sediment amounts (Scavia *et al.* 2002). 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, climate conditions not caused by the human addition of carbon dioxide to the atmosphere 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 current status of the species, its habitat (including designated critical habitat), and 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 impacts of State or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

The Carmel River is a central California coastal river that drains approximately 255 square miles of watershed to the Pacific Ocean. Land use within the Carmel River watershed is comprised of open space, grazing lands, viticulture, golf courses, and residential, suburban, urban, and light industrial developments (Carmel River Watershed Conservancy 2004). There are significant human impacts in the basin, including the over appropriation of surface and groundwater, urbanization, an expansive road network, operation of dams, and grazing and agriculture practices that cumulatively result in a degradation of habitat quality in the Carmel River (Smith *et al.* 2004).

A. Status of Listed Species in the Carmel River

The Carmel River once contained the largest southernmost steelhead run in the present range of the S-CCC steelhead DPS. The Carmel River population of S-CCC steelhead is considered a very important population within the DPS, as it likely provides frequent and occasional dispersal to the smaller coastal populations. While the coastal populations are in better condition than the populations in the larger interior rivers (like the Pajaro River), these smaller coastal populations are not currently considered viable by NMFS and may not be able to persist without straying from the Carmel River population (NMFS 2011). Therefore, the Carmel River S-CCC steelhead run is one of the core populations within the DPS that is targeted by NMFS for increased conservation and recovery efforts. If this run is improved, it will likely make a large contribution to the recovery of the DPS. Moreover, the Carmel River Watershed is considered unique from the other watersheds supporting the DPS in that the watershed provides habitat which results in a population that possesses both interior and coastal population attributes. As discussed in the *Status of the Species,* these attributes may provide more resistance to environmental variability as well as maintain genetic diversity. As such, the Carmel River run of S-CCC steelhead is considered highly valuable compared to other populations within the DPS.

Based upon steelhead adult migration counts at the San Clemente and Los Padres Dams in the Carmel River; data indicate steelhead in this watershed have undergone a steady decline. The SCD was built at RM 18.6 in 1921, and the Los Padres Dam was constructed 28 years later at RM 24.8 in 1949. According to the CDFG, the annual steelhead run prior to dam construction in the Carmel River was as much as 8,000 adults (Becker and Reining 2008). CDFG records of adult steelhead at the Los Padres Dam ladder fish trap from 1949 to 2008 ranged from 558 in 1962 to just 2 in 1973, with an average of 100 for the years in which counts were made. Using observations from local field personnel, the CDFG estimated the annual steelhead spawning population in the mainstem Carmel River to be about 1,650 fish in 1965 (Titus *et al.* 2009). More recent data estimates the historical population in the Carmel prior to the construction of the dams was a run size somewhere between 1500 - 8000 adults annually (Becker *et. al* 2010). Upstream of Los Padres Dam, adult returns have averaged 190 fish since 1997. In the drought years of 1976 to 1977 no adult steelhead were captured in the Los Padres Dam ladder trap[3], and none were observed at the San Clemente Dam fish ladder. In addition, during the 3-year period from 1988 to 1990, the river never breached the sandbar at the mouth, making the river inaccessible to and from the ocean, thus no fish, including migrating steelhead, entered or left the river. Between Los Padres Dam and San Clemente Dam, a comparison of returns before and after 1980 indicates the adult return to this portion of the basin has not recovered to levels that were common to the Carmel River population prior to the 1976-1977 drought (MPWMD 2004).

The failure of steelhead numbers to return to levels seen before the 1976-1977 drought is likely due to the degradation of habitat in the Carmel River resulting from the dams and other factors. Nehlson *et al.* (1991) concluded the Carmel River steelhead stock was at a high risk of extinction. The population decline of steelhead in the Carmel River is the result of partial barriers to historic spawning and rearing areas due in part to dam presence at the Los Padres Dam (RM 24.8), San Clemente Dam (RM 18.6), and Old Carmel River Dam (RM 18.3), flow reductions from water diversion, and habitat fragmentation and degradation (MPWMD 2004; Titus *et al.* 2009). Additionally, pumping from wells for water supply throughout the river downstream of SCD removes a significant amount of water from the river when steelhead migrate. The reduced river flow presents additional impediments to migration due to seasonal river drying between Scarlett Narrows (RM 8.7) and the Pacific Ocean. Thus, steelhead in the Carmel River have their migration opportunities reduced because higher winter and early spring flows needed for migration are curtailed by the water storage and use described above.

Adult steelhead enter the Carmel River at its mouth in the Carmel Lagoon near the city of Carmel-by-the-Sea. Adult migration on the Carmel typically occurs January through May, with the majority of spawning occurring between February and March although spawning may occur from mid-January to April. Smolt typically migrate downstream corresponding with large flow events in the winter and spring, but may move downstream during all months of the year. However, in general for the Carmel, the peak period of smolt outmigration is March to May. Kelts also migrate downstream from February through mid-April. Currently, using a combination of ladder counts, spawning redd surveys, and angler surveys, in the absence of angling, about one half (55%) of the adults that enter the Carmel River move upstream of the San Clemente Dam (Dettman and Kelly 1986). The remaining adults spawn in tributaries or mainstem of the river downstream of the dam. In 2004, the Monterey Peninsula Water Management District (MPWMD) reported that the number of returning adults had rebounded from the drought years of the early 1990’s and appeared to have stabilized in the range of 400 to 800 fish (MPWMD 2004). However, as described above, adult steelhead returns at the San Clemente Dam fish ladder have fluctuated considerably since 1965. Data From 1999-2012, ladder counts for steelhead adults returning to the San Clemente Dam numbered 472, 804, 642, 483, 388, 328, 368, 222, 412, 95, 157, 234, and 470 (MPWMD 2003-2012). These years generally indicate a downward trend in numbers, although in some years the numbers did show an increase. Fisheries staff from the MPWMD consider the apparent decline in counts at the SCD ladder to be due to mortality from various sources, and partly due to increased numbers of fish

3 Although it should be noted that the trap was not functional through much of its life and likely only captured a portion of the actual number fish attempting to pass the dam.

spawning before they reach the fish ladder perhaps in response to improved habitat conditions and access to these areas downstream of the dam. If an increase in spawning is occurring downstream of the dam, the decline in run size would be less steep than the decline in fish numbers at the ladder indicate (Williams *et al.* 2011).

B. Factors Affecting the Species and Critical Habitat in the Action Area

1. Ecological Effects of Dams on the Carmel River

The ecological effects of large dams on river systems have been well documented (Baxter *et al.* 1977, Petts 1984, Drinkwater 1994, Yeager 1994, Ligon 1995, Shuman 1995, Ward 1995 Collier *et al*. 1996, Kondolf 1997, Graf *et al.* 1999, WCD 2000, Bednarek 2001, Duda *et al.* 2008, Khloen *et al.* 2008, Pess *et al.* 2008). The consequences are numerous and varied, and can include both direct and indirect impacts to the entire river ecosystem. Dams are known to disrupt the natural flow regime of a river, changing it from a free-flowing system to a blocked one that affects both the river's physical and biological characteristics. Dams are also known to alter sediment releases and transport. The trapped sediments are critical for maintaining physical processes and habitats downstream of the dam including the maintenance of productive instream habitat, barrier beaches/islands, floodplains, and coastal wetlands. These same negative effects from dam presence are evident in the Carmel River system.

The SCD reservoir has impounded water and trapped sediment for 90 years, creating conditions suited for establishment of riparian vegetation on the accumulated sediment, causing wide flood plains to develop upstream along the Carmel River. The variations in the standing pool elevation, or impoundment, is the most influential factor determining the areal extent of the riparian vegetation on the reservoir's perimeter and on the flood plains (URS 2012). Ample evidence of scouring and drift deposits on a wide alluvial floodplain immediately upstream of the reservoir indicate where braided channels have developed during periods of heavy inundation. In areas where these floodplains are absent, water typically abuts rocky outcrops or cliffs.

The trapping of sediments in the reservoir has created several major ecological changes detrimental to S-CCC steelhead. Trapped sediments are prevented from replenishing the downstream river ecosystem. When a river is deprived of its sediment load, it seeks to recapture it by eroding the downstream river bed and banks leading to river channel incision, or deepening of the river leading to steeper, less stable banks at higher risk for erosion and failure. Risk of bank failure is further exacerbated from channel incision, as it exposes the root structures of riparian and wetland plants subjecting them to scour and erosion. The damage caused by this can extend for substantial distances below a dam. NMFS notes that even stable river systems have some eroding banks. Rivers and streams are products of their catchments. As such, they are dynamic systems which mean they are in a constant state of change. Stream bank erosion is a natural process that over time has resulted in the formation of the productive floodplains, high quality instream habitat, and alluvial terraces of many river systems. The factors controlling river and stream formation are complex and interrelated, and include the amount and rate of supply of water and sediment into stream systems, catchment geology, and the type and extent of vegetation in the catchment. As these factors change over time, river systems respond by altering their shape, form and/or location. However, the rate at which erosion is occurring in stable systems is generally much slower and of a smaller scale than that which occurs in unstable systems. In disturbed or altered systems this process can be accelerated, leading to unstable conditions.

Riverbed incision can also lower groundwater tables, making it difficult for riparian plant roots to access water as well as drawing water from wells for human use. These problems have been observed and documented throughout the Carmel River downstream of the SCD, and are detailed further in the following section. The Carmel River is incised throughout the lower reaches extending below RM 18.6 the location of SCD. The system is known to be deprived of river sediment, and instream habitat complexity is missing in many of the reaches. The negative effects associated with loss of sediment are also evident at the lagoon, where a barrier beach forms. The decline in the volume of sediment being transported downstream to the lagoon is compounded by historical artificial management of the lagoon sandbar. This has substantially altered the annual cycles of bar migration and buildup, resulting in an overall lack of sand at the barrier beach. This causes less sand to be redistributed on the beach from wave action, and may prevent the lagoon from closing or reduce the height of the sand bar, decreasing the ability of the lagoon to maintain a higher water volume; and may increase the number of seasonal breaches from wave overtopping and river outflow that would not typically occur under unaltered river conditions. All of these factors negatively affect the quality and amount of habitat available to steelhead in the lagoon.

Another significant and obvious impact is the transformation of the river reach directly upstream of the dam from a free-flowing river ecosystem to an artificial slack-water reservoir habitat. Changes in temperature, chemical composition, DO levels and the physical properties of a reservoir are often not suitable to the aquatic plants and animals that evolved for that system. Moreover, these altered environments found within reservoirs are known to pose a threat to native species as they often host non-native and invasive plant and animal species that are more tolerant of the poor water quality conditions, slower moving water (*i.e.*, lake-like conditions) or better adapted to conditions in the reservoir (*e.g.*, tolerant species of macroinvertebrates such as snails and chironomids, and other aquatic species, bullfrogs, algae, predatory fish). This has decreased steelhead foraging opportunities of preferred prey species and exposed them to higher rates of predation from predatory, non-native fish.

Furthermore, because of the inherent dynamic nature of an unaltered river system, a river can support a wide diversity of species. These species have evolved phases of their life stages to adapt and coincide with a river's variability. Thus, when this natural variability is disrupted by altered or blocked flow associated with dams, the biological response can be shown as decreased species richness (e.g., diversity and abundance) of aquatic organisms. The annual biological assessments conducted by the MPWMD staff indicate that the benthic macroinvertebrate indices (BMI) of the river below the reservoirs (LPD and SCD) show a decreased BMI compared to less disturbed reference reaches (MPWMD 2010). Benthic macroinvertebrates are a key food source for juvenile steelhead. Instream sediment particle size, water quality, and flow regime are key factors in controlling the distribution and abundance of benthic invertebrates. MPWMD conducted a 10 year bioassessment program to determine the values and constraints of benthic invertebrate production in the Carmel River. This program determined that BMI values in reaches downstream of LPD and SCD were consistently lower with some improvement in BMI as the distance downstream of the reservoir increased (King 2010). The reason for this decline may be attributed to the lack of fine substrates, changes in water quality due to impoundment, and changes in flow regime associated with the reservoir. This reservoir effect was found to be much greater than other effects associated with urban development along the lower Carmel River (King 2010). This is consistent with the multiple effects associated with dams as described above.

Dams can also completely or partially block fish passage and migrations, and can create habitat discontinuity by partially or completely separating spawning habitats from rearing habitats. At both SCD and OCRD artificial fish passage structures and trapping measures have been necessary to try and accommodate both downstream and upstream steelhead fish passage.

a. Existing Conditions at the San Clemente Dam

The SCD is a concrete arch dam with a maximum height of 106 feet (including the outlet tower) and a crest elevation of 537 feet. The thickness of the dam is five feet at the base of the parapet wall, and 17 feet at the base of the dam. As indicated in the as-built drawings, the lowest point at the base of the dam is at the 446-foot elevation at the right abutment. The spillway is an overpour structure at the center of the dam, with a crest elevation of 525 feet. The spillway is comprised of 24 gated spillway bays, each of which is 5.5 feet wide. The gates have not been used to restrict flows over the spillway crest since 1996.

The SCD has three intakes, at elevations of 515 feet, 495 feet, and 470 feet. The lower two intakes are currently blocked by sediment. The upper intake has been fitted with a standpipe at an elevation of 522 feet. Two additional pipes extend through the dam at approximately elevation 454 feet. The intakes to these pipes are also buried by sediment and are not operational. In 2002, the DSOD ordered the installation of six 12-inch valved ports, to draw down (*i.e.*, lower water levels) the reservoir to 515 feet during low-flow periods. These ports are used each year to lower the reservoir, during the annual SCD Drawdown Project described earlier. A 68-foot-high fish ladder on the left abutment (looking downstream) of the dam provides passage for migrating steelhead between the plunge pool located 300 feet below, at the downstream base of the dam and additional spawning habitat upstream of the reservoir. The concrete fish ladder penetrates the dam at elevation 524.5 feet. In 2004, a downstream fish passage system was installed to allow fish to exit when the reservoir has been drawn down. The system consists of a borehole through the dam (at 515 feet elevation) that connects a slide gate on the reservoir side of the dam to a 14-inch pipe on the downstream side. The 14-inch polyvinyl chloride (PVC) pipe runs parallel to the fish ladder and discharges into the ladder at an elevation of 513 feet. On the upstream side of the dam is an adjustable weir, which provides surface spill into a box that then flows into the bypass system.

After SCD was constructed, the channel downstream of the dam began a process of incision and armoring as a result of the lack of sediment and bedload in flows from SCD reservoir. Armoring is common downstream of dams as fine riverbed materials are washed downstream without a source of replacement, leaving only coarse materials that prevent further erosion of the riverbed (except during the largest floods). The process of incision and armoring continued until about 1940, when a new dynamic equilibrium was established. After completion of the Los Padres Dam in 1949, this process was repeated in the reach upstream of SCD, below the Los Padres Dam, but on a smaller scale due to the presence of bedrock controls and the limited amount of alluvial material in the channel. River incision in the Carmel below both dams increased the depth and speed of water flow and the rate of bank erosion, although erosion was limited by the growth of riparian vegetation along the newly cut banks (Jones and Stokes 1998). In some reaches of the river downstream of SCD, the channel deepened by up to 13 ft. As a result of the incised channel, flooding on the floodplains decreased. This allowed residential and commercial properties to develop in the floodplain. Numerous golf courses and private residences are now built along the Carmel River.

The change in river channel morphology and armoring of the channel has eliminated spawning gravels for a distance of approximately two miles below San Clemente Dam. The lack of gravels in this section of the river also has changed and eliminated riffles, important in the production of prey sources for rearing steelhead. The increased development of the floodplain has created a much greater emphasis on flood protection and preventing erosion of banks, resulting in the placement of hard structures such as bare rip-rap, concrete rubble, cement walls, and cars, etc., along a high percentage of the lower river (approximately 35-40 percent of the river between RM 0.5-15.5 has been altered in some manner). The use of these hard structures has significantly degraded the habitat value of much of the lower 18 miles of river.

As described previously, upstream of the SCD, the reservoir has trapped large amounts of sediment, forming drift deposits on a wide alluvial floodplain immediately upstream of the reservoir. Riparian vegetation has established in some of these areas, changing the configuration of the river channel affecting fish passage and accessibility to instream habitat for steelhead.

b. Existing Conditions of the Old Carmel River Dam

Approximately 1,700 feet (0.3 miles) downstream of SCD is the OCRD, which was completed in 1883 by the Pacific Improvement Company to provide sufficient water to support the Del Monte Hotel and the Los Laureles Rancho. It is approximately 160 feet long, four feet wide at the crest, and 16 feet wide at the base. The dam is nearly 32 feet high, with a dam crest and spillway elevation of 443 feet. It appears to be founded on bedrock. This dam no longer operates as a water diversion facility and causes problems with adult fish passage during upstream migration periods.

A fish ladder is on the left side of the dam (looking downstream), with a downstream invert elevation of 434 feet. A sluiceway approximately 4 feet wide by 15 feet high (invert elevation approximately 432 feet) is on the right side of OCRD, and acts as a permanently open lower water outlet. Historical evidence indicates that this sluiceway may have been equipped with a gate and operated to divert water downstream of OCRD. A plunge pool is immediately downstream of OCRD, with an estimated bottom elevation of 419 feet. Adults often have difficulty finding the entrance to the ladder, move upstream past the ladder entrance, and attempt to jump the dam, often injuring themselves in the effort. During years when flow conditions make it difficult to find the ladder entrance, a higher proportion of fish with injuries to the snout and head arrive up at Los Padres Dam. Because of the thickness at the crest of the dam, an area of high velocity over the top of the dam occurs and fish must immediately accelerate upon completing their jump. These factors make fish passage at this facility problematic (Entrix 2000). In an effort to address this, the sluiceway has been modified to allow easier passage for steelhead at lower flows.

