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

May 11, 2012

In response refer to:
2011/05478

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

Dear Colonel DiCiro:

Thank you for your letter of October 25, 2011, requesting initiation of 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 Santa Clara Valley Transit Authority's proposed Upper Penitencia Creek Improvement Project. The project is located along a portion of Upper Penitencia Creek approximately 1,400 feet upstream of its confluence with Coyote Creek within the City of San Jose, Santa Clara County, California (Corps File No. 26644S).

The enclosed biological opinion is based on our review of the Santa Clara Valley Transportation Authority's proposal to restore approximately 1,000 linear feet of channel in Upper Penitencia Creek and describes NMFS' analysis of potential effects on threatened Central California Coast (CCC) steelhead (*Oncorhynchus mykiss*) and designated critical habitat in accordance with section 7 of the ESA. Threatened CCC steelhead are present within the project's action area and Upper Penitencia Creek is designated critical habitat for this species. In the enclosed biological opinion, NMFS concludes the project is not likely to jeopardize the continued existence of threatened CCC steelhead, is not likely to adversely modify its critical habitat, and will likely result in instream habitat improvements beneficial to the conservation and recovery of the species. However, NMFS anticipates take of CCC steelhead during project construction. An incidental take statement which applies to this project with non-discretionary terms and conditions is included with the enclosed biological opinion.

Please contact Darren Howe at (707) 575-3152 or by email at Darren.Howe@noaa.gov if you have any questions concerning this section 7 consultation, or if you require additional information.

Sincerely,

for Rodney R. McInnis
Regional Administrator

Enclosure

cc: Chris Yates, NMFS, Long Beach, CA
Holly Costa, Corps Regulatory Division, San Francisco, CA
Ann Calnan, Santa Clara Valley Transportation Authority, San Jose, CA
Ryan Olah, USFWS, Sacramento, CA
Copy to file ARN #151422SWR2011SR00552

Enclosure

BIOLOGICAL OPINION

ACTION AGENCY: U.S. Army Corps of Engineers, San Francisco

ACTION: Instream and floodplain enhancement project on Upper Penitencia Creek, adjacent to Berryessa Road in San Jose, California

CONSULTATION CONDUCTED BY: National Marine Fisheries Service, Southwest Region

TRACKING NUMBER: 2011/05478

DATE ISSUED: **May 11, 2012**

I. CONSULTATION HISTORY

By conference call on July 19, 2011, NOAA's National Marine Fisheries Service (NMFS) began technical assistance on the Santa Clara Valley Transportation Authority's (VTA) proposed Upper Penitencia Creek Improvement Project.

By email message on September 14, 2011, with the U.S. Army Corps of Engineers' (Corps) approval, VTA transmitted the biological assessment for the project to NMFS.

By email message on September 22, 2011, VTA's consultant (ICF) transmitted the basis of design report to NMFS.

By letter dated October 25, 2011, the Corps requested informal consultation with NMFS pursuant to section 7 of the Federal Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531, *et seq*.), for the proposed Upper Penitencia Creek Improvement Project in San Jose, California (Corps File Number 26644S). The Corps' October 25, 2011, letter requested consultation to address potential effects on threatened Central California Coast (CCC) steelhead and Central Valley Valley/Late fall-run Chinook. Central Valley Valley/Late fall-run Chinook has been designated as Species of Concern by NMFS, but this designation does not apply the ESA consultation procedures to this species. Accordingly, fall-run Chinook salmon were not considered in this consultation and are not evaluated in this biological opinion. NMFS informed the Corps of the status of Chinook salmon and that this species would not be addressed in this consultation.

During subsequent coordination with the Corps in October 2011, NMFS and the Corps determined that the project had the potential to adversely affect CCC steelhead due to proposed dewatering of Upper Penitencia Creek for construction purposes. On October 25, 2011, NMFS initiated formal consultation with the Corps. By email dated October 31, 2011, the permit applicant, VTA, was notified by NMFS that NMFS and the Corps would be conducting formal consultation on the project.

By email message on November 2, 2011, NMFS requested design plans, noted NMFS' preference for post-project removal of the dewatering pipeline (the previously distributed biological assessment noted that the pipeline would be buried and abandoned in place following project completion), and requested clarification as to whether the project was proposed to be constructed in one year's worth of summer time work, or two.