The bridge over OCRD is slightly upstream of the crest of the dam. The right abutment and piers are partially supported by the dam and by the right hill slope and alluvium. The top of the bridge is approximately 17 feet higher than the dam crest. The bridge is approximately 175 feet long, consists of a single lane, and forms a portion of the Low Road (described in the project description, Access Roads section). The bridge was constructed later than the dam, presumably between 1919 and 1921 during the construction of SCD. The bridge foundation consists of two intermediate piers (16 feet long by 3.5 feet wide) and one abutment on the right side of the bridge. A concrete block wall is located immediately downstream of the right abutment. It is presumed that this concrete block wall supports the river side of the Low Road.

2. Water Withdrawals from the Underflow of the Carmel River

A number of wells, which pump water from the underflow of the Carmel River, are located downstream of the two dams. The CAW operates 21 of these wells and is the largest holder of a water right on the river. Additional wells are operated privately under much smaller water rights. Of these additional wells, the State Division of Water Rights has identified 14 major diverters who cumulatively divert up to 1,729 acre-ft annually from the underflow of the Carmel River. As a result of these withdrawals, the Carmel River goes dry downstream of the Narrows (RM 9.5), usually by July of each year. From July until the rains begin, the only water remaining in the lower river is in isolated pools that gradually dry up as the groundwater table declines with continued withdrawals. Similarly, surface flow into the lagoon normally recedes in late spring and ceases in summer as rates of water extraction from the river and alluvial aquifer exceed baseflow discharge (Duffy 1998). The cumulative effects of the water withdrawals and the resulting drying up of half of the lower river reduce the steelhead rearing capacity of the lower river from approximately 138,000 (Kelley 1983) to 70,000 (MPWMD 2001). The lowered groundwater tables and drying of the lower river also diminish the window of time available for migration of adults in the fall and winter and outmigration by smolts in the spring and summer. Substantial rainfall is needed to recharge the aquifer before surface flows reach the ocean. In the drought years of 1988 to 1990, the river flow receded in the lower 8 miles of the river and failed to breach the sandbar. Reduced surface flows and lowered groundwater tables also create poor water quality conditions and lowered water levels in the Carmel River and lagoon, which result in reduced growth and mortality of rearing fish.

The water supply for the entire Monterey Peninsula originates from two primary sources: the Carmel River system and the Seaside Groundwater Basin (SGB). In July of 1995, the State Water Resources Control Board (SWRCB) adopted Order WR 95-10 as a result of complaints issued against CAW for illegal water diversions. The SWRCB concluded that CAW did not have legal right to the 10,730 acre-feet of water annually diverted from the Carmel River; and the illegal diversions were resulting in adverse impacts to public trust resources in the river. Subsequently, a cease and desist order under Water Code section 1831 was issued by the SWRCB to CAW for non-compliance (Order WR 2009-0060)**,** and CAW was directed to reduce pumping by 75% over an established time period until the full reduction to 3,376 acre-feet is achieved (this is the amount that CAW has legal rights to) and implement measures to minimize harm to the trust resources, and to identify other sources of water to make up for the 75% reduction.

In 2002, CAW agreed to implementation of the long-term water project referred to as Plan B. The project includes the construction and operation of a seawater desalination plant, which will include intake and discharge facilities, water transmission pipelines, storage reservoirs, pump stations, and aquifer storage and recovery facilities to replace the temporarily permitted 10,730 acre-feet of water pumped from the Carmel River Valley aquifer until the targeted reduction is achieved. More recently, Plan B has been modified and CAW has proposed to implement a similar water supply project, which includes Aquifer Storage and Recovery (ASR) to comply with the SWRCB Order 95-10. The Water Supply Project and ASR would supply 12,500 acre-feet of water per year for urban users on the Monterey Peninsula, as well as for injection into the SGB. The ASR is managed by the MPWMD (under their mitigation program) in conjunction with CAW, and involves the diversion of excess winter and spring time flows from the Carmel River system for conveyance to ASR wells in the SGB. The excess water is captured by CAW wells in the Carmel Valley during periods when flows in the Carmel River exceed fisheries bypass flow requirements, treated to potable drinking water standards, and then conveyed through CAW's distribution system to Seaside. Recharge is accomplished via injection of these excess flows into specially designed ASR wells in the SGB. The recharged water is temporarily stored underground in the SGB, utilizing the available storage space within the aquifer system. During periods of high demand, the same ASR wells and/or existing CAW production wells in the SGB are used to recover this stored water, which in turn allows for reduced extractions from the Carmel River system during dry periods.

In part, as a result of the implementation of the ASR and modified water withdrawal operations, the dry-back distance for the Carmel River inflows to the lagoon has decreased. In the past few years river inflows have dried back for approximately of 5-7 miles, instead of 8 (Kevin Urquhart, MPWMD, pers. comm. 2011); and in 2011, river inflow to the lagoon never receded. This was also a very wet year, but modifications to river withdrawals and timing of reservoir releases may be influencing the amount of water that remains in the lower river during the drier months.

3. Sleepy Hollow Rearing Facility (SHSRF)

Under the MPWMD mitigation program, the SHSRF was constructed in 1997 to hold and rear juvenile steelhead, which are rescued during the summer months when the lower reaches of the river become dry. Although there have been some difficulties encountered with early operations of the SHSRF, significant upgrades and modifications have occurred over the past several years to the facility to improve operations. The continued rescue and relocation efforts of juvenile fish have likely improved the Carmel River S-CCC steelhead population's ability to survive. Without the conservation efforts of this facility, many juvenile steelhead would become stranded, with no chance of survival during the dry summer months, when the decline in surface flows strand juvenile steelhead in drying isolated pools or stream sections.

4. Habitat for Steelhead

Within the action area of this project, twelve reaches located on the mainstem and within tributaries of the Carmel were identified that possess habitat for steelhead (nine on the mainstem and three on tributaries). These reaches support the PCEs and essential features required for migration, spawning, and rearing. Of the three tributaries, two are located on the Upper and Lower reaches of San Clemente Creek, and the other is Cachagua Creek (Figure 3). Details of these reaches are provided in the biological assessment for this project and summarized below, numbered from upstream to downstream beginning with reach number one[4] (URS 2012). For those reaches on the mainstem, five of them possess the PCEs for migration, rearing and spawning habitat, three possess only rearing and spawning habitat, and one reach has habitat restricted to limited spawning as that reach typically goes dry in the summer. Of the tributaries, Cachagua Creek has abundant rearing habitat and the Upper San Clemente reach has all three habitats available to steelhead for spawning, rearing and migration.

Reach 1 consists of 1.3 miles of the Carmel River between the LPD and the Cachagua Creek confluence. Substrate within this reach is dominated by large boulders and bedrock outcrops. As a result, the reach provides poor spawning habitat, but does contain good rearing habitat. Rearing is sustained or enhanced by minimum summer stream flows released from LPD. Aside from LPD, there are no barriers to migration within this reach.

The stretch of the river forming Reach 2 extends from Cachagua Creek to the SCD. This reach of the Carmel River provides good spawning, incubation, and rearing habitat. Previous studies indicate that approximately 33% of Age 0+ and 20% of Age 1+ rearing habitat in the Carmel River is found between the SCD at this reach extending up to the LPD (Dettman and Kelley 1986, Dettman 1990). There are no barriers to migration within this reach.

Reach 3 consists of the area previously inundated by the San Clemente Dam's Reservoir. Where the Carmel River reestablished a channel through the sediment-filled impoundment, habitat exists that supports steelhead rearing and migration exists. Overall, substrates within this reach are likely too fine to support much spawning and incubating habitat. The lower portion of this reach just above the reservoir has a sand bed channel that, along with the small remaining reservoir, provides some rearing habitat. The fish ladder at SCD allows for upstream migration of adults as well as downstream migration when the reservoir is not spilling. When the reservoir is spilling, downstream migration also occurs through the spillway.

Reach 4 includes the three mile portion of the Carmel River from SCD to the Tularcitos Creek confluence. The river runs through a steep-sided, rocky canyon and has no tributaries. The substrate within the channel consists of cobble and boulders and provides habitat for rearing and migration but not for spawning. The channel within this reach is mostly devoid of gravel and sand because it is retained within SCD. Two partial barriers to migration exist within this reach. OCRD and the Sleepy Hollow ford crossing. Partial passage barriers can develop at the road crossing during flows of a few hundred At these flow rates, velocities in the culverts under the roadway can be too high and flows over the roadway can be too fast and shallow to support upstream passage.

Reach 5 consists of the 1.4 mile portion of the Carmel River between the Tularcitos Creek confluence and Robles del Rio. The substrate within this reach consists of cobble, gravel, and sand. This reach has a higher proportion of gravel and sand than Reach 4, as Tularcitos Creek provides a supply of finer substrates. The reach provides habitat for spawning, incubation,

---

[4] In the biological assessment (URS 2012) for this project, ten mainstem reaches plus three tributaries were identified. However, one (reach 0) of those mainstem reaches are outside the action area, thus not included in the baseline of this biological opinion.

rearing, and migration. It includes access to two tributaries: Tularcitos and Hitchcock creeks. Tularcitos Creek supports some spawning and rearing. Hitchcock Creek is a seasonal tributary that supports some spawning, incubation, and rearing during wet years.

Reach 6 includes the 4.6 mile portion of the Carmel River between Hitchcock Canyon and Randazzo Bridge, including Las Garzas Creek tributary. This reach provides habitat for spawning, incubation, rearing, and migration. A small section of this reach may become intermittent during dry years. This reach also contains a critical riffle that is a potential barrier to fish passage during low flows. The Las Garzas Creek tributary provides approximately two to three miles of spawning and incubation habitat. The tributary provides limited rearing habitat due to its seasonal streamflow.

Reach 7 includes the 3.4 mile portion of the Carmel River between the Randazzo Bridge and the Schulte Road Bridge, including Robinson Canyon Creek tributary. In this reach, the Carmel River is low gradient, possessing a bed of cobble, gravel, and sand. The reach provides habitat for spawning, incubation, rearing, and migration. Only a mile of Robinson Canyon Creek supports steelhead spawning, incubation, and some rearing. In years with limited rainfall, this reach can dry up to the confluence with Robinson Canyon Creek.

Reach 8 includes the 2.4 mile portion of the Carmel River between the Schulte Road Bridge and Highway 1. The streambed substrate consists mostly of sand and provides very limited habitat for spawning and incubation. During dry years, this reach can become completely dry. There are no barriers to migration within this reach. Potrero Creek is the main tributary to this reach and provides limited habitat for spawning, incubation, and rearing.

Reach 9 includes the 1.1 mile section of stream channel and lagoon from downstream of State Highway 1 to the mouth of the Carmel River. The channel has a sand bed that does not support spawning or incubation.   The Carmel River Lagoon is considered part of S-CCC critical habitat by NMFS, particularly for providing rearing habitat for juveniles and smolts. Rearing habitat is limited by available surface water flowing in the channel. Rearing occurs in all years, primarily for 1+ and older juveniles, and is confined to the lagoon except in wet years when persistent summer flows keep the river connected to the lagoon. Winter storms generally open the sandbar at the mouth of the river by mid-December, sometimes as early as November, allowing adult access during the migration season. The lagoon is described in greater detail below.

a. Lower San Clemente Creek

In the action area, this reach includes San Clemente Creek from the confluence of the Carmel River up to the project boundary, for a distance of about 2,150 feet. Like the Carmel River above the SCD, this reach has aggraded a wedge of sediment during the life of the reservoir. Substrates within this reach are dominated by sand and some gravel, with materials trending from coarse to finer as the channel approaches the reservoir. Numerous debris piles and log jams are present, some being very large in size. The channel morphology is dominated by large pools formed by debris jams, interspersed with runs. A few riffles are present at the upstream end of this reach. Some spawning and rearing habitat occurs in this reach.

b. Upper San Clemente Creek

This reach of San Clemente Creek extends upstream from the construction area and the portion of the creek affected by the reservoir's impoundment of sediment to the headwaters of the creek for a distance of about 8 miles, although only the lower 900 lf of this reach are within the action area. Habitat for steelhead within this reach is primarily limited to migration and rearing habitat. Substrates are generally not suitable for spawning, though some spawning may occur. Although San Clemente Creek typically has very low flow in late summer, the step-pools and boulder niches likely provide rearing and holding for juveniles (URS and Interfluve 2011b). This reach typifies the characteristics of Lower San Clemente Creek prior to construction of the reservoir (URS and Interfluve 2011b). Substrate within the channel is dominated by rounded cobbles and boulders partially embedded in coarse sand.

c. Cachagua Creek

This creek is a tributary that feeds into the Carmel River upstream of the SCD Reservoir. Bridge #529 is located here. At the point where Bridge #529 crosses the creek, flows are likely perennial, with very low summer flows through an active channel with a width of five to eight feet. Substrate in the channel consists of cobble, gravel and habitat was a mix of riffle and pool/run habitat. In the action area, which includes the footprint of the bridge, and the 60 lf immediate up/downstream areas, conditions are generally unsuitable for spawning. However, the stream provided an abundance of juvenile rearing habitat.

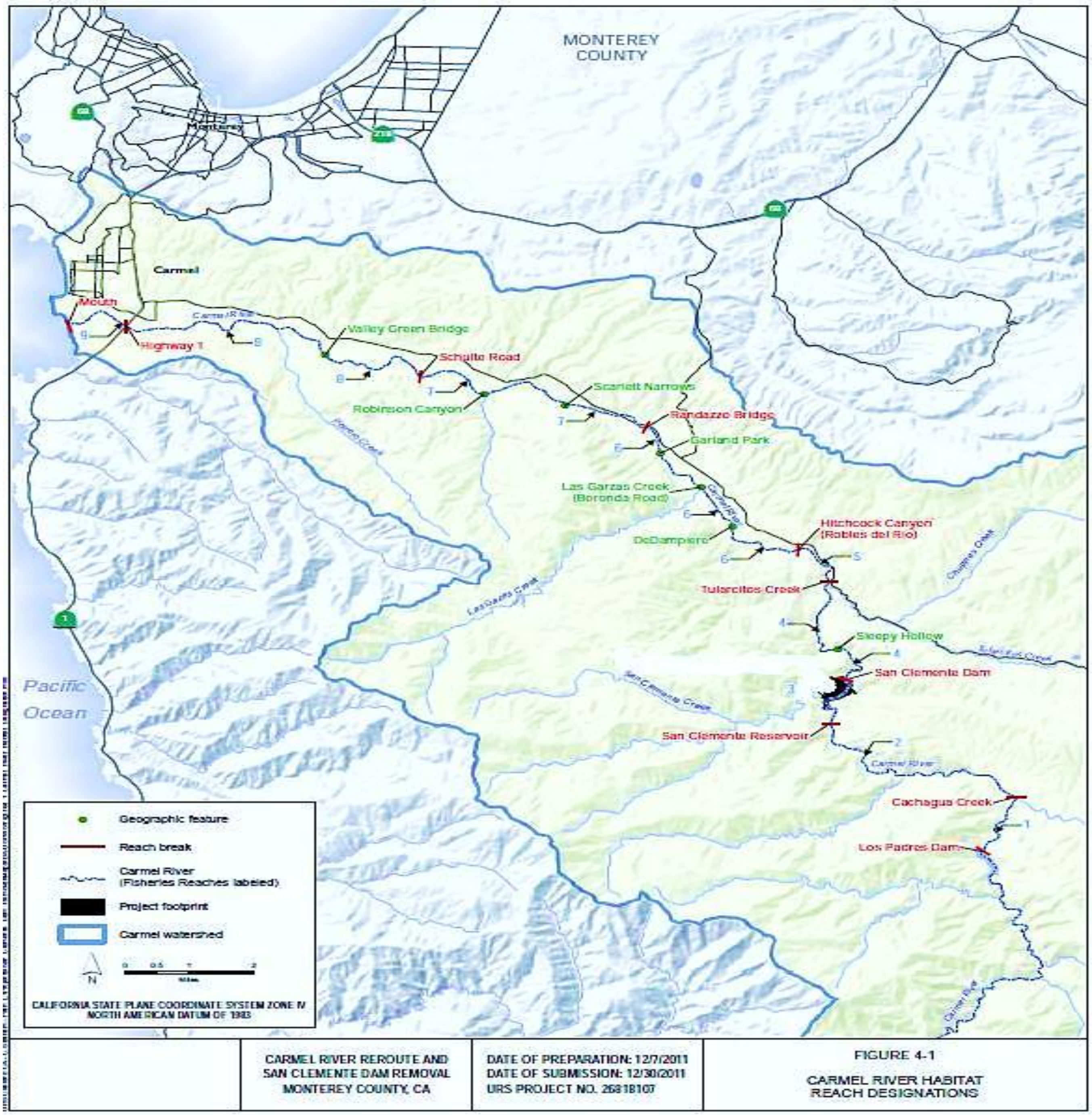

Figure 3. Carmel River Fish Habitat Reaches (URS 2012). The numbers on the map correspond to the individual reaches.

5. Carmel Lagoon

The Carmel River Lagoon (part of reach 9) is formed at the mouth of the Carmel River by a sandbar built up behind the Carmel Bay beach. The sandbar is between two rock outcrops spaced about 700 feet apart. The height of the sandbar varies between 10 and16 feet National Geodetic Vertical Datum (NGVD) in the summer and 0 to 16 feet in the winter. In more recent years, the height of the sandbar has decreased, likely in part due to a lack of suitable sand input and resupply. At low water levels, the Carmel Lagoon consists of the outlet of the Carmel River into the main body of the lagoon, which occupies the high flow channel of the river, and three narrow arms. The North Arm is relatively short, and extends and fans out into a wetland area to the north of the main lagoon. The South Arm is longer than the north arm, and is located at the base of the inland side of the southern rock outcrop and connects the main body of the lagoon to the Odello Arm. The Odello Arm, or Odello Expansion is an area to the south of the main river channel and separated by a 10-foot levee. The Odello Arm was excavated by the California Department of Transportation in 1997 as a wetland mitigation bank project. The South Arm was deepened at the same time. In the summer and fall of 2004, the California State Parks initiated the Carmel River Lagoon Enhancement Project. The project involved excavation of a dry remnant south arm of the lagoon and adjacent farmland (Odello farmland) intended to create more lagoon volume, and thus more available habitat for S-CCC steelhead and the California Red-legged Frog. The substrate of the lagoon is sand in the main body and silt and organic material in the arms. The areas surrounding and between the arms of the lagoon are colonized with wetland species of tules (*Scirpus californicus*) and rushes (*Juncus balticus*). The lagoon at high levels (*i.e.,* 10 feet NGVD), inundates the wetlands surrounding the North Arm.

The Carmel River Lagoon habitat provides important PCEs for steelhead rearing and migration, including connectivity to shallow water areas and wetland adjacent to the lagoon. Habitat quality and availability for rearing steelhead in the lagoon fluctuates over time. Rearing habitat is influenced by the physical processes associated with coastal ocean dynamics and freshwater inflows, and is dependent upon water depth and quality. Water quality parameters of salinity, DO, dissolved carbon dioxide (CO_2), and temperature are interrelated and are determined by the amount of fresh water inflows from the Carmel River and surrounding groundwater, and by seawater inflow, either by overwash of the sandbar, through the open tidal inlet, or seepage through the sandbar. The amount of seawater entering the lagoon is controlled by the elevation and configuration of the tidal inlet, the surface elevation of the lagoon, and the height of the sandbar. A freshwater to slightly brackish lagoon, which is partially or completely closed to tidal influence and therefore has a greater depth, generally has higher DO levels, minimal salinity stratification, and is most productive for rearing juvenile steelhead. These conditions usually occur at the lagoon in late spring and early summer just after the sandbar has closed, when flows drop down to 20-25 cfs typically May-July. During dry years, opening of the lagoon sandbar in the late fall or winter may be delayed or intermittent.

6. <u>Prior Habitat Improvement Actions</u>

To alleviate the long-term effects of gravel entrapment and increase spawning habitat in the Carmel River, the MPWMD received a grant in 1991 from the California Wildlife Conservation Board (CWCB) to restore spawning habitats in a 7.4-mile long reach between LPD and the Sleepy Hollow area below SCD. The contract with the CWCB called for placing gravel into selected spawning sites and maintaining the sites over a ten-year period. Over the 10-year duration of the project, MPWMD injected a total of 2,444 cubic yards of gravel into the Carmel River and steelhead have used this material for spawning throughout the reaches below both dams. However, injection of spawning sized material alone over the ten-year period has not improved juvenile steelhead rearing habitat. For example, aquatic insect habitat has not improved because water withdrawals and other factors affecting instream habitat are likely preventing abundant, diverse assemblages of macroinvertebrates from establishing.

C. Previous Consultations

Pursuant to section 7 of the ESA, NMFS has previously conducted consultations for projects that affected the action area of this project. In 2003, 2004, 2006 and 2007, NMFS completed formal consultation with the Corps for the San Clemente Dam Drawdown Project. The 2007 biological opinion for this was reaffirmed in 2012 for an additional year via a letter dated May 21, 2012. The project made annual fish rescues and conducted water quality monitoring during lowering of the water in the reservoir during the summer months for dam safety. NMFS concurred with the Corps' determination that the project was likely to adversely affect S-CCC steelhead, but not jeopardize the species nor adversely modify critical habitat. Incidental take was exempted for the years the project activities occur through March 2012. An informal consultation was completed for the Carmel River Lagoon Water Management Project in 2009. The project is intended to modify the sandbar (usually by closing the outlet channel to the ocean) of the Carmel Lagoon such that the highest possible lagoon volume and subsequent water quality at the beginning of the dry summer period is maintained in order to enhance habitat conditions for steelhead and CRLF. California State Parks was the original applicant for the project and implemented it in 2009. However, in April 2012 the County of Monterey assumed responsibility for the project and will implement the project in the future beginning the summer of 2012. In addition, NMFS completed a programmatic formal consultation in 2004 and 2010 with the Corps for the MPWMD's Carmel River Restoration and Maintenance Regional General Permit. The projects activities include maintenance and restoration activities that occur along tributaries and the mainstem of the Carmel River from RM 24.8 at Los Padres Dam, ending at RM 1, near the Carmel Lagoon.

VI. EFFECTS OF THE 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 steelhead. Our approach was based on knowledge and review of the ecological literature and other relevant materials. We used this information 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 are likely to be exposed to. Next, we evaluate the likely response of salmonids to these stressors in terms of changes to salmonids survival, growth, and reproduction, and changes to the ability of PCEs to support the value of critical habitat in the action area. PCEs include sites essential to support one or more life stages of the species. These sites for migration, spawning, and rearing in turn contain physical and biological features that are essential to the conservation of the species. Where data to quantitatively determine the effects of the proposed action on CCC steelhead and their critical habitat were limited or not available our assessment of effects focused mostly on qualitative identification of likely stressors and responses.

The proposed action is anticipated to have direct and indirect effects on S-CCC steelhead and their critical habitat. These effects are separated by type and by their short-term and long-term duration where applicable. Adverse effects to steelhead and their critical habitat are expected during the years of construction activity, but once construction is completed the benefits to the species and habitat are expected to be substantial, and contribute to achievement of conservation and recovery goals for the species. In-water or in-channel work is limited to four years of construction during May 15 and October 31 of each year. This work entails annual installations of water diversions, drawdown of the reservoir, excavation of sediments, rerouting the river channel, stabilizing the sediment slope and stockpiles and removal of the dams. Fish capture and relocations will be conducted prior to seasonal flow diversions, reservoir drawdowns, and dewatering. The remainder of the work is expected to occur on land and be fully isolated from the river; therefore, any effects from such work will be discountable.

A. Effects to Steelhead

The proposed action will affect steelhead through death or injury that may occur during the installation of water diversions, lowering of water levels at the reservoir (drawdown/dewatering), dewatering at construction sites, and from fish capture, rescue, and relocation. In addition, the proposed action's construction activities will require temporary and permanent alterations to occupied habitat. Temporary alterations, such as changes in water quality, the removal of riparian vegetation, and the exclusion of fish from habitat may increase predation or decrease feeding success, or temporarily affect access to rearing and spawning habitats for a small portion of the Carmel River's S-CCC steelhead population. The project's proposed avoidance and minimization measures will reduce, but not eliminate the potential for construction activities that result in injury or death of S-CCC steelhead. There may be additional disturbances that could affect the behavior of steelhead if steelhead are located near the actions producing these disturbances when the actions take place, such as during blasting of rock and substrate for the construction of the Reroute Channel and Combined Flow Reach, hoe-ramming for concrete demolition, and vibrating in sheet piles for the flow diversion systems. However, the project will incorporate measures to completely avoid or minimize the disturbances associated with these actions such that their impacts on steelhead are insignificant.

Once the project is complete, two substantial migration impediments to steelhead will have been removed from the Carmel River and approximately 19 miles of habitat will have been improved, and unimpeded access to approximately 25 miles of the mainstem of the Carmel River will be restored.

1. Death or Injury of Steelhead from Flow Diversion and Dewatering

Project construction will require dewatering of waters occupied by steelhead at several locations and time periods during construction. In CY1, the work required to reinforce the Bridge (#529) over Cachagua Creek may require dewatering. NMFS expects up to 60 lf of the Carmel River to be dewatered for this work. In CY2, CY3 and CY4, the San Clemente Creek and Carmel River will be dewatered from just upstream of the reroute channel to the SCD, including the reservoir. This will entail diverting flow and dewatering in the Carmel River 4,490, 4,600, and 4,890 lf during these years, respectively. For San Clemente Creek, 2,200 lf of dewatering will occur during CY3, and CY4, respectively. The plunge pool below SCD may be dewatered in CY3 if partial removal of the SCD crest and upper portions of the fish ladder occur that year. The plunge pool will be dewatered for the final stage of SCD removal in CY4. Approximately 39,000 cubic feet of space (the entire plunge pool) will be dewatered. In CY4 or CY5, dewatering or isolation of approximately 500 lf of the Carmel River will also be required for removal of OCRD.

Any dewatering implemented during construction will only occur between May 15th and October 31st, during construction each year. This timing avoids the migration and spawning season for adult steelhead. Therefore, adverse effects to steelhead adults, migration corridors, or spawning habitat are not expected to occur. However, rearing juveniles and smolts could be present. In order to minimize adverse impacts to juvenile steelhead, juvenile fish will be captured and relocated from dewatered areas prior to earthmoving or other construction activities commencing.

Juvenile and smolt S-CCC steelhead will be captured via electrofishing, fyke nets, rotary screw traps, seining and/or dip netting, and then placed in insulated, oxygenated tanks filled with Carmel River water, and transported to suitable habitat in the river. Fish rescue and relocation activities pose a risk of injury or mortality to rearing juvenile steelhead. Any fish collecting gear, whether passive (Hubert 1996) or active (Hayes *et al.* 1996), has some associated risk to fish, including stress, disease transmission, injury, or death. The amount of capture, injury or mortality of S-CCC steelhead due to dewatering, rescue and relocation is dependent upon the number present in the area to be dewatered. The amount of unintentional injury and mortality attributable to fish capture varies widely depending on the method used, as well as the ambient conditions, expertise and experience of the field crew. However, this project will only use methodologies in accordance with NMFS guidance (discussed previously) and with experienced and expert crews; therefore, wide variation in unintentional injury and mortality is unlikely. For these reasons, and based on similar relocation efforts NMFS is familiar with, approximately two percent of the fish are likely to be injured or killed during capture and relocation activities (Collins 2004, CDFG 2005, 2006, 2007, 2008, 2009, 2010b). In addition, stream flow diversions could harm individual rearing juvenile and smolt steelhead by concentrating or stranding them in residual wetted areas before they are relocated (Cushman 1985). Juvenile and smolt S-CCC steelhead that avoid capture in the project site will die during dewatering activities from stranding and asphyxiation. Direct mortality from stranding and asphyxiation is expected to be minimal due to relocation efforts prior to dewatering. Based on similar dewatering projects (Alley 2004, Rich 2005, Michaud 2006, Cressey 2009), NMFS expects the number of juvenile steelhead that will be killed (no more than one percent) as a result of stranding and asphyxiation after dewatering activities to be less than those killed during capture and relocation (no more than two percent; *See* Collins 2004, *supra*).

Stress caused by capture and relocation can also have sub-lethal effects and temporarily reduce fitness of fish following release. For salmonids, stress from handling is compounded by warm water temperatures, poor water quality, and low dissolved oxygen. By appropriately managing these parameters during relocation efforts, these sub-lethal effects are greatly diminished. Furthermore, 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 have to compete with other fish causing increased competition for available resources such as food and habitat (Keeley 2003). 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 greater habitat availability and a lower density of fish. As each fish moves, competition remains either localized to a small area or quickly diminishes as fish disperse. NMFS cannot accurately estimate the number of fish affected by competition, but does not believe this impact will be large enough to affect the survival chances of individual fish.

Once the project is complete, juvenile and smolt steelhead migration and rearing space will return to the dewatered areas (except in the areas that will be reconfigured to have no water such as in the Sediment Stockpile). The amount of mortality of S-CCC steelhead due to dewatering, capture and relocation is dependent upon the number of fish present in the area to be dewatered. The maximum area that will need to be dewatered for each project component and associated estimates of fish numbers for each reach affected are described below. Total fish captured for relocation and estimated mortalities are summarized in Table 2.

a. Dewatering for work at Bridge #529

At Bridge #529 over Cachagua Creek, dewatering may be required to install the three new bridge support footings. If surface flow is present during construction, cofferdams will be built to direct water around and isolate the construction area and fish rescue and relocation will occur. Regardless of the presence or absence of surface flow, pumping will be required to remove groundwater from the excavations during construction of the bridge footings. Dewatering will occur for approximately 60 lf of stream. Cachagua Creek is located within Reach 2 of the project area, which possesses an abundance of rearing habitat. Using data collected by MPWMD staff (MPWMD 2004 in URS 2012), NMFS estimates juvenile abundance for this reach to be 1.42 fish/lf (MPWMD 2004 in URS 2012). Assuming a fish number of 1.42 fish/lf, with a maximum of 60 lf of dewatering area, and injury or mortality of one percent due to stranding/asphyxiation during dewatering and two percent from handling during capture and relocation, the modification of Bridge #529 is likely to result in in capture and relocation of no more than 86 juvenile steelhead, and injury or mortality to approximately three fish (one due to stranding/asphyxiation (1%) and two due to handling (2% [1.42 fish/lf * 60 lf = 86 fish; 86 fish * 0.03 = 3 total]) for one year of construction[5].

b. Dewatering for the Removal of OCRD

The OCRD removal will involve demolishing the dam in two sections sequentially, while temporarily re-routing the active low-flow channel within the existing river bed away from each section as demolition proceeds. In order to provide sufficient access for construction equipment, a short diversion pipe will be installed to convey the active flow through the access bench. This will require an approximate 500 lf of the river to be diverted and dewatered, with fish rescue occurring in the dewatered areas. Fish rescue will be completed in the areas isolated from flow, using methods such as electrofishing, block nets, and seines. The area estimates of dewatered limits are based on OHWM, which represents an area several times greater than the space of riverine habitat that will be present at the start of dewatering due to the timing of construction during the drier months of the year. The OCRD is located on the Carmel River at Reach 4 of the project area. Using the MPWMD survey data for this reach, NMFS estimates summer fish numbers in the areas that maintain summer flows to be 0.63 fish/lf. Using the same methods as above, results in take of 315 fish with injury or mortality occurring to 10 fish (3 from stranding/asphyxiation and 7 from rescue and relocation (.63 fish/lf * 500 lf = 315; 315 * 0.03 = 10 total per one year).

c. Dewatering for Flow Diversion of Carmel River and San Clemente Creek

[5] These numbers have been rounded to the greatest whole number.

For flow diversion, fish traps will be installed upstream of the Reroute Channel and Diversion Dike on both the Carmel River and San Clemente Creek to prevent steelhead from entering the water diversion system, and from being subjected to poor water quality conditions during drawdown. Downstream migrating fish that are collected in the traps will be relocated downstream of the project footprint. Fish exclusion, rescue/trapping and relocation will use methods similar to those implemented during summer drawdown of the reservoir, as discussed in the 2007 biological opinion for the SCD Drawdown Project. These methods are as described below.

A rotary screw trap or fyke nets will be employed to capture the majority of downstream migrating steelhead in the Carmel River and San Clemente Creek during the reservoir dewatering in CY3 and CY4. A floating barrier fence or log boom will be installed across the channel upstream of the diversion systems and trapping operation to remove any large debris moving downstream. The rotary screw traps will be located downstream of the barrier fence. . Wing walls constructed of netting will be installed on the trap in order to collect fish from 100% of the channel.

In the 2007 biological opinion for SCD Drawdown activities, 30,965 steelhead were anticipated to be captured in five years of fish relocation operations, with mortality of approximately 1,965 steelhead during that five year period (2007-2011). Annually, 5,800 steelhead were expected to be captured. This number included 5,158 juveniles, 1 smolt, and 1 kelt, captured during trapping, rescuing and relocation; 580 juveniles relocated (captured) when rescued along the drying edges of the reservoir, and another 60 juvenile rescues from the downstream fish ladder. Mortality was expected for no more than 1% (58) each year as a result of trapping, rescue and relocation and drying edges of the reservoir, 330 as a result of stranding and asphyxiating in the sediment deltas, predation and low water quality conditions in the reservoir; another 6 from stranding and asphyxiating in the fish ladder. This resulted in a total lethal take each year of 394 fish, which represents 0.6% of the estimated juvenile population in the Carmel River. The actual amount of incidental take that occurred over the past five years (2007-2011) of reservoir drawdown associated fish capture (trapping, rescue, relocation) was 20,616 juvenile steelhead, with mortality of 124 individuals. In two of the past five years (2010 and 2011) more than 1% mortality occurred during trapping, rescue and relocation (1.6% and 1.8%), but when comparing the total catch effort and number of fish caught during those years, (831 and 743, respectively) the 1% take limit was easily exceeded since the actual fish capture numbers were low compared to what was expected. Thus, the total incidental take that occurred over the past five years has been well within the limits set forth in the 2007 biological opinion. Most of the mortalities were of young of the year (YOY) fish, though a few mortalities of age 1+ fish occurred. No mortalities occurred for smolts or kelts. Many of these mortalities have been attributed to predation by crayfish within the traps. In recent years, the installation of multiple fyke nets that separate the channel based on high and low flow velocities has helped to reduce crayfish predation. Crayfish tend to move into the traps in low velocity regions, while the steelhead move into the trap in the high velocity regions. NMFS anticipates trapping and transporting of steelhead during the CRRDR Project will likely to result in similar numbers of steelhead captured, injured, or killed as with past five years of SCD Drawdown activities. Based on this information, NMFS expects incidental take of 5,160 juveniles with mortality occurring for no more than 1% or 52 fish as a result of diverting flows from San Clemente Creek and the Carmel River and associated trapping, rescue and relocation upstream of the reservoir.

Another consideration for estimating take during dewatering for this project is the CRRDR Project's dewatering schedule may begin earlier in the year, May 15th. The SCD Drawdown start date was May 31st or later. This two week earlier start date for the CRRDR Project may result in more juveniles being present. However, given that the anticipated incidental take amounts in the 2007 biological opinion have not been reached during most of the past five years, NMFS believes these numbers are still a reasonable surrogate for the anticipated take for the CRRDR Project, even with an earlier start date for dewatering the reservoir.