By email message on November 2, 2011, VTA transmitted the draft mitigation and monitoring plan for the project, and California Department of Fish and Game (CDFG) streambed alteration agreement for the project, and noted that: 1) construction will be completed in one construction season, and 2) the diversion pipeline will be removed entirely at the completion of construction.

By email message on November 7, 2011, VTA transmitted planting plans and the draft post-project fisheries monitoring protocol to NMFS and the Corps. NMFS provided comments on this plan, and suggested that VTA consider, as an alternative, coordination with a steelhead Passive Integrated Transponder (PIT) tagging program proposed by the Santa Clara Valley Water District (SCVWD) within the watershed.

On November 9, 2011, NMFS staff attended a site visit with VTA to view the proposed project area. The Corps' project manager was invited to the site visit, but was unable to attend and recommended the site visit occur without Corps participation. Also on November 9, 2011, VTA's consultant (HNTB Corporation) transmitted the grading plans for the project to NMFS via email message.

By email and telephone communication in March and April 2012 between NMFS and VTA, VTA committed to performing post-project biological (fish) monitoring. VTA proposed implementation of one of the following two post-project fisheries monitoring programs: 1) participation in the SCVWD PIT tag program within the watershed via installation of PIT tag antenna (reader) stations within the project site, or 2) a combination of post-project electrofishing and seining within the project site. As the PIT tag program was not finalized for implementation within the watershed at the time of consultation, it was uncertain whether the participation in the PIT tag program, or a combination of electrofishing and seining would be implemented. Given VTA's commitment to perform fisheries monitoring, NMFS agreed to consider both methodologies in the biological opinion, with the condition that VTA would submit a post-project fisheries monitoring plan with sufficient time to allow for NMFS review and comment prior to implementation during the first year following construction completion (*i.e.*, prior to monitoring in 2013).

By email messages to NMFS and the Corps on April 19, 2011, VTA transmitted the revised Mitigation and Monitoring Plan, proposed Diversion and Dewatering Plan, and construction schedule. Revisions to the Mitigation and Monitoring Plan included Hydrologic and Geomorphic physical monitoring of the project site.

II. DESCRIPTION OF PROPOSED ACTION

The Corps proposes to issue a permit under Section 404 of the Clean Water Act (CWA) to VTA to construct an instream habitat and floodplain enhancement project within a reach of approximately 1,000 linear feet in Upper Penitencia Creek. The downstream end of the project reach begins approximately 1,400 linear feet upstream of Upper Penitencia Creek's confluence with Coyote Creek within the City of San Jose, Santa Clara County, California. To facilitate construction, approximately 1,300 feet of Upper Penitencia Creek will be dewatered at the project site. Instream construction is scheduled to occur between June 15 and October 15, and is expected to occur in 2012. Although work will be completed during the dry season, it is anticipated that some surface streamflow in Upper Penitencia Creek will be present. The project proposes to dewater the work site for construction purposes. Fish, including CCC steelhead, in the work area will be collected and relocated prior to dewatering the work site. NMFS does not anticipate any interrelated or interdependent actions associated with the proposed action.

The Upper Penitencia Creek Enhancement Project will enhance a highly degraded, artificially aligned portion of Upper Penitencia Creek to provide habitat for steelhead migration and refuge, and support floodplain features and wetlands. This will be achieved by incorporating instream habitat features within a widened channel and floodplain that will be stabilized with bioengineered bank treatments.

A. Description of Proposed Work

1. Project Design and Construction

The downstream limit of construction for the Upper Penitencia Creek Improvement Project is located at the downstream edge of the VTA railroad right of way at Berryessa Road, approximately 1,400 feet upstream of Upper Penitencia Creek's confluence with Coyote Creek. From the downstream edge of the VTA right of way, the limits of construction extend approximately 1,300 linear feet upstream. Within the project reach, Upper Penitencia Creek flows in a northwesterly direction, and then makes an approximately 90 degree bend to the southwest. The project reach is bordered to the north by Berryessa Road, to the east by commercial and residential uses, to the west by commercial uses and the VTA right of way, and to the south by additional commercial uses.

Primarily through grading and excavation, the proposed project will widen the floodplain, realign the low-flow channel, construct secondary channel, backwater, and seasonal wetland areas, and incorporate habitat features (riffles, pools, large woody debris) benefitting aquatic habitat conditions and conveyance of high stream flow events. Channel stability will be achieved with bioengineered bank treatments including native riparian plantings over buried geotextile, large woody debris, rock weirs, and a timber cribwall. Constructed stream banks are designed to support and maintain instream habitat features within a widened and stabilized floodplain. The project design incorporates a transition area between the restored channel reach and the existing grade at both the upstream and downstream ends. The restored floodplain design and channel meander will increase channel length from 920 feet to approximately 1,000 feet, and add one acre of seasonal wetlands within the floodplain.