In the Carmel River and San Clemente Creek, downstream movement of juveniles usually reaches low numbers late in the trapping period as spring dispersal ends. Because of this, during the annual SCD Drawdown activities, traps are removed at the end of the season only when a five-day running of average of 10 fish or less are caught at either of the trap sites, or no fish are caught in the San Clemente or Carmel River traps for three consecutive days. This usually occurs by July or August of each year. However, any fish that move downstream from above the diversion system after the traps have been removed could possibly pass through the bypass/diversion pipe and into the plunge pool downstream of the SCD. These fish may or may not survive the transport through the pipe nor the outfall drop. NMFS assumes that very few fish will enter into the diversion pipe. Based on the numbers provided at the close of each season from the previous six years of the SCD Drawdown Project, (2006-2011), NMFS estimates that a maximum of 60 fish may pass through the diversion pipes each year once traps have been removed, totaling 120 fish over the two years (CY3 and 4) flow is diverted around the reservoir and associated fish trapping efforts have ceased. Because there is no way to estimate survival rates for those fish that enter into the diversion system, NMFS assumes the worst case scenario will be for all of these fish to be injured or killed.

d. Dewatering for Reservoir Drawdown

Once water within the reservoir is entirely isolated from flow, the reservoir will be drawn down and fish rescues would proceed as described previously. Mortality of fish during this phase will likely be greater than during rescue within areas of the active river, due to the increased difficulties associated with removing fish from a large ponded area such as a reservoir. Using the estimates of fish that were expected to killed as a result of stranding/asphyxiation in the reservoir sediment deltas, fish ladder, poor water quality conditions, and predation, from the SCD Drawdown activities, NMFS assumes all the individuals that escape trapping and relocation upstream of the reservoir will die. NMFS estimates 640 juveniles will die each year during CY2-CY4. These numbers assume a higher level of mortality (worst case scenario) from current drawdown operations due to the fact the reservoir will be dewatered almost entirely, as low as the 506 feet elevation.

e. Dewatering of Plunge Pool

During CY3 and CY4 of construction, and prior to partial and complete removal of SCD, the plunge pool, located approximately 300 feet below the dam, will also be dewatered. The same fish capture and relocation strategies will occur prior to dewatering of the plunge pool as with other project actions. The length of the area to be dewatered in the plunge pool is 125 lf. However, because this is a pool, and provides ideal rearing conditions for steelhead, estimating the number of steelhead per linear feet may be an underestimate. In order to account for this, NMFS conservatively estimates a number up to three times the lf amount may be present in the plunge pool during dewatering. Based on this assumption, NMFS expects 237 juvenile fish to be present in the plunge pool, and are likely to be captured and relocated during dewatering; with injury or mortality of one percent due to stranding/asphyxiation during dewatering and two percent from handling during capture and relocation during CY3 and CY4 (.63fish/lf * 125 lf * 3 = 237. 237 * .03 = 8). This is likely to result in capture and relocation of no more than 237 juvenile steelhead, and injury or mortality to approximately 8 fish, 3 from stranding/asphyxiation (1%) and 5 due to handling (2%) each year.

Table 2. Capture/Mortality per Construction Year and Activity

Construction Activity	**Total Capture/Mortality of Individuals**				
	CY1	**CY2**	**CY3**	**CY4**	**CY5**
Dewatering for Bridge #529	86 / 3				
Dewatering for Removal of OCRD				315 / 10*	
Flow Diversions around Reservoir		5160 / 52	5160 / 52	5160 / 52	
Fish entering Bypass Pipe			60 / 60	60 / 60	
Dewatering of Reservoir		640 / 640	640 / 640	640 / 640	
Dewatering of SCD Plunge Pool			237/8	237/8	
Total Per Year	86 / 3	5800 / 692	6097 / 760	6412/ 770	0
Total for Project (CY1-CY5)	18,395/2,225				

*This may occur in CY5 if not completed in CY4

2. Effects to Steelhead during Migration Periods

The project schedule and design has been planned to reduce effects on steelhead migration as much as feasible. Flows to the Carmel River and San Clemente Creek would be restored for the majority of the adult migration season between construction years, allowing steelhead to migrate as per the current conditions. The SCD fish ladder would operate as it does currently until the SCD is removed. A small proportion of adults and juveniles may be migrating during the beginning of the water diversion period. Although fish trapping and relocation efforts would be conducted during this period, steelhead may experience delays in migration as a result. However, based on data from past SCD Drawdown activities, very few upstream adult migrants and a small number of downstream smolt migrants may be affected in this way. Brief delays in migration are not expected to result in injury or mortality to adults.

3. Effects to Steelhead from Temporary Water Quality Degradation

Water quality degradation from elevated levels of turbidity, low DO levels and increased water temperatures during flow diversion and dewatering activities may adversely affect steelhead, especially those steelhead located in the reservoir during drawdowns.

Turbidity refers to the amount of light scattered or absorbed by a fluid. Elevated levels of turbidity may result when fine sediment is contributed to the river or mobilized during construction. Turbidity due to suspended sediment is likely low in the river throughout most of a given year. Suspended sediment produces little or no direct mortality on adult fish at levels observed in natural, relatively unpolluted streams (Waters 1995). High concentrations of suspended sediment can result in direct mortality (Lloyd 1987, Sigler *et al.* 1984, McLeay *et al.* 1984, McLeay *et al.* 1983) or deleterious sublethal effects to fish, including reduced feeding efficiency and decreased food availability (Velagic 1995, Gregory and Northcote 1993, Reynolds *et al.* 1989, Berg and Northcote 1985, Newcomb and Flagg 1983, Bisson and Bilby 1982, Herbert and Merken 1961, Cleary 1956). Cedarholm and Reid (1987) observed evidence of stress in juvenile coho salmon exposed to suspended sediment levels from 1,000 to 12,000 mg/L. Temporary visual impairment, caused by the suspended sediments, reduced the ability of the salmon to capture prey (Berg 1982). Redding *et al.* (1987) reported physiological changes indicative of stress in coho salmon and steelhead exposed to sublethal levels of suspended sediments. Studies on adult and juvenile salmon have shown that salmon, when exposed to short-term pulses of suspended sediments, dispersed from or avoided the area (Bisson and Bilby 1982, Whitman *et al.* 1982, Berg and Northcote 1985). Increased turbidity may affect the ability of fish to feed, block or delay juvenile or adult steelhead migration, cause juvenile steelhead to move into areas of higher predator density, and/or cause short- or long-term physiological damage that ultimately prevents a listed steelhead from successfully reproducing. Turbidity may increase in the river during construction, and during redistribution of sediments when flow is restored to the dewatered reaches. While turbidity levels may increase over background levels, the increase is likely to be temporary and minor with no long-term detectable effects to steelhead. And since the majority of fish are expected to be rescued from upstream of the reservoir and relocated to areas with good water quality parameters, and adequate feeding opportunities during construction, a very low number of steelhead are expected to be exposed and adversely affected through exposure to temporary elevated levels of turbidity.

Low DO levels may affect those fish that are located in the reservoir and become stranded in shallow pools of water during dewatering. Depletion of DO is the water quality parameter with the greatest potential to harm or kill fish during dewatering of the reservoir. For steelhead, several DO thresholds have been established based on life-history stage. The accepted minimum for DO levels is 5 mg/L (Bell 1991, Bjornn and Reiser 1991) for rearing and migration habitat. In spawning areas, DO should not drop below 7 mg/L (Bell 1991). The U.S. Environmental Protection Agency (1986) concluded that if the exposure period was limited to less than 3.5 days with temperatures between 50 and 68 degrees ºF, DO concentrations of at least 3 mg/L should not produce any direct mortality of salmonids for rearing. Dean and Richardson (1999) exposed rainbow trout juveniles to 3 mg/L for 36 hours and this resulted in 14% mortality, with no mortality occurring at concentrations greater than 3 mg/L. The proposed project will follow the limits set in the 2007 SCD Drawdown Opinion, which is a minimum of 5 mg/L during lowering of the reservoir. Fish exclusion nets and traps will not be removed until this DO threshold is met in the reservoir, prior to reestablishing access of fish to the reservoir. During the SCD Drawdown activities from 2003-2011, fish did not exhibit any signs of stress even when DO dropped below the thresholds for brief periods of time. As such, low mortality of juveniles is anticipated to occur as a result of reduced DO during dewatering.

During active project construction (CY2, CY3, and CY4), water temperature in the river and reservoir may be directly affected by the water diversion system, and from loss of mature riparian canopy. However, measures will be taken to ensure that the diversion system does not cause warming of the diverted waters, including shielding of the diversion piping with bed load materials, white paint, or cloth, and methods implemented during previous SCD Drawdown activities. The biggest problem posed by increasing temperatures is that it makes steelhead more vulnerable to other degraded water quality measures, such as reduced DO or elevated turbidity. Similar to the SCD Drawdown activities, the limits for DO and turbidity set for this project take elevated temperature into account. However, as fish are expected to be relocated form areas where temperature increases are likely to occur during flow diversion and dewatering, the majority of impacts to fish from elevated water temperatures will be avoided. Mortality from low DO during dewatering is accounted for the take estimates associated with stranding and asphyxiation described above during fish rescue and relocation for all components of this project, including dewatering of the reservoir.

4. Impacts to Steelhead During Blasting Activities

Blasting may be utilized during construction of the Reroute Channel; there is a possibility that targeted blasting could also be used in construction of the Combined Flow Reach. The Reroute Channel construction is planned for the second full construction season (CY3), after the water diversion and fish relocation have already occurred for the year. In addition, the Reroute Channel is being constructed through the ridge separating the Carmel River and San Clemente creek starting approximately 200 feet above the final channel thalweg. This is expected to provide an initial buffer between the blast zone and proposed river elevation. Ground-borne sound transmission into adjacent water bodies may occur during blasting, however, due to prior dewatering and fish relocation, fish are not expected to be in the vicinity of blasting activities, and therefore, are not expected to be impacted as a result of potential blasting associated with the CRRDR Project.

5. Effects to Steelhead from Hoe-ramming During Demolition of Concrete

A hydraulic hammer attachment or similar equipment (*e.g.,* jack-hammer) will be used to break apart concrete and other material during the removal of the SCD and OCRD. This type of hammering produces a percussive sound that may propagate into adjacent water bodies. NMFS currently uses a dual metric criteria for onset of physical injury to fish from percussive underwater sounds. These thresholds are 206 decibels (dB) peak referenced to one micropascal (re: 1µ Pa) for single-strike sound pressure levels, and for cumulative sound, 187 dB SEL (re: 1µ Pa^2-sec) for fish equal to or greater than 2 grams, and 183 dB SEL (re: 1µ Pa^2-sec) for fish smaller than 2 grams. The sound pressure levels produced from this type of activity (hoe-ramming, jack-hammering, etc.) are not expected to rise to these thresholds, which would injure or kill fish, although ground-borne transmission could affect the adjacent water column. This may cause temporary behavioral responses such as rapid bursts in swimming speed or other erratic swimming patterns. However, since fish will be relocated from these areas prior to these demolition activities, they are not expected to be affected from underwater sound that may occur during the use of percussive equipment to break apart concrete.

6. Effects to Steelhead during Vibratory Hammering of Sheet Piles for Installation of Cofferdams

In the second year of construction (CY2), sheet piles will be driven into the alluvium of both the Carmel River and San Clemente Creek to create temporary cofferdams needed for the flow diversion systems. The sheet piles will be installed with a vibratory hammer. NMFS considers the use of vibratory hammers for pile installation to be less harmful to fish than other methods such as impact hammering. Although the continuous sound wave produced during vibrating of piles into a substrate does have the potential to produce sound frequencies detectable by fish in an adjacent water column, this type of continuous, broadband sound does not have the percussive effects as those associated with impact hammering. Thus the sound levels reached from this method are not expected to reach levels that would harm or injure fish. Fish may demonstrate behavioral changes as a result of vibrating in sheet piles if they are located within the zone of impact where sound levels may be high enough to disturb them. However, many of the sheet piles driven for cofferdam construction will be placed outside of the wetted channel, which will attenuate sound transmission more rapidly. Therefore, relatively little sound energy is expected to propagate into nearby waters. Even when sheet piles are driven into the wetted channel, shallow water depths (less than three feet) in the vicinity of the construction are expected to quickly attenuate sound levels. In addition, fish are expected to be relocated from the areas prior to the installation of cofferdams and are not likely to be affected from vibratory hammering for sheet pile installation.

7. Effects to Steelhead during Irrigation of Vegetation

Once the riparian vegetation is planted, irrigation of the plants will be necessary. The irrigation system that will be installed will be an above ground system with overhead sprinklers in riparian areas and a drip irrigation system in upland areas. Although the system is expected to use well water for the water supply, river water may be used. If river water is used, limits on amounts diverted will be established according to NMFS seasonal flow criteria guidelines for the Carmel River in order to avoid impacting aquatic species. Thus, NMFS expects no adverse effects on steelhead from river water being diverted for plant irrigation.

8. Summary of Effects on Steelhead

In summary, take is expected for 5,800 individuals during CY2, and 5,860 individuals each year for CY3 and 4, with lethal-take occurring to 692 individuals in CY2, and 752 during each year of CY3 and 4 during the diversion of river flow around the reservoir and dewatering the reservoir itself (692 from trapping, rescue and relocation, predation and stranding/asphyxiation in the reservoir; plus 60 that may enter the bypass pipes in CY3 and CY4 and die). These numbers, combined with the fish capture and relocation at Bridge #529, the OCRD, and plunge pool result in total capture and relocation of 18,395 individuals, and of those, mortality of 2,225 juvenile and smolt fish for all five years of flow diversion, dewatering, and fish rescue and relocation takes place during the CRRDR Project (see Table 2). The population of out-migrating juvenile (including smolts) steelhead from upstream of SCD was estimated to be as high as 70,000 fish (NMFS 2007a). Total annual lethal take of 692 and 770 individuals during CY2-CY4 (when the bulk of the take occurs) represents 0.009 - 0.01% of the 70,000 estimated juvenile population. How this may affect adult returns is an important consideration. According to Shapovalov and

Taft (1954), the expected survival from juvenile to adult is 1.7 to 2.8%. Ward and Slaney (1991) report average egg-to-fry survival of steelhead of only 6.5%, and average fry-to-smolt survival of 12.9%. Smolt survival to adult was found to be 15%, and determined necessary to sustain positive population growth (Ward and Slaney 1988 and Ward 2000). However, the survival rate identified by Ward (2000) was based on a typical 3-year freshwater rearing period, which is different from the Carmel River, which has a 1 to 2-year freshwater rearing period for steelhead. As such, a 15 percent survival rate for smolt to adult in the Carmel River would at least maintain, and most likely increase population growth. Another important consideration is that juvenile production in the watershed varies according to environmental conditions. Therefore, a better way to estimate the effects on the potential adult population in the Carmel is by using a conservative estimate of the juvenile production between SCD and LPD (excluding production in the tributaries throughout the watershed), which ranged from 8,000 to 58,000 individuals from 2003-2009[6]. These numbers incorporate annual variability in production based on changing conditions in the river from year to year. Based on these juvenile population estimates between SCD and LPD and the associated mortalities expected from the CRRDR Project between CY1-CY4, in the result is an estimated range of 0.01% to 0.09% mortality of juveniles in the Carmel River from the proposed project. Using the juvenile mortality estimates, and the survival rates (juvenile to adult) expected for steelhead based upon the data provided above, results in a loss of approximately 12 adult steelhead per year from the CRRDR Project. This number represents the maximum potential loss of adults based upon the lowest survival rates of 1.7% and lowest Carmel River juvenile population estimate of 8,000, minus the highest percentage .09% of the juvenile population killed during the CRRDR project each year: 1.7*8,000 = 136 (number of adults expected from juvenile survival during a normal year); .09*8,000 = 720; 8,000-720 = 7,280 (survival rate based on juvenile morality and subsequent population number expected during the project); 7,280*1.7 = 124 (adults expected from juvenile survival during CRRDR project); 136-124 = 12 (the potential difference in adult numbers based upon juvenile loss during construction).

NMFS considers the likely mortality of juveniles and smolts extremely low relative to their numbers in the Carmel River and expects minimal if any impacts on future adult returns. The maximum loss of up to 12 adults per year as a result of juvenile and smolt mortality during construction is a worst case scenario that is unlikely given variable environmental conditions (*i.e.*, in some years the juvenile population and/or survival rate will be much higher and smolt losses are expected to be very small). This loss, even if it were to occur, is unlikely to produce a reduction in the total number of future juveniles rearing in the Carmel River due to the large number of juveniles produced by each spawning pair. Adult returns fluctuate annually as recorded at the SCD ladder from 2003-2012. The range of adults returning during these years was from 95 to 804. Therefore, the potential loss of up to 12 adults annually is not expected to affect the capacity of surviving adults to maintain or increase population growth in the Carmel in years after these losses occur. NMFS does not expect that the potential adult losses discussed above would compound because juvenile losses will only occur for a few years (no more than 4) and there are likely to be enough juveniles produced each year by the relatively large number of remaining adults to fully seed juvenile rearing habitat during the project.

---

[6] Juvenile population data was only available through 2009.

B. Effects on Steelhead Critical Habitat

The proposed action would have both direct and indirect effects to steelhead critical habitat. Direct effects will occur during project construction activities in the action area, and indirect effects will occur once construction has been completed and changes to habitat in the river occur from approximately one mile upstream of the SCD reservoir, extending downstream to the mouth of the Carmel River at the lagoon. There are temporary, and minor deleterious effects expected from loss of habitat during construction. After construction and channel restoration are complete habitat for steelhead is expected to be improved, including improvement of access to spawning and rearing habitat upstream of SCD.

Construction activities to remove SCD and OCRD will result in the loss of a portion of the current channel of the Carmel River, removal of sediment behind the two dams, removal of vegetation along channels, channel re-routing and grading, and installation of in-channel features such as LWD and boulders. These activities will result in approximately 8,000 lf of riverine and riparian habitat disturbance from sediment excavation, vegetation clearing, and grading activities. This includes approximately 3,000 lf of the Carmel River between the Reroute Channel and the stabilized Sediment Slope that will be permanently filled with excavated sediment. Approximately 27 acres of riparian vegetation will be removed. Following the channel reroute, restoration planting would begin as described in the *Project Description*.

Several channel improvements will be undertaken during this project that are expected to benefit steelhead critical habitat. These improvements will affect steelhead spawning, rearing and migration habitats. Channel improvements will provide improved steelhead habitat beginning just downstream of the plunge pool at SCD and continue upstream to the Upper Carmel River Reach and the Upper San Clemente Reach. Some additional improvements would be made around where OCRD is being removed. Approximate lengths of steelhead habitat improvements are:

- 2,600 lf of the Combined Flow Reach
- 400 lf of the Reroute Channel
- Up to 1000 lf of the Upper Carmel River Reach
- Up to 900 lf of the Upper San Clemente Creek Reach

Approximately 20 out of 27 acres (8,300 lf) of riparian vegetation will be replanted, replacing removed trees at a ratio of 3:1. Downstream of SCD, about 1,100 lf of riverine habitat will be temporarily disturbed due to plunge pool road improvements and OCRD removal. This area will also be fully restored and improved for steelhead habitat. At Cachagua Creek, bridge improvements for Bridge #529 will permanently fill 300 square feet of steelhead habitat, and less than 0.1 acre of riparian habitat would be temporarily disturbed. While some riverine and riparian habitat will be lost as a result of this project, improved fish habitat, habitat continuity, and the removal of dam failure risk and the restoration of natural sediment transport processes are considered beneficial effects of this project.

Although the project will have temporary impacts to steelhead critical habitat during and for a short timeframe after construction is complete, the final result of the project will be the reestablishment of natural river processes and unobstructed access to approximately 25 miles of critical habitat for steelhead in the Carmel River. Over time, once the natural river processes resume, the project is expected continue to provide benefits for steelhead critical habitat by improving the PCE's required for steelhead recovery and conservation.

1. Effects to Steelhead Spawning Habitat

Following CY4, the action would permanently bypass approximately 3,000 lf of the Carmel River (Reach 2 and a portion of Reach 3) that is considered marginal spawning habitat due to extensive sand deposition. The Reroute Channel and the removal of the dam will provide improved fish passage, providing access to more suitable upstream spawning habitat once construction is completed. The proposed project will also restore the fluvial transport of sediment, improving spawning habitat both above and below the Reroute Channel and all of the downstream reaches of the river below the project area. With the implementation of the avoidance and minimization measures that NMFS is familiar with from other projects, the proposed action is not expected to produce levels of erosion or siltation that would degrade downstream spawning habitat. Removal of the SCD and reservoir would restore the movement of gravel and cobble from the upstream portions of the watershed to the downstream portions.

Restoration of sediment transport is expected to improve spawning substrates downstream by allowing passage of smaller particle size material to intermix with the cobbles, creating the habitat complexity required for good steelhead spawning habitat. Construction of the Reroute Channel will also cause eventual steepening and coarsening of the reach of Carmel River directly upstream of the Reroute Channel, which currently contains a high proportion of sand. Over time, this reach would proportionally lose more sand to downstream transport and the suitability of spawning habitat is likely to increase as the proportion of gravel and cobble increases. Steelhead prefer spawning gravel sizes of 6-100mm (Bjornn and Reiser 1991). A study conducted in 1982 at 15 steelhead redds on the Carmel River found that over 60% of the substrate adjacent to the redds was between 22 and 63 mm in size (MPWMD 2004). Other sources provide a range of 10 to 130 mm (Moyle 2002) or 6 to 102 mm (Bjornn and Reiser 1991). This project has been modeled to estimate the changes in median substrate size as a result of the proposed action. The results of the modeling analysis indicate that restoration actions proposed for this project would cause Reaches 3, 4, 5, and 6,where large substrate currently dominates, to have more smaller sized substrates, while Reaches 2, 7, and the affected parts of Reach 8, where smaller substrates dominate, would have more large sized substrates (URS 2012 Interfluve 2011b). Thus, the action would redistribute and sort instream substrate material, through adding larger sized material *i.e.,* coarsening of reaches that possess too fine sediments and add finer materials to reaches that possess overly coarse sediment material. A higher proportion of the river channel would have substrates suitable for steelhead spawning than what currently exists.

2. Effects to Steelhead Rearing Habitat

During CY2, CY3, and CY4, approximately 5,700 lf of rearing habitat in the Carmel River and San Clemente Creek, and 7.6 acres of low quality rearing habitat in the reservoir would be temporarily unavailable during the instream work window (dry season) as a result of water diversion. Once the water diversion systems are removed, habitat in the restored reaches will become available to steelhead once again. As described above, following CY4, the proposed action will bypass approximately 3,000 lf of the Carmel River controlled by the reservoir (Reach 2) and a portion of Reach 3 that has low velocities and is impacted by extensive deposition of sands. In its place, approximately 1,400[7] feet of combined flow channel would be created, featuring boulder step-pool sequences and low velocity areas which would provide holding areas for migrating adults and juveniles as well as habitat for fry and YOY steelhead, and better rearing habitat for Age 1+ juveniles and smolts. Moreover, steelhead will have better cover from predators within the Combined Flow Reach than current conditions existing in the reach of the Carmel River (that will be bypassed), because of the addition of step-pool boulders and LWD.

Following the restoration of flows, forage for juveniles would likely be temporarily decreased in the dewatered reaches due to reductions in benthic macroinvertebrates caused by seasonal dewatering. These forage species are expected to rapidly recolonize the area once construction activities have ceased and the ecosystem rebounds to function more naturally. This will result in benefits to instream habitat, which will support a more diverse assemblage and higher abundance of benthic organisms. Substrate size plays an important role in the abundance and distribution of benthic invertebrates. In the Carmel River watershed, the areas dominated by boulders and cobble directly below SCD and LPD scored lower values for BMI. This may be due to the lack of interstitial spaces required for survival by several taxa of BMI. Channels dominated by fine substrates (sand and silt), on the other hand, have decreased wetted surface area and usually exhibit lower diversity of BMI. Therefore the completed project will allow a diversity of substrates, including fines, sand, gravel, and cobble, to pass downstream of the reservoir which should in turn increase the BMI through creating instream habitat complexity necessary to support a diverse and abundant assemblage of benthic species.

Additionally, the Carmel River lagoon is recognized as an important rearing habitat for steelhead. The wetted area and depth of the lagoon basin varies considerably, dependent on river inflow, tidal stage, water table, and closure of the sand bar. The lagoon is a partially managed system, which is typically artificially breached in the fall to prevent flooding of nearby areas. The lagoon is also managed as wildlife habitat by the California State Parks. As discussed in the *Environmental Baseline*, several habitat enhancement and monitoring projects have occurred in recent years to increase the amount and value of habitat within the lagoon. The proposed action is expected to result in a greater input of sediment, primarily sands, into the lagoon. This may result in some filling of the lagoon volume, but may also result in adding to the crest elevation of the seasonal sand berm at the mouth, increasing the capacity of the lagoon basin. A raise in the crest of the sand berm may also reduce the incidence of overtopping during heavy surf events, thus reduce the risk of flooding for surrounding areas, but more importantly prevents large amounts of saltwater from entering the lagoon, and may decrease the number of sand bar breaches that could empty the lagoon, which help to maintain water quality parameters in the lagoon required for ideal rearing conditions.

[7] A portion of the original instream 3000 lf of the Carmel will be converted into riparian and wetland habitats through the stabilization of the sediment and replanting of native vegetation.

3. Effects to Steelhead Migration Habitat

During the adult migration season between construction years, flow would be restored to the dewatered portions of the Carmel River, San Clemente Creek, and the reservoir, allowing rearing juveniles and migrating adults to utilize that habitat. Following CY4, the removal of SCD would improve downstream passage conditions for juveniles, kelts, and smolts. Under current conditions, downstream migrants that go over the spillway may be injured or killed when landing in the plunge pool. When reservoir levels fall below the spillway elevation, some downstream migrants exit the reservoir through the fish bypass system previously discussed. Although the primary design criteria are for adult upstream passage, the design of the Combined Flow Reach should provide a reasonable diversity of flow paths to allow juvenile upstream passage during a range of flow conditions (URS and Interfluve 2011). This would allow greater movement of juveniles throughout the year, allowing better habitat utilization and improving juvenile production. Along with the removal of the dam, the SCD fish ladder would be removed and upstream migration would take place through the Combined Flow Reach. Currently, upstream migrants require a four to eight hour time period to traverse the fish ladder; which does not meet current fish passage criteria. Therefore, the Combined Flow Reach is expected to decrease the passage delay at the dam and provide more resting areas for upstream migrants, better attractant flows, greater diversity in water velocities and passage routes, and be less energetically taxing than the current migration route. The Combined Flow Reach would meet current adult salmonid passage criteria established by NMFS and CDFG.

Effects to steelhead migration corridors are expected from fluvial processes which will modify river channel morphology, *e.g.* aggrade or erode the reaches of the Carmel River downstream of the dam. NMFS does not expect these changes in channel morphology to adversely affect upstream passage of adults, nor downstream emigration for juveniles since the return to more natural river dynamics is expected to improve migration corridors through removing dams that have been barriers to fish passage along the river. Moreover, by the time river flows have increased enough to breach the seasonal lagoon sand bar, the flow and depth in the river should be sufficient for steelhead migration throughout the action area. These effects will provide benefits to critical habitat for S-CCC steelhead by improving juvenile and adult mobility within the action area as well as providing access to a greater range of habitat.

4. Effects Common to More than One PCE of Critical Habitat

a. Riparian Vegetation

Riparian vegetation borders a stream and is an integral part of the habitat for listed steelhead. The functional values of riparian corridors and the benefits they provide to aquatic systems overall, and stream fish populations in particular, are well documented (Hall and Lantz 1969, Karr and Schlosser 1978, Lowrance *et al.* 1985, Wesche *et al.* 1987, Gregory *et al.* 1991, Platts 1991, Welsch 1991, Castelle *et al.* 1994, Lowrance *et al.* 1995, Wang *et al.* 1997). Riparian vegetation contributes to steelhead habitat and critical habitat by providing many of the essential features of rearing, migrating, and spawning PCEs: natural shading to reduce water temperatures, cover from predators, input of food items that fall into the water, nutrient sources for benthic macroinvertebrates, and a source of LWD for instream cover and refuge.

Removal of riparian vegetation can also include the formation of wider, shallower, less complex river or stream channels and an increase in sediment and pollutant chemical input. The removal of shading and increase in solar input may also increase water temperatures and/or produce large amounts of algae. As algae dies, biological oxygen demand increases and DO concentrations decrease, reducing water quality. The loss of riparian vegetation may reduce the amount of energy stored in organic material that serves as food for aquatic invertebrates entering the stream ecosystem, leading to a decrease in aquatic invertebrates. Many of the potentially affected aquatic invertebrates are forage for steelhead. Reduced forage can result in reduced growth rates of steelhead and increased competition for available forage, thus reducing size and fitness and decreasing abundance of steelhead. All of the above effects associated with removal of riparian vegetation may result in temporary reduced steelhead carrying capacity and production within the affected reaches.

For this project, the value of riparian vegetation would likely be diminished for a period of several years while restoration plantings develop (increase in height, canopy cover and density). This effect would be partially reduced immediately after project construction through the project's in-stream habitat enhancement, such as the installation of LWD. In the years following instream habitat enhancement, the revegetation/restoration efforts of this project are likely to result in post-project conditions of a healthier, denser, and more diverse riparian vegetation than what exists currently. NMFS expects this will increase the carrying capacity of areas where riparian vegetation is replanted and restored.

b. Water Quality

Water quality is an essential feature of S-CCC steelhead spawning, rearing, and migration PCEs. The project has several activities that may affect the water quality in the Carmel River, thus affecting critical habitat for steelhead. These activities are primarily associated with channel relocation, sediment excavation, flow diversions, reservoir dewatering activities and dewatering other river reaches during construction. Adverse effects on water quality may also occur due to river bank and channel substrate disturbance, temporary loss of riparian habitat, increases in water temperature or biological oxygen demand from losses in riparian cover or changes in channel morphology, and/or temporary increases in fine sediments. The main water quality parameters that will be affected by these activities are turbidity, sedimentation, DO and temperature. The effects of these water quality parameters on steelhead are described above. A series of avoidance and minimization measures would be enacted to protect water quality during construction, as described in the *Avoidance, Minimization Measures and Monitoring* section of this document.

During project preparations (*i.e.*, construction of access roads and reinforcement of Bridge #529) significant impacts to water quality from erosion or sedimentation are not anticipated. Avoidance and minimization measures, such as the implementation of a SWPPP and other erosion control measures are expected to reduce such effects to discountable levels. Minor and brief increases in turbidity may still occur, particularly during the installation of dewatering structures.

Reservoir drawdown will also result in changes to water quality conditions from a temporary increase in turbidity levels in the Reservoir and downstream in the Carmel River. During dewatering of the Reservoir, the methods previously used during SCD Drawdown activities will be followed to minimize the effects to water quality from turbidity and sediment. If water quality monitoring indicates turbidity does not meet the SCD Drawdown Project criteria, water will be filtered before releasing into the river. Monitoring data from previous reservoir drawdowns demonstrate that turbidity increases continually while the reservoir is lowered. The baseline period has the lowest turbidity, then it increases as the drawdown progresses, then typically takes a few days to recover post-drawdown. Levels ranged from baseline conditions of 0 to 66 NTUs post-drawdown.

Turbidity. The duration and concentration of the turbidity would depend partially on the length of time required to dewater segments of the reservoir, lower the reservoir levels, construct each project element, and the volume and rate that sediment is contributed to the river, or mobilized, during and after construction activities. For all earthmoving components of this project, CAW proposes to isolate the work areas from flowing water, install erosion control devices at the time of construction, monitor turbidity and filter sediment laden water prior to being discharged into the river if necessary. Thus, while turbidity levels may increase over background levels, the increase is likely to be temporary and minor with no long-term detectable effects to steelhead critical habitat.

***Sedimentation*.** Construction operations will disturb and expose soil. The major impact to steelhead critical habitat from disturbing and exposing soil is the production of excess fine sediment. Many construction elements proposed for this project will require removal of vegetation, instream channel excavation, filling with sediment, disrupting the structure of the soil surface, and in some instances leaving the soil susceptible to rainfall and runoff erosion, channel erosion, and wind erosion. All of these factors may lead to increases in sediment inputs. Water quality can be adversely affected by excess sedimentation, leading to a series of channel and habitat responses and ultimately affecting steelhead production by increasing their energetic demands and susceptibility to disease and predation. Substantial sedimentation rates could bury less mobile organisms that serve as a food source for many fish species (Ellis 1936, Cordone and Kelley 1961), degrade instream habitat conditions (Cordone and Kelly 1961, Eaglin and Hubert 1993), infiltrate redds resulting in progressively lower egg survival (Tappel and Bjornn 1983, McNeil and Ahnell 1964, Reiser and White 1988, Tagart 1984), and cause reductions in fish abundance (Alexander and Hansen 1986, Berkman and Rabeni 1987) and growth (Crouse *et al.* 1991). Siltation may reduce habitat diversity by filling pool habitat, thereby reducing juvenile rearing habitat and adult holding habitat. Deposited fine sediment can also reduce the amount of spawning habitat. Silt may clog spawning gravels, thereby reducing water flow through the gravel and reducing the interstitial dissolved oxygen concentrations which reduces the habitat capacity to support steelhead eggs and fry. These effects to steelhead are described above.

Similar to what was described above in the turbidity section, CAW will isolate the work areas from flowing water, install erosion control devices as necessary and detain sediment laden water for treatment prior to being discharged back into the river. Moreover, this project is designed to stabilize and contain the majority of accumulated sediment behind the reservoir. This differs somewhat from other dam removal projects (*e.g.,* Elwha Dam) that typically allow large sediment loads to be released into the river downstream, causing several years of potentially negative habitat consequences from sedimentation post dam removal. Thus, while some sedimentation, resulting from channel excavation, construction of water diversions, access roads, and staging areas may be reintroduced to the channel after each construction season. These temporary effects from minor increases in sedimentation are not expected to appreciably reduce the value of critical habitat in reaches of the Carmel River downstream of SCD. The project has been designed to allow for sorting of gravel throughout the lower reaches of the river which is expected to immediately provide improved habitat conditions for spawning and rearing. The overall result of the project is for a natural sediment transport regime to resume. No long-term degradation of habitat is anticipated once the project is completed.

Dissolved Oxygen Levels. Effects to steelhead from low DO levels were described previously. This water quality parameter has the greatest potential to harm or kill fish during dewatering of the reservoir, thus affect critical habitat during construction. During 2003-2011 SCD Drawdown operations, DO varied depending on location, depth, and time of day of sample. Data recorded during these years showed a range in DO from 1.7 mg/l to 10.8 mg/l (Entrix 2012) during drawdowns. The DO concentrations were inversely correlated with turbidity and water temperatures, *i.e.* higher water temperatures and turbidity resulted in lower DO. Additionally, DO levels decreased with water depth and increased between morning and late afternoon (likely due to lower temperatures). Based on these monitoring results, and because drawdown for construction dewatering will utilize the same methods as drawdown for dam safety, DO is not expected to drop below 1.7 (~2) mg/L for longer than half a day, and will be monitored until it reached 5 mg/L before excluded fish are allowed to reenter the reservoir. Although, the temporary decrease in DO will diminish habitat with good quality DO ranges that support steelhead, these temporary reductions in DO are not expected to permanently impair habitat where they occur. Moreover, during dewatering operations, aerators will be operated as needed, to maintain appropriate DO levels. NMFS expects the low DO levels to reduce the quality of the critical habitat to rearing steelhead during construction, but the short duration and ability to add aerators will keep the habitat functional.