To facilitate construction, approximately 1,300 feet of Upper Penitencia Creek will be temporarily dewatered at the project site. Prior to in-stream construction, cofferdams will be installed at the upstream and downstream limits of the project site, and will be used to divert the flow into a pipeline around the work area. Pipeline inlets will be cleaned daily. Cofferdams will be installed and removed by hand, and will be constructed with sandbags and gravel bags. The temporary pipeline will be removed upon project completion. In-stream construction will be restricted to the dry season, between June 15 and October 15. The duration of in-channel construction activities will not exceed 16 weeks.

Prior to dewatering, a fisheries biologist will collect and relocate fish from the work site. Fish will be collected primarily by electrofishing, but seines, dip nets, and traps may also be used, if appropriate. Collected fish will be relocated to a suitable location in Upper Penitencia Creek upstream or downstream of the work site.

Following construction, all water diversion structures will be removed and disturbed channel areas will be restored to natural grade and substrate condition. The site will be stabilized with erosion control materials and revegetated with native plants. Construction equipment will access the site from the adjacent bank and upland area. Areas temporarily impacted by construction activities will be restored to pre-project condition, or enhanced through planting of native vegetation and grading.

2. Post-Construction Monitoring

To facilitate evaluation of the project's efficacy in improving aquatic and riparian habitat conditions for native fish, the project will include vegetation monitoring, hydrologic and geomorphic (physical), and biological (fisheries) monitoring components.

a. Vegetation Monitoring

The vegetation monitoring program is described in the mitigation and monitoring plan prepared for the project, and includes a monitoring methodology, as well as reporting elements.

Monitoring will occur for 5 years following project completion to evaluate the project's efficacy in improving wetland and riparian habitat, and will assess:

1. plant survivorship - implementing survivorship criteria for each of the 5 monitoring years;

2. plant health and vigor - using identified ranking criteria; and

3. natural recruitment of native plant species.

Photographic documentation stations will be established and photos will be taken annually for inclusion in the annual report to document the efficacy of vegetation establishment.

b. Physical Monitoring

The physical monitoring program is described in the mitigation and monitoring plan prepared for the project, and contains hydrologic, and geomorphic monitoring, as well as reporting elements. Monitoring will occur for 10 years following project completion and will be implemented to inform the assessment of the project's efficacy in improving aquatic habitat conditions for native fish, including CCC steelhead. Monitoring will include the following elements:

1. Annual Profile and Cross-sections Surveys;

2. Storm Observations and Bedload Sediment Transport Surveys;

3. Salmonid Winter Refuge and Passage to Upstream Habitat Assessments;

4. Channel and Bank Stability and Bed Material Observations; and

5. Documenting Riffles and Pools, Creek Bank, Backwater Wetland and Riparian Plant Conditions.

Data collection to inform these monitoring elements, and the frequency of their implementation is detailed in the following table:

Data Collection Elements	**Monitoring Year**	**Data Collection Period**
1. Longitudinal Profile	Years 1, 3 and 5; post year 5 dependent upon peak flows	September to October of each collection year
2. Cross-sections	Years 1, 3 and 5; post year 5 dependent upon peak flows	September to October of each collection year

3. Flow and Bedload Transport	Years 1 – 5; post year 5 dependent upon peak flows	November – April of each collection year
4. Point Velocity	Years 1 – 5; post year 5 dependent upon peak flows	November – April of each collection year
5. Channel dynamics obs.	Years 1 – 5; post year 5 dependent upon peak flows	September to October of each collection year
6. Channel bed samples	Years 1, 3 and 5; post year 5 dependent upon peak flows	September to October of each collection year
7. Photo Points	Years 1 – 5; post year 5 dependent upon peak flows	September to October of each collection year
Note: The anticipated schedule for Data Collection Elements 1 through 4 may be interchanged (if a dry year is encountered such that peak flows do not exceed roughly 125 cubic feet per second) with non-anticipated years.		