Temperature. As previously described in the Effects to Steelhead section, during CY2, CY3, and CY4, water diversion may directly affect temperature in the river and reservoir. Water temperatures in some of the restored reaches may also be affected until a mature riparian canopy is reestablished (see *Riparian Vegetation* above). However, the implementation of measures such as shielding of the diversion piping with bed load materials, coating the bypass pipes with white paint, or cloth, and similar methods used during previous SCD Drawdown activities the will ensure that warming of diverted waters will be minimal.

Similar to the SCD Drawdown activities, the limits for DO and turbidity set for this project take elevated temperature into account. San Clemente Reservoir temperature profiles during previous drawdowns generally decrease with depth and increase between the morning and afternoon monitoring events. Water temperatures in the reservoir vary based on the depth, time of day, and time of year. Temperatures during drawdown operations for dam safety ranged from 57.2 – 79.88 ºF during 2003-2011.

Water temperatures during the next potential four years of lowering (dewatering) the reservoir levels are expected to fall within these ranges because the drawdowns will be conducted using the same methods as the dam safety drawdowns. NMFS does not expect water temperatures to change substantially as a result of the drawdown process, although water temperature will naturally increase during the summer season. Downstream water temperature will be similar to the Reservoir water temperature. Pore water[8] temperature is expected to be cooler than the Reservoir, but the small volume of this inflow is not expected to greatly influence reservoir water temperatures. Once the Reservoir is drawn down, the wide, shallow section of the Carmel River may increase water temperature somewhat. In addition, trapping fish above the reservoir and monitoring changes to the water quality will help avoid most of the potential adverse impacts from any increased water temperature in the reservoir. Therefore, NMFS does not anticipate temperatures during drawdowns to adversely affect critical habitat during project construction.

Once project construction is complete, water temperature may be indirectly affected by the alterations to the stream bed that would result from the rerouted channel and Combined Flow Reach. The Combined Flow Reach would be steeper, thereby having a greater flow velocity and may experience more evaporative cooling than would occur in the rerouted or bypassed portion of the Carmel River. The canyon of the Combined Flow Reach is narrower and aligned more to the north than that of the bypassed portion, reducing overall solar incidence. This effect would be strengthened as the Combined Flow Reach is increasingly shaded by the riparian growth during the revegetation process. In addition, removal of the reservoir would also reduce solar incidence on the waters of the Carmel River. All of these factors are expected to result in a decrease in water temperatures from the bypass and combined flow compared to current conditions, though the magnitude of this effect has not been modeled.

C. Effects of Interrelated or Interdependent Actions

Interrelated actions are all other actions that would not occur but for a larger action and depend on the larger action for their justification; interdependent actions are all other actions that would not occur but for the action under consultation (USFWS and NMFS 1998). Once the project is completed, the ownership of the land will be conveyed to the Bureau of Land Management (BLM). This transfer of ownership is necessary in order to protect the open space in perpetuity. This preservation of the open space through the transfer of ownership is considered a beneficial effect by NMFS.

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". Many actions occurring in the watershed upstream may affect the action area of this proposed project. Any future Federal actions will be reviewed through separate section 7 consultation processes and not considered here. NMFS does not anticipate any cumulative effects in the action area other than those ongoing actions already described in the Environmental Baseline above, and resulting from climate change. Given current baseline conditions and trends, NMFS expects that many of the factors identified in the Environmental Baseline will continue to degrade steelhead habitat in the action area unless actions are taken to reduce their impacts. In the long term, climate change may produce temperature and precipitation changes that may adversely affect steelhead habitat in the action area. However, because this project will improve habitat, NMFS expects it will it provide some

[8] Pore water or interstitial water is the water occupying the spaces between sediment.

resistance to climate change by allowing fish to migrate more freely through the lower 25 miles of the Carmel River, providing access to better spawning and rearing habitats.

VIII. INTEGRATION AND SYNTHESIS OF EFFECTS

S-CCC steelhead DPS are listed as threatened. The decline of this steelhead DPS is primarily due to anthropogenic influences associated with agriculture, water withdrawals, mining, urbanization, and to some degree environmental influences such as disease and predation. Based on the extensive loss of historic habitat and degradation of remaining habitat due mainly to human activities (dams, water use, etc.) described in this opinion, the S-CCC steelhead DPS population in the Carmel River Watershed is likely to continue in decline absent efforts to improve and restore their habitat. Steelhead occur in the Carmel River in densities and abundance lower than historic conditions. Juvenile and smolt S-CCC steelhead DPS are expected to be present within the action area during in-water construction windows. All freshwater life history stages of steelhead will use the action area at other times of the year during and after this proposed project.

As described above, diverting river flow and dewatering at the construction site will require fish to be collected and relocated from the work area prior to dewatering construction areas and drawing down the reservoir. NMFS expects that experienced fish biologists will work effectively and have low steelhead injury and mortality rates during fish collections from the river reaches. Similarly, during flow diversions around the reservoir and dewatering, the implementation of known fish trapping methods and water quality monitoring utilized during the past nine years of drawdown actions are expected to effectively reduce the level of injury and mortality from these actions.

Fish located within the 60, 500, and 125 lf distances corresponding to the area of the river to be dewatered during improvements of the Bridge #529 over Cachagua Creek, and the work required for removal of the OCRD, and dewatering of the plunge pool below SCD respectively, may be injured or killed as a result of fish capture and relocation. Mortality and injury combined from these activities (rescue and relocation) are expected to be less than 3 percent of the fish in the areas where dewatering, capture and relocation will occur. Because no more than 638 (86 for Bridge #529, 315 at the OCRD, and 237 during each year CY3 and 4 for the plunge pool) juvenile steelhead are likely to be present in the areas dewatered, NMFS expects no more than 29 juvenile and smolt steelhead will be harmed or killed by dewatering, capture and relocation (3, 10, 8, and 8, respectively).

Capture and relocation of steelhead will also occur during flow diversion, and dewatering of the reservoir. The majority of steelhead captured and relocated will not die as a result however, a small percentage of the juveniles (including smolts) captured for relocation during CY2-CY4 will die. During each flow diversion and dewatering of the reservoir, as many as 5,860 may be captured for relocation, for a total of 17,520 juveniles in the three construction seasons. Of these, up to 752 fish are likely to die, 692 as a result of dewatering, fish trapping, rescue and relocation, and 60 as a result of entering the bypass pipe and dying during transit through the pipe or when exiting at the outfall. There will be an additional 237 (474 total) fish taken during fish rescue, relocation and dewatering of the plunge pool in either CY3 or CY4, with death likely occurring to 8 juveniles and smolts each year (16 total) .

Based on these annual expectations, a total of 18,395 individuals will be captured and relocated from dewatering river reaches, dewatering of the reservoir, and the flow diversion system during CY1-CY4. No more than 2,225 of these steelhead will die. These steelhead will be primarily juveniles, and a few will be smolts. Individuals that are rescued and safely relocated, are expected to recover fully, with no lasting impacts to the population of steelhead in the Carmel River watershed or DPS.

These numbers represent a low percentage of the Carmel River juvenile and smolt steelhead population. Because mortality is high during the juvenile and smolt life history stages, steelhead spawners produce thousands of eggs which often hatch into hundreds of alevins. The survival of eggs, alevins, juveniles, and smolts varies year to year based on climate conditions and other factors. Despite previous and ongoing impacts to habitat as described above (see *Environmental Baseline*), due to the relatively large number of juveniles produced by each spawning pair, steelhead spawning in the Carmel River in future years are likely to produce enough juveniles to replace those that are lost due to the CRRDR Project's construction activities. Thus it is unlikely that the small loss of juveniles from this project will impact future adult returns. NMFS expects completion of this project to improve juvenile and smolt survival rates and increase future spawning opportunities for adults.

During construction, critical habitat would be impacted by the use of water diversions, the removal of riparian vegetation, and minor changes in water quality. In addition, the action will result in temporary exclusion from occupied habitat and temporary reductions in riparian and riverine habitat value. Adverse effects to critical habitat from project construction are expected to be mostly limited to the five years of instream summer construction, mostly from temporary impacts associated with disturbances to the water column, streambed, and bank of the river during construction activities. Some reduction in the value of critical habitat is expected during restored plant reestablishment periods in areas where construction occurs. These impacts will likely begin to diminish within three years of construction and the installation of habitat features such as boulders and LWD will ameliorate some of this reduction in habitat value until the restored vegetation areas reach full maturity. The areas affected by the removal of riparian vegetation are small relative to critical habitat in the Carmel River and the small and temporary reduction in critical habitat value due to the project is unlikely to affect the value of critical habitat in the Carmel River for S-CCC steelhead. Permanent loss of habitat space is expected to be small and have an insignificant impact on the value of critical habitat in the action area. A permanent loss of marginal spawning habitat in the reach immediately upstream of the reservoir will occur as a result of the project (*e.g.,* Sediment Stockpile).

Following construction, the proposed action will have immediate and long term beneficial effects to critical habitat, through the removal of impediments to migration, redistribution of sediment, and the elimination of the threat of a disastrous dam failure event. Removal of SCD, its reservoir, and OCRD will improve fish passage to spawning areas and improve seasonal movement and migration for juveniles. Removal of SCD will allow substrates (sand, gravel and cobble) to pass to downstream reaches, improving both spawning and rearing habitat. Construction of the Reroute Channel will also improve habitat upstream by allowing accumulated sand to move downstream, increasing substrate size and channel competence in the reach upstream.

The project will make fish passage more successful and allow spawning steelhead easier access to suitable spawning habitat upstream of the project footprint. Furthermore, the project will restore the movement of bedload through the Carmel River, improving spawning conditions up and downstream of SCD. The Combined Flow Reach would provide good quality rearing habitat with cool temperatures and continuous water flows, particularly for Age 1+ juveniles and smolts. Rearing habitat within this reach is expected to be far superior to what is provided currently at the Reservoir. The new Combined Flow Reach will allow for juvenile fish passage at all but high flow extreme events. This will increase the value of critical habitat in this section of the Carmel River which is currently impassable to juveniles.

As previously described, the proposed action is specifically intended to benefit the recovery of the S-CCC steelhead DPS. The project is designed to restore a majorly altered river system to a more natural condition. Although steelhead and their critical habitat will be impacted during construction (death, injury, turbidity, etc.) these impacts are not anticipated to significantly affect the conservation and recovery of the species, as they are unlikely to affect adult returns after the project is complete or impair the value of critical habitat in the action area. Completion of the project and long-term goals of re-establishing watershed processes is likely to provide favorable environmental conditions for steelhead in the Carmel River watershed, including additional resistance to climate change. Therefore, once construction of the project is completed, NMFS expects it to improve the PCEs of migration, rearing and spawning critical habitat in the action area and improve steelhead population numbers.

IX. CONCLUSION

After reviewing the best scientific and commercial data available, including current status of S-CCC steelhead DPS, the Environmental Baseline for the action area, the cumulative effects of the proposed Carmel River Reroute and San Clemente Dam Removal Project, it is NMFS' biological opinion that the Carmel River Reroute and San Clemente Dam Removal, as proposed, is not likely to jeopardize the continued existence of the S-CCC steelhead DPS.

After reviewing the best available scientific and commercial information, 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 Carmel River Reroute and San Clemente Dam Removal Project is not likely to destroy or adversely modify designated critical habitat for S-CCC steelhead DPS.

X. INCIDENTAL TAKE STATEMENT

Section 9 of the Endangered Species Act and Federal regulations pursuant to section 4(d) of the Act 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 to 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 intended as part 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 or their designee so that they become binding conditions of the permit issued to CAW, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to require a permittee or contractor to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms added to the grant, permit, or contract, 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 or Extent of Take

The amount or extent of take described below is based on the analysis of effects of the action done in the preceding biological opinion. If the action is implemented in a manner inconsistent with the project description provided to NMFS, and as a result take of listed species occurs, such take would not be exempt from section 9 of the ESA.

NMFS anticipates incidental take of S-CCC steelhead DPS as a result of temporary stream flow diversions, dewatering in the action area, and fish capture and relocation. However, NMFS anticipates that the number of individual fish affected by incidental take of the S-CCC steelhead DPS will be limited to the juvenile and smolt life history stages. Nearly all fish taken are likely to be juveniles. Incidental take as a result of dewatering and fish capture and relocation activities will be exceeded if more than 86, and 310 steelhead are captured, or more than 3 and 10 steelhead are killed during dewatering activities required for Bridge #529 and OCRD work, respectively. Incidental take will also be exceeded if more than 237 fish are captured each year during CY3 or 4 during dewatering activities for the plunge pool, or more than 8 are killed each year. Incidental take will also be exceeded if more than 5,800 steelhead are caught during annual reservoir drawdown, flow diversion, and associated fish trapping in CY2 or more than 5860 are captured each year during CY3 and CY4, or more than 692 steelhead are killed in CY2, 752 steelhead are killed in CY3 and CY4 (52 from during trapping operations during flow diversion, 640 from reservoir drawdowns, and 60 that enter the flow diversion pipe).

B. Effect of the Take

In the accompanying biological opinion, NMFS has determined that the anticipated take is not likely to result in jeopardy to the species.

C. Reasonable and Prudent Measures

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

1. Undertake measures to ensure that harm and mortality to steelhead resulting from fish capture, relocation and dewatering activities are low.

2. Ensure BMPs are implemented in a manner that avoids injury or harm to steelhead from degradation of aquatic habitat and stream water quality.

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

D. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Corps, its permittees, and their designees 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. The following terms and conditions implement reasonable and prudent measure 1:

    a. The Corps and/or the permittees must 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 must 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, must 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 must monitor the construction site during placement and removal of cofferdams, construction of flow diversion systems, dewatering the affected river reaches and reservoir, fish rescue and relocation actions, and during removal of fish exclusion devices to ensure that any adverse effects to steelhead are minimized. The biologists must be on site during all dewatering events to capture, handle, and safely relocate steelhead.

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

d. If any steelhead are found dead or injured, the biologist must contact NMFS biologist Jacqueline Meyer by phone immediately at (707) 575-6057 or the NMFS North Central Coast 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 steelhead mortalities must 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 must 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 North Central Coast Office without obtaining prior written approval from the NMFS North Central Coast Office, Supervisor of the Protected Resources Division. Any such transfer will be subject to such conditions as NMFS deems appropriate.

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

a. The Corps and permittees must allow any NMFS employee(s) or any other person(s) designated by NMFS, to accompany field personnel to visit the project sites during activities described in this opinion to ensure proper implementation of BMPs and other project minimization measures.

b. 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 to protect water quality in the river during construction.

c. Construction equipment used within the creek channel must 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 must contain the spill and remove the affected soils.

d. All pumps used to divert steelhead-bearing water (except for the diversion system around the reservoir), outside the dewatered work area, must 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.

e. Once construction is completed each year, all temporary, construction related, project- introduced material into the riverbed (cofferdams, *etc.*) must be removed by November 1.

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

a. The Corps and permittee must provide written reports to NMFS by the dates determined in the final monitoring and reporting plans for the project. The reports must be provided to NMFS' North Central Coast Office, Attention: Jacqueline Meyer, 777 Sonoma Avenue, Room 325, Santa Rosa, California, 95404-6528. The report must contain, at a minimum, the following information:

i. **Construction related activities --** The reports must include the dates construction began and was completed; a discussion of any unanticipated effects or unanticipated levels of effects on steelhead, 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 steelhead 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 must 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.

XI. REINITIATION NOTICE

This concludes formal consultation for the Carmel River Reroute and San Clemente Dam Removal Project. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental 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; (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the amount or extent of incidental take is exceeded, formal consultation must be reinitiated immediately.

XII. 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 listed species or critical habitat, or to develop information.

1. To better understand the response of a river system post-dam removal, the Corps should sponsor the development and implementation of research projects to document the long-term changes to river dynamics over time. Studies (not all inclusive) should include:

- Habitat rebound periods – *i.e.*, time it takes to become a mature, functional riparian canopy
- Fish passage efficiency of restored reaches
- Sediment Transport
- Species assemblages, diversity and abundance as well as recruitment and colonization of new habitat

XIII. LITERATURE CITED

Abadia-Cardoso, A., Clemento, A. J. and Garza, J. C. (2011), Discovery and characterization of single-nucleotide polymorphisms in steelhead/rainbow trout, *Oncorhynchus mykiss*. Molecular Ecology Resources, 11: 31–49. doi: 10.1111/j.1755-0998.2010.02971.x. Southwest Fisheries Science Center, National Marine Fisheries Service, 110 Shaffer Road, Santa Cruz, CA 95060, USA

Alley, D.W. 2004. Report of construction monitoring leading to isolation of construction sites and fish capture/relocation on San Francisquito Creek at the Sand Hill Road Bridge and golf cart crossing in the Stanford Golf Course, 4 June-2 September 2004. Report to NMFS. October 2004.

Araki, H. B. Cooper, and M. S. Blouin. 2009. Carry-over effects of captive breeding reduce reproductive fitness of wild-born descendants in the wild. Biology Letters, Conservation Biology. 10 June 2009.

Barnhart, R.A. 1986. Species Profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest), steelhead. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.60), 21 p.

Baxter, R.M. 1977. Environmental effects of dams and impoundments. Annual Review of Ecology and Systematics 8:255-283.

Bednarek, A.T. 2001. Undamming Rivers: A Review of the Ecological Impacts of Dam Removal. Environmental Management Vol. 27 (6): 803-814.

Beamish, R.J., and D.R. Bouillion. 1993. Pacific salmon production trends in relation to climate. Canadian Journal of Fisheries and Aquatic Sciences 50:1002-1016.

Beamish, R.J., C.M. Neville, and A.J. Cass. 1997. Production of Fraser River Sockeye salmon (*O. nerka*) in relation to decadel-scale changes in the climate and the ocean. Canadian

Journal of Fisheries and Aquatic Sciences 54:543-554.

Becker, G.S., and I.J. Reining. 2008. Steelhead/rainbow trout (*O. Mykiss*) resources south of the Golden Gate, California. Cartography by D.A. Ashbury. Center for Ecosystem Management and Restoration, Oakland, California.

Berg, L. 1982. The effect of exposure to short-term pulses of suspended sediment on the behavior in juvenile salmonids. Pages 177-196 *in* Hartman, G.F. 1982. Proceedings of Carnation Creek Workshop: a ten year review. Canadian Department of Fisheries and Oceans, Nanaimo, British Columbia.

Berg, L. and T.G. Northcote. 1985. Changes in territorial, gill-flaring, and feeding behavior in juvenile coho salmon (*Oncorhynchus kisutch*) following short-term pulses of suspended sediment. Can. J. Fish. Aquat. Sci. 42:1410-1417.

Bergen, T.J. and M.J. Filardo. 1993. An analysis of variable influencing the migration of juvenile salmonids in the Columbia River basin. North American Journal of Fisheries Management. 13:48-63.

Bilby, R.E. Fransen., B.R., and P.A. Bisson. 1996. Incorporation of nitrogen and carbon from spawning coho salmon into the trophic system of small streams: evidence from stable isotopes. Canadian Journal of Fisheries and Aquatic Sciences 53:164-173.

Bilby, R.E. Fransen., B.R., and P.A. Bisson. 1998. Response of juvenile coho salmon (*O. kisutch*) and steelhead (*O. mykiss*) to the addition of salmon carcasses to two streams in southwestern Washington, USA. Canadian Journal of Fisheries and Aquatic Sciences 55:1909-1918.

Bisson, P.A. and R.E. Bilby. 1982. Avoidance of suspended sediment by juvenile coho salmon. N. Am. J. Fish. Man. 4:371-374.

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

Bond, M.H. 2006. Importance of estuarine rearing to central California steelhead (*O. mykiss*) growth and marine survival. M.A. Thesis, University of California Santa Cruz.

Boughton, *et al.* 2006. Steelhead of the South-Central/Southern California Coast: Population Characterization for Recovery Planning NOAA-TM-NMFS-SWFSC-394.

Boughton, *et al*. 2007. Viability Criteria for Steelhead of the South-Central and Southern California Coast. NOAA-TM-NMFS-SWFSC-407.

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

Buchanan, D. V., Sanders, J. E., Zinn, J. L., and Fryer, J. L. 1983. Relative susceptibility of four strains of summer steelhead to infection by *Ceratomyxa shasta*. Trans. Amer. Fish. Soc. 112:5410543.

Busby, P.J., T.C. Wainwright, G.J. Bryant, L. Lierheimer, R.S. Waples, F.W. Waknitz and I.V. Lagomarsino. 1996. Status review of west coast steelhead from Washington, Idaho, Oregon and California. U.S. Dept. of Commerce., NOAA Tech. Memo. NMFS-NWFSC-27. 261 p.

California Department of Fish and Game (CDFG) 1965. California Fish and Wildlife Plan, Volume I: Summary. 110 p.; Volume II: Fish and Wildlife Plans, 216 p.; Volume III: Supporting Data, 1802 p.

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

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

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

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

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

California Department of Fish and Game. (CDFG). 2010a. *California Salmonid Stream Habitat Restoration Manual*: Volume Two, Fourth Edition. Prepared by: Gary Flosi, Ross N. Taylor, Michael Love, Bill Weaver, Danny Hagans, Eileen Weppner, And Kozmo Bates.

California Department of Fish and Game. (CDFG). 2010b. Freshwater Sportfishing Regulations. California Department of Fish and Game, Sacramento, CA.

California Department of Fish and Game (CDFG). 2010c. Annual report to the National Marine Fisheries Service for Fisheries Restoration Grant Program Projects conducted under Department of Army Regional General Permit No. 12 (Corps File No. 27922N) within the U.S. Army Corps of Engineers, San Francisco District, January 1, 2009 through December 31, 2009. Northern Region, Fortuna Office. March 1.

Carmel River Watershed Conservancy. 2004. Carmel River Watershed Assessment and Action Plan. Available online at www.carmelriverwatershed.org/WA/5_4_1text.pdf

Castelle, A.J., A.W. Johnson, and C. Conolly. 1994. Wetland and stream buffer size requirements-a review. J. Env. Qual. 23:878-882.

Cedarholm, C.J. and L.M. Reid. 1987. Impact of forest management on coho salmon (*Oncorhynchus kisutch*) population of the Clearwater River, Washington: a project summary. Pages 373-398 *in* Salo and Cundy. 1987. Streamside management: forestry and fishery interactions. University of Washington Institute of Forest Resources Contribution 57.

Chapman, D.W., and T.C. Bjornn. 1969. Distribution of salmonids in streams, with special reference to food and feeding, p. 153-176. *In*: T.G. Northcote (ed.). Symposium on Salmon and Trout in Streams. H.R. Macmillan Lectures in Fisheries. Institute of Fisheries, University of British Columbia, Vancouver, BC. 388 p.

Cleary, R.E. 1956. Observations of factors affecting smallmouth bass production in Iowa. J. Wildl. Man. 20:353-359.

Clemento, A. J. *et al.* 2009. Population Genetic Structure and Ancestry of *Oncorhynchus mykiss Populations* Above and Below Dams in South-Central California. *Conservation Genetics* 10:1321-1336.

Collier, M., R.H., Webb, and J.C. Schmidt. 1996. Dams and Rivers: A Primer on the Downstream Effects of Dams. U.S. Geological Survey, Tucson, Arizona, Circular 1126, 94 pp.

Collins, B.W. 2004. Report to the National Marine Fisheries Service for instream fish relocation activities associated with fisheries habitat restoration program projects conducted under Department of the Army (Permit No. 22323N) within the United States Army Corps of Engineers, San Francisco District, during 2002 and 2003. California Department of Fish and Game, Northern California and North Coast Region. March 24, 2004. Fortuna, California

Cressey, S. 2009. Fish relocation results report, 222 Bridge Road, Hillsborough, California. September 19, 2009 letter to Charles Lebo. 44 pages.

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

Davies, K.F., Gascon, C., and C.R. Margules. 2001. Habitat fragmentation, consequences, management, and future research priorities. Pages 81-98 in Soule M.E. and G.H. Orians (Editors). Conservation Biology: Research Priorities for the Next Decade. Island Press, Washington D.C.

Dettman, D.H. and D.M. Kelley. 1986. Assessment of the Carmel River Steelhead Resource, Vol. 1. Biological Investigations. Final. September 1986. Prepared for the Monterey Peninsula Water Management District.

Dettman, D. 1990. Technical Memorandum 90-01 *Spawning Habitat Mitigation Plans for Alternative Water Supply Projects in the Carmel River Basin*. Prepared for the Monterey Peninsula Water District.

Duda, J.J., J.E., Frelich, and E.G. Schreiner. 2008. Baseline studies in the Elwha River ecosystem prior to dam removal: introduction to the special issue: Northwest Science 82(Special Issue):1-12.

Duffy, D. 1998. Draft Environmental Impact Report for the Seismic Retrofit of the San Clemente Dam. Prepared for the California Department of Water Resources. Denise Duffy &Associates. 947 Cass Street, Suite 5, Monterey, California 93940.

Department of Water Resources (DWR) and USACE (U.S. Army Corps of Engineers). 2006. Draft EIR/EIS for the San Clemente Dam Seismic Safety Project.

Department of Water Resources (DWR) and USACE (U.S. Army Corps of Engineers). 2008. Final EIR/EIS for the San Clemente Dam Seismic Safety Project.

———. Division of Safety Dams. 2011.San Clemente Dam Seismic Safety Project. Exhibit D. Mitigation Monitoring and Reporting Program (MMRP). March.

Entrix, Inc. 2000. Final Biological Assessment for the Seismic Retrofit of San Clemente Dam. Prepared for the US Army Corps, San Francisco District, On Behalf of California-American Water Service Company. January 7, 2000.

Entrix, Inc. 2010. San Clemente Dam Drawdown Project. May – July 2009. Final Report January 2010. Project Number: 3018611. Prepared by ENTRIX, Inc. on behalf of the U.S. Army Corps of Engineers San Francisco, CA for California American Water.

Entrix, Inc. 2011. Biological Assessment: South-Central California Coast Steelhead for the San Clemente Dam Drawdown Project 2012–2016

Environmental Protection Agency (EPA). 1986. Quality Criteria for Water 1986. EPA 440/5-86-001, Washington D.C.

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

Feist, M.L. Blake E., James J. Anderson and Robert Miyamoto. 1992. Potential impacts of pile driving on juvenile pink (*Oncorhynchus gorbuscha*) and chum (*O. kept*) salmon behavior and distribution. FRI-UW-9603. Fisheries Resources Institute, University of Washington. Seattle.

Fewtrell J.L. 2003. The response of Finfish and Invertebrates to Seismic Survey Noise. Thesis submitted for degree of Doctor of Philosophy. Curtin University of Technology. Australia. October 2003.

Franklin, H. 2005. Steelhead and salmon migrations in the Salinas River. Unpublished report of historical observations in the Upper Salinas Watershed, Paso Robles, California.

Garrison, R.L., Isaac, D.L., Lewis, M.A., and W.M. Murray. 1994. Annual Coded Wire Program Oregon Missing Production Groups. Annual Report 1994. Prepared for U.S. Department of Energy, Bonneville Power Administration, Environment, Fish and Wildlife, Portland, Oregon. Project No. 89-069, Contract No. DE_B179-89BP01610. Oregon Department of Fish and Wildlife. December 1994.

Garza, J. C. and A. Clemento. 2007. Population Genetic Structure of Oncorhynchus *mykiss* in the Santa Ynez River, California. Final Report for Project Partially Funded by the Cachuma Conservation Release Board.

Graf, W.L. 1999. Dam nation: a geographic census of American Dams and their large-scale hydrologic impacts. Water Resources Research. 35:1305-1311.

Gregory, S.V., F. J. Swanson, W.A. McKee, and K.W. Cummins. 1991. An ecosystem perspective of riparian zones. BioScience 41:540-551.

Gregory, R.S., and T.G. Northcote. 1993. Surface, planktonic, and benthic foraging by juvenile chinook salmon (*Oncorhynchus tshawytscha*) in turbid laboratory conditions. Can. J. Fish. Aq. Sci. 50:233-240.

Girman, D. and J. C. Garza. 2006. Population Structure and Ancestry of O. mykiss populations in South-Central California Based on Genetic Analysis of Microsatellite Data. Final Report for California Department of Fish and Game Project No. P0350021 and Pacific State Marine Fisheries Contract No. AWIP-S-1.

Good, T.P., R.S. Waples, and P. Adams (editors). 2005. Updated status of federally listed ESUs of West Coast salmon and steelhead. United States Department of Commerce, NOAA Technical Memorandum. NMFS-NWFSC-66, 598 p.

Gresh, T.J. Lichatowich and P. Schoonmaker. 2000. An estimation of historic and current levels of salmon production in the northeast pacific ecosystem. Fisheries 15(1):15-21.

Hall, J.D. and R.L. Lantz. 1969. Effects of logging on the habitat of coho salmon and cutthroat trout in coastal streams. Pages 355 to 376 *in*: Northcote (ed.). Symposium on salmon and trout in streams, Institute of Fisheries, Univ. of British Columbia, Vancouver.

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

Hayes, D.B., C.P. Ferreri, and W.W. Taylor. 1996. Active fish capture methods. Pages 193-220 *in* B.R. Murphy and D.W. Willis, editors. Fisheries Techniques, 2nd edition. American Fisheries Society. Bethesda, Maryland. 732 pages.

Herbert, D. W.M., and J.C. Merkens. 1961. The effect of suspended mineral solids on the survival of trout. Int. J. Air Water Poll. 5:46-55.

Hubert, W.A. 1996. Passive capture techniques. Pages 157-192 *in* B.R. Murphy and D.W. Willis, editors. Fisheries Techniques. Second Edition. American Fisheries Society. Bethesda, Maryland. 732 pages.

Jensen, P.T. and P.G. Swartzell. 1967. California salmon landings 1952-1965. California Department of Fish and Game (CDFG), Fish Bulletin 135:1-57.

Jones & Stokes Associates, Inc. 1998. Draft Supplemental Environmental Impact Report for the Carmel River Dam and Reservoir Project. November 13, 1998. Prepared for Monterey Peninsula Water Management District.

Karr, J. R. and I. J. Schlosser. 1978. Water resources and the land-water interface. Science 201:229-234.

Keeley, E.R. 2003. An experimental analysis of self-thinning in juvenile steelhead trout. Oikos 102:543-550.

Kelley, D.W. Dettman, D.H. , and Reuter J.E. 1987. Preservation of the Carmel River steelhead run with passage facilities over San Clemente Dam or with hatchery near its base. Report for the Monterey Peninsula Water Management District, Monterey, California.

King, Thomas J. 2010. Ten Year Summary of the Monterey Peninsula Water Management Program on the Carmel River. Prepared for the Monterey Peninsula Water Management District, November 2010.

Kloehn, K.K., T.J. Beechie, S.A., Morley, H.J., Coe, and J.J. Duda. 2008. Influence of dams on river-floodplain dynamics in the Elwha River, Washington. Northwest Science Special Issue 82:224-235.

Kondolf, G.M. 1997. Hungry Water: Effects of Dams and Gravel Mining on River Channels. *Environmental Management* 21(4): 533-551.

Ligon, F.K., W.E. Dietrich, and W.J. Trush. 1995. Downstream Ecological Effects of Dams. *Bioscience* 45(3):183-192.

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

Lindley, S. T., C. B. Grimes, M. S. Mohr, W. Peterson, J. Stein, J. T. Anderson, L.W. Botsford, D. L. Bottom, C. A. Busack, T. K. Collier, J. Ferguson, J. C. Garza, A. M. Grover, D. G. Hankin, R. G. Kope, P. W. Lawson, A. Low, R. B. MacFarlane, K. Moore, M. Palmer-Zwahlen, F. B. Schwing, J. Smith, C. Tracy, R. Webb, B. K. Wells, and T. H. Williams. 2009. What caused the Sacramento River fall Chinook stock collapse? Pre-publication report to the Pacific Fishery Management Council. March 18, 2009, 57 pp.

Lloyd, D.S. 1987. Turbidity as a water quality standard for salmonid habitats in Alaska. N. Am. J. Fish. Man. 7:34-45.

Lowrance, R., R. Leonard, and J. Sheridan. 1985. Managing riparian ecosystems to control nonpoint pollution. J. Soil Water Cons. 40:87-91.

Lowrance, R., and twelve co-authors. 1995. Water quality functions of riparian forest buffer systems in the Chesapeake Bay Watershed. U.S. Environmental Protection Agency, EPA 903-R-95-004.

Luers, A.L., Cayan, D.R., and G. Franco. 2006. Our Changing Climate, Assessing the Risks to California. A summary report from the California Climate Change Center. 16 pages.

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

McLeay, D.J., A. J. Knox, J.G. Malick, I.K. Birtwell, G. Hartman, and G.L. Ennis. 1983. Effects on Arctic grayling (*Thymallus arcticus*) of short-term exposure to Yukon placer mining sediments: laboratory and field studies. Can. Tech. Rep. Fish. Aq. Sci. 1171.

McLeay, D.J., G.L. Ennis, I.K. Birtwell, and G.F. Hartman. 1984. Effects on Arctic grayling (*Thymallus arcticus*) of prolonged exposure to Yukon placer mining sediment. Can. J. Fish. Aq. Sci. 1241.

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

Michaud, J. 2006. Letter dated October 23, 2006 from J. Michaud to Gary Stern, NMFS re: Town of Ross sediment removal project, Corte Madera Creek, Marin County.

Monterey Peninsula Water Management District (MPWMD). 1999. 1998-1999 Annual Reports for the MPWMD Mitigation Program. 101 p.

Monterey Peninsula Water Management District (MPWMD). 1999. Unpublished Data. Downstream migrant trapping below Los Padres Reservoir. Results for 1999.

Monterey Peninsula Water Management District (MPWMD). 2003. 2001-2002 Annual Report for MPWMD Mitigation Program.

Monterey Peninsula Water Management District (MPWMD). 2004. Environmental and Biological Assessment of the Carmel River Watershed Monterey County, California. Executive Summary. Prepared for the Carmel River Watershed Conservancy.

Moyle, Peter B. 2002. *Inland Fishes of California*. University of California Press, Berkeley, California. pp. 245-251.

Myrick, C. and J. Cech. 1998. Temperature effects on Chinook salmon and steelhead: a review focusing on California's Central Valley Populations. Bay-Delta Modeling Forum Technical Publication 01-1.

Nehlsen, W., J.E. Williams, and J.A. Lichatowich. 1991. Pacific salmon at the crossroads: stocks at risk from California, Oregon, Idaho, and Washington. Fisheries 16:4-21.

Newcomb, T.W. and T.A. Flagg. 1983. Some effects of Mt. St. Helens volcanic ash on juvenile salmon smolts. Mar. Fish. Rev. 45:8-12.

National Marine Fisheries Service (NMFS). 1997. Southwest Region Fish Screening Criteria for Anadromous Salmonids.

National Marine Fisheries Service (NMFS). 2006a. Steelhead of the south-central/southern California coast: population characterization for recovery planning. NOAA Tech Memo.: NOAA-TM-NMFS-SWFSC-394.

National Marine Fisheries Service (NMFS) 2006b. Potential steelhead over-summering habitat in the South-Central/Southern California Coast Recovery Domain: maps based on the envelope method. NOAA Tech. Memo.: NOAA-TM-NMFS-SWFSC-391.

National Marine Fisheries Service, Southwest Region (NMFS). 2007a. Biological Opinion for Proposed California-American Water Company Drawdown of San Clemente Reservoir on the Carmel River, Monterey, California. May 23, 2007.

National Marine Fisheries Service (NMFS). 2007b. Federal Recovery Outline for the Distinct Population Segment of South-Central California Coast Steelhead. National Marine Fisheries Service, Southwest Regional Office, Long Beach, California. September 2007.