Reporting will occur annually in years 1-5, and year 10. Reporting in years 6-9, and the extent of survey efforts in year 10 will be dependent upon occurrence of peak flows (flows greater than or equal to 270 cubic feet per second).

c. Fisheries Monitoring

The project proposes to monitor post-project use of the site by steelhead and other fish species. At this time, two options have been proposed and the final selection is dependent on whether the SCVWD proceeds with the application of PIT tags on fish in Upper Penitencia Creek. If PIT tags are deployed by SCVWD in 2012 or 2013, VTA will install PIT reader (*i.e.*, antenna) stations at the downstream and upstream ends of the restored channel reach in Upper Penitencia Creek. If PIT tags are not deployed by SCVWD, annual electrofishing will be used to collected fish residing in the restored channel reach. The purpose of this monitoring element is to identify use of the restored site by fish, and identify if the site is being used by steelhead.

The PIT tag antenna stations would consist of antennas housed within an approximately 4-foot wide fiberglass shell (mat) that lies across the channel width. The site is expected to use four antennas (each within their own mat), placed in pairs at both the upstream and downstream project limits. The use of paired antennas has been proposed as it allows better detection efficiency than single antenna systems. Installation of each antenna would require very minor disturbance of the substrate to allow the mat to be placed at the same grade as the adjacent substrate. Hand tools would be used to excavate an 8-inch deep trench in the substrate across the channel and the antenna mat would be placed in the trench. Excavated substrate would be

returned to the trench to transition the leading and trailing edges of the mat; resulting in the mat being flush with the adjacent substrate. Antennas would connect to reader stations located in the adjacent riparian or upland area via cables. Two reader stations are proposed for use; one for each of the paired antenna locations. The reader stations collect and store the data, are equipped with a power source (either battery power or direct power) necessary to power the equipment, and will be contained within small electronics equipment enclosures, such as those that are typically mounted to utility poles, fence posts, or other similar structures.

If PIT tags are not deployed, the restored channel reach will be assessed through fish community and population surveys. Fish collection by electrofishing, beach seines, and/or dip nets would be conducted annually for a period of 5 years in the restored reach to identify fish species present and habitat utilization. VTA proposes to finalize the fisheries monitoring component of this project and submit it to NMFS for review and approval by September 30, 2012. Reports detailing the results of this monitoring will be produced and submitted to NMFS annually during the 5-year monitoring period.

B. Action Area

The proposed project is located in the City of San Jose, Santa Clara County, California, along Upper Penitencia Creek, extending from the VTA railroad right of way crossing along Berryessa Road upstream for a distance of approximately 1,300 linear feet. Approximate site coordinates are 37.3722 degrees north latitude and 122.8747 degrees west longitude. The action area extends along approximately 1,400 linear feet of Upper Penitencia Creek and includes the stream's bed, banks and riparian corridor. Laterally, the action area encompasses the left and right banks, the creek channel, and the associated floodplain and riparian corridor. The action area includes areas that may be affected by stream diversion, fish capture and relocation, and construction activities occurring in approximately 1,300 linear feet of the stream channel. The action area also includes 100 linear feet of stream channel downstream of the dewatered reach, because this area may be affected by turbidity and sedimentation arising from project construction, and changes to summer low-flow conditions. The total action area length is 1,400 feet (1,300 + 100 feet).

III. ANALYTICAL FRAMEWORK

A. Jeopardy Analysis

In accordance with policy and regulation, the jeopardy analysis in this biological opinion relies on four components: (1) the Status of the Species, which evaluates the CCC steelhead (*Oncorhynchus mykiss*) Distinct Population Segment's (DPS) 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 DPS or Evolutionary Significant Unit (ESU).

B. Adverse Modification Analysis

This Biological Opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CPR 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 and watershed-wide condition of critical habitat for the CCC steelhead DPS in terms of primary constituent elements (PCEs, for example, sites for 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 critical habitat in the action area; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the PCEs in the action area and how that will influence the conservation value of affected critical habitat units; and (4) Cumulative Effects, which evaluates the effects of future, non-Federal activities in the action area on the PCEs and how that will influence the conservation value of affected critical habitat units.

For purposes of the adverse modification determination, we add the effects of the proposed Federal action on CCC steelhead critical habitat in the action area, and any Cumulative Effects, to the Environmental Baseline and then determine if the resulting changes to the conservation

value of critical habitat in the action area are likely to cause an appreciable reduction in the conservation value of critical habitat range-wide. If the proposed action will negatively affect PCEs of critical habitat in the action area, we then assess whether or not this reduction will impact the value of the DPS or ESU critical habitat designation as a whole.

C. Use