National Marine Fisheries Service (NMFS). 2011. Draft Southern California Steelhead Recovery Plan. NOAA Fisheries, Southwest Region.

Nedwell. J.R., Edwards, B., Turnpenny, A.W.H., and J. Gordon. 2004. Fish and Marine Mammal Audiograms: A Summary of Available Information. Subacoustech Report ref: 534R0214. September 2004. 281pp.

Oreskes, N. 2004. The Scientific Consensus on Climate Change. Science. Volume 306:1686. December 3.

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

Pess, G.R., M.L., McHenry, T.J. Beechie, and J. Davies. 2008. Biological impacts of the Elwha River Dams and potential salmonid responses to dam removal. Northwest Science Special Issue 82:72-90.

Petts, G.E. 1984. Impounded Rivers: Perspectives for Ecological Management. John Wiley and Sons. Chichester, England, 322 pp.

Platts, W. S. 1991. Livestock grazing. Pages 389-423 *in*: W. R. Meehan (ed.). Influences of Forest and Rangeland Management on Salmonid Fishes and their Habitats. Am. Fish. Soc. Spec. Pub. 19.

Redding, J.M., C.B. Schreck, and F.H. Everest. 1987. Physiological effects on coho salmon and steelhead of exposure to suspended solids. Trans. Am. Fish. Soc. 116:737-744.

Reynolds, J.B., R.C. Simmons, and A.R. Burkholder. 1989. Effects of placer mining discharge on health and food of Arctic grayling. Water Res. Bull. 25:625-635.

Rich, A. 2005. Letter dated November 8, 2005 from A.A. Rich to Gary Stern, NMFS re: Fish relocation in Corte Madera Creek for the Town of Ross from September 29.

Shapavalov, L., A.C. Taft. 1954. The Life Histories of Steelhead Rainbow Trout (*Salmo gairdneri gairdneri*) and Silver Salmon (*Onchorynchus kisutch*). State of California, Dept. of Fish & Game. Fish Bulletin No. 98.

Scavia, D. 2002. From Toxic Algae To Climate Variability And Change: Impacts In The Coastal Zone. Proceedings of the 26th International Seminars on Planetary Emergencies. World Federation of Scientists. Erice, Italy.

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

Shirvell, C.S. 1990. Role of instream rootwads as juvenile coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*O. mykiss*) cover habitat under varying stream flows. Canadian Journal of Fisheries and Aquatic Sciences 47:852-860.

Shuman, J.R. 1995. Environmental Considerations for Assessing Dam Removal Alternatives for River Restoration. *Regulated* Rivers: Research and Management 11:249-261.

Sigler, J.W. 1988. Effects of chronic turbidity on anadromous salmonids: Recent studies and assessment techniques perspective. Pages 26-37 *In*: Effects of dredging on anadromous pacific coast fishes. Workshop proceedings, Seattle, September 8-9, 1988. Report by Washington Sea Grant Program. Washington University, Seattle, Washington.

Smith, J.J. 1990. The effects of sandbar formation and inflows on aquatic habitat and fish utilization in Pescadero, San Gregorio, Waddell and Pomponio Creek Estuary/Lagoon systems, 1985-1989. Report prepared under Interagency Agreement 84-04-324, between Trustees for California State University and the California Department of Parks and Recreation. Department of Biological Sciences, San Jose State University, San Jose, California

Smith, D., Newman, W., Watson, F., and J. Hameister. 2004. Physical and Hydrologic Assessment of the Carmel River Watershed California. The Watershed Institute. California State University Monterey, Seaside, California.

Titus, R.G., Erman, D.C., and W.M. Snider. 2009. History and status of steelhead in California coastal drainages south of San Francisco Bay. Draft Manuscript. California Department of Fish and Game. California.

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

URS and Interfluve 2011a. *Carmel River Reroute and Dam Removal Project, Draft Task 3: Concept Refinement Memorandum*. Prepared for the State Coastal Conservancy and California American Water. March.

———. 2011b. Carmel River Reroute and Dam Removal Project, Draft Subtask 4.4: Channel and Fish Passage Assessment. Prepared for the State Coastal Conservancy and California American Water. August.

Velagic, E. 1995. Turbidity study: a literature review. Prepared for Delta planning branch, California Department of Water Resources by Centers for Water and Wildland Resources, University of California, Davis.

Wang, L., J. Lyons, P. Kanehl, and R. Gratti. 1997. Influences of watershed land use on habitat quality and biotic integrity in Wisconsin streams. Fisheries 6:6-12.

Ward, B.R., and P.A. Slaney. 1988. Life history and smolt-to-adult survival of Keogh River steelhead trout (*Salmo gairdneri*) and the relationship to smolt size. Canadian Journal of Fisheries and Aquatic Sciences 45:1110–1122.

Ward, J.V., and J.A. Stanford. 1995. Ecological Connectivity in Alluvial River Ecosystems and its Disruption by Flow Regulation. *Regulated Rivers: Research and Management* 11:105-119.

Waters, T.F. 1995. Sediment in streams: sources, biological effects, and control. Am. Fish. Soc. Mon. 7.

Welsch, D.J. 1991. Riparian forest buffers: functions and design for protection and enhancement of water resources. USDA Forest Service, NA-PR-07-91, Radnor, Pennsylvania

Wesche, T.A., C.M. Goertler, and C.B. Frye. 1987. Contributions of riparian vegetation to trout cover in small streams. N. Am. J. Fish. Man. 7:151-153.

Whitman, RP., T.P. Quinn and E.L. Brannon. 1982. Influence of suspended volcanic ash on homing behavior of adult chinook salmon. Trans. Am. Fish. Soc. 111:63-69.

Williams, T.H. S.T. Lindley, B.C. Spence, and D. A. Boughton. 2011. Status Review Update for Pacific Salmon and Steelhead Listed Under the Endangered Species Act: Southwest 17 May 2011 – Update to 5 January 2011 report. National Marine Fisheries Service Southwest Fisheries Science Center. Santa Cruz. CA.

Winston, M.R., C.M. Taylor, and J. Pigg. 1991. Upstream Extirpation of Four Minnow Species due to Damming of a Prairie Stream. *Transactions of the American Fisheries Society* 120:98-105.

World Commission on Dams (WCD). 2000. Dams and development: a new framework for decision-making, Earthscan Publications, London UK.

Turnpenny, A.W.H., Thatcher, K.P., and J.R. Nedwell 1994. The Effects to Fish and Other Marine Animals from High-Level Underwater Sound. Fawley Aquatic Research Laboratories, Ltd. Research Report. October 1994. 79 pp.

United Nations Framework Convention on Climate Change (UNFCC). 2006. Handbook. Bonn, Germany: Climate Change Secretariat. Produced by Intergovernmental and Legal Affairs, Climate Change Secretariat Contributing editors: Daniel Blobel and Nils Meyer-

Ohlendorf of Ecologic – Institute for International and European Environmental Policy, Berlin, and Carmen Schlosser-Allera and Penny Steel. ISBN: 92-9219-031-8. 220 pp.

Yeager, B.L. 1994. Impacts of Reservoirs on the Aquatic Environment of Regulated Rivers. Tennessee Valley Authority, Water Resources, Aquatic Biology Department, TVA/WR/AB-93/1, Norris, Tennessee.

A. Federal Register Notices Cited

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

75 FR 13082. National Marine Fisheries Service. Endangered and Threatened Species; 5-Year Reviews for 5 Evolutionarily Significant Units of Pacific Salmon and 1 Distinct Population Segment of Steelhead in California 76: 50447-50448. August 15, 2011

71 FR 5248. National Marine Fisheries Service. Final rule: Listing Determinations for 10 Distinct Population Segments of West Coast Steelhead. Federal Register 71:834-862. January 5, 2006.

70 FR 52488. National Marine Fisheries Service. Final rule: Designation of Critical Habitat for Seven Evolutionarily Significant Units of Pacific Salmon and Steelhead in California. Federal Register 70: 52488-52586. September 2, 2005.

62 FR 43937: National Marine Fisheries Service. Final Rule: Listing of Several Evolutionary Significant Units of West Coast Steelhead. Federal Register, Volume 62 pages 43937-43954. August 18, 1997.

61 FR 56138. National Marine Fisheries Service. Final Rule: Threatened Status for Central California Coho Salmon Evolutionarily Significant Unit (ESU). Federal Register 61:56138-56149. October 31, 1996.

B. Personal Communications

Ambrose, John. August 2011. NMFS. Personal communications with Jacqueline Meyer, NMFS.

Urquhart, K. 2011. MPWMD. Personal communications with Jacqueline Meyer, NMFS.

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

ACTION AGENCY: United States Army Corps of Engineers, South Pacific Division, San Francisco District (USACE)

ACTION: Carmel River Reroute and San Clemente Dam Removal Project

CONDUCTED BY: National Marine Fisheries Service, Southwest Region

TRACKING NUMBER: 2012/02129

DATE ISSUED: **July 23, 2012**

Statutory and Regulatory Information

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996, establishes a national program to manage and conserve the fisheries of the United States through the development of federal Fishery Management Plans (FMPs), and federal regulation of domestic fisheries under those FMPs, within the 200-mile U.S. Exclusive Economic Zone ("EEZ"). 16 U.S.C. §1801 *et seq*. To ensure habitat considerations receive increased attention for the conservation and management of fishery resources, the amended MSA required each existing, and any new, FMP to "describe and identify essential fish habitat for the fishery based on the guidelines established by the Secretary under section 1855(b)(1)(A) of this title, minimize to the extent practicable adverse effects on such habitat caused by fishing, and identify other actions to encourage the conservation and enhancement of such habitat." 16 U.S.C. §1853(a)(7). Essential Fish Habitat (EFH) is defined in the MSA as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" 16 U.S.C. §1802(10). The components of this definition are interpreted at 50 C.F.R. §600.10 as follows: "Waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle.

Pursuant to the MSA, each federal agency is mandated to consult with NMFS (as delegated by the Secretary of Commerce) with respect to any action authorized, funded, or undertaken, or proposed to be, by such agency that may adversely affect any EFH under this Act. 16 U.S.C. §1855(b)(2). The MSA further mandates that where NMFS receives information from a Fishery Management Council or federal or state agency or determines from other sources that an action authorized, funded, or undertaken, or proposed to be, by any federal or state agency would adversely affect any EFH identified under this Act, NMFS has an obligation to recommend to such agency measures that can be taken by such agency to conserve EFH. 16 U.S.C. §1855(4)(A). The term "adverse effect" is interpreted at 50 C.F.R. §600.810(a) as any impact that reduces quality and/or quantity of EFH and may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce quantity and/or quality of EFH. In addition, adverse effects to EFH may result from actions occurring within EFH or outside EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

If NMFS determines that an action would adversely affect EFH and subsequently recommends measures to conserve such habitat, the MSA proscribes that the Federal action agency that receives the conservation recommendation must provide a detailed response in writing to NMFS within 30 days after receiving EFH conservation recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with NMFS EFH conservation recommendations, the Federal agency must explain its reasons for not following the recommendations. 16 U.S.C. §1855(b)(4)(B).

Proposed Action

The California American Water (CAW) proposes to remove the San Clemente Dam (SCD) and restore riparian habitat and unobstructed fish passage at the confluence of the Carmel River and San Clemente Creek within unincorporated areas of Monterey County, California. Work within Corps jurisdiction would include demolishing SCD and Old Carmel River Dams (OCRD), rerouting Carmel River to San Clemente Creek by excavating through an adjacent ridge, disposing of debris and reservoir sediments in the reach of the Carmel River to be abandoned, restoring channel geomorphology based on steelhead passage criteria, and revegetating the riparian corridor and sediment disposal area. Work would require placement of approximately 230,150 cubic yards of sediment, 80,900 cubic yards of boulders/rocks, and 4,303 cubic yards of concrete/metal/demolition debris into jurisdictional waters of the United States. The USACE intends to permit these activities under section 404 of the Clean Water Act of 1973 (33 U.S.C. Section 1344).

Action Area

The action area includes the Carmel River and San Clemente Creek upstream of SCD extending to Los Padres Dam at RM 24.8, and extends 18.6 miles downstream of SCD to the Pacific Ocean, including the Carmel River Lagoon. The Carmel River Lagoon is located within an area identified as EFH for various life stages of fish species managed with the Coastal Pelagic and Pacific Groundfish FMPs. In addition, the project occurs within an area designated as coastal estuary Habitat Areas of Particular Concern (HAPC) for various federally managed fish species within the Pacific Groundfish FMP. HAPC are described in the regulations as subsets of EFH that are rare, particularly susceptible to human-induced degradation, especially ecologically important, or located in an environmentally stressed area. Designated HAPC are not afforded any additional regulatory protection under MSA; however, federal projects with potential adverse impacts to HAPC are more carefully scrutinized during the consultation process.

The wetted area and depth of the lagoon basin varies considerably, depending on river inflow, tidal stage, water table, and closure of the sand bar (CCoWS 2007). The lagoon is a partially managed system, which may be artificially breached in the fall to prevent flooding of nearby areas. The sandbar generally opens by mid-December and closes around May or June when average daily flows fall below 20 cubic feet per second. The lagoon is also managed as wildlife habitat by the California Department of Parks and Recreation. Several habitat enhancement and monitoring projects have occurred in recent years to increase the amount and value of habitat within the lagoon (CCoWS 2007).

Sediment input to the Carmel River and Lagoon is a function of the hydraulic conditions in the river and the flow, channel slope and cross-section, and sediment size influenced by watershed activities or events that generate sediment loads. The existing dams on the main stem have blocked the transport of gravel, cobble and boulder substrates since 1921 at SCD. Only the suspended load of silt and fine sand is transported over the spillway to downstream reaches.

Effects of the Action

Based on information provided in the EFH assessment and developed during consultation, NMFS concludes that proposed action would adversely affect EFH within the Carmel River Lagoon for various federally managed species within the Pacific Groundfish and Coastal Pelagic FMPs through (1) temporary increases in turbidity and (2) a greater input of sediment.

Turbidity

Short term increases in turbidity would occur within the river during construction, including dewatering and excavation activities. If suspended sediment loads remain high for an extended period of time, fish may suffer increased larval mortality (Wilber & Clarke 2001), reduced feeding ability (Benfield & Minello 1996) and be prone to fish gill injury (Nightingale & Simenstad 2001a). Additionally, the contents of the suspended material may react with the dissolved oxygen in the water and result in short-term oxygen depletion to aquatic resources (Nightingale & Simenstad 2001).

The Biological Assessment for the proposed project (URS 2011) describes a number of minimization measures that will be implemented to control turbidity (*see* section 8.2 Avoidance, Minimization and Monitoring during Construction). Minor and brief increases in turbidity may still occur within the river, for EFH these episodes may occur during the installation and removal of the dewatering systems, but will primarily occur post-construction, after the Dams are removed and sediment transport resumes. However, turbidity plumes that occur within the river likely would dissipate to some extent before reaching the lagoon, with level of dissipation depending on distance between point of origin and the lagoon.

Changes to Sediment Input

Removal of SCD and OCRD will restore natural sediment movement within the river, resulting in an increased volume of sediments, primarily sands, reaching the lagoon. This may result in some filling of the lagoon volume, but may also increase the crest elevation of the seasonal sand berm at the mouth, increasing the capacity of the lagoon basin and reducing the incidence of overtopping during heavy surf events. Increased capacity likely will balance any habitat loss due to filling from sand transport. And, despite increased capacity, flood control management actions likely will continue to be the driving factor for timing of lagoon breaching.

<u>EFH Conservation Recommendations</u>

As described in the above effects analysis, NMFS has determined that the proposed Carmel River Reroute and San Clemente Dam Removal Project would adversely affect EFH for various federally managed fish species within the Pacific Groundfish, Pacific Salmonid, and Coastal Pelagic FMPs through increased sediment transport and minor increases in turbidity to the lagoon. However, the proposed action contains adequate measures to avoid, minimize, mitigate, or otherwise offset the adverse effects to EFH. In addition, adverse effects to the lagoon from changes from sediment input likely will be balanced with beneficial effects. Therefore, NMFS has no additional EFH Conservation Recommendations to provide.

<u>Statutory Response Requirement</u>

Please be advised that regulations at section 305(b)(4)(B) of the MSA and 50 CFR 600.920(k) of the MSA require your office to provide a written response to this letter within 30 days of its receipt and at least 10 days prior to final approval of the action. A preliminary response is acceptable if final action cannot be completed within 30 days. Your final response must include a description of measures to be required to avoid, mitigate, or offset the adverse impacts of the activity. If your response is inconsistent with our EFH Conservation Recommendations, you must provide an explanation of the reasons for not implementing those recommendations. The reasons must include the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

<u>Supplemental Consultation</u>

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

Literature Cited

Benfield, M.C. & T.J. Minello. 1996. Relative effects of turbidity and light intensity on reactive distance and feeding of an estuarine fish. Environmental Biology of Fishes, 46: 211-216.

Central Coast Watershed Studies (CCoWS). 2007. *Carmel River Lagoon Enhancement Project: Water Quality and Aquatic Wildlife Monitoring, 2006*-7.

Nightingale, B., & C.A. Simenstad, Jr. 2001. Dredging activities: Marine issues. Seattle, WA 98105: Washing ton State Transportation Center, University of Seattle. (http://depts.washington.edu/trac/reports/reports.html)

URS Corporation. 2011. Carmel River Reroute & San Clemente Dam Removal Project Environmental Permitting Task 3.3, Biological Assessment Prepared for National Marine Fisheries Service. Prepared for: California State Coastal Conservancy and California American Water.

Wilber, D.H. & D.G. Clarke. 2001. Biological effects of suspended sediments: A review of suspended sediment impacts on fish and shellfish with relation to dredging activities in estuaries. North American Journal of Fisheries Management, 21: 855-875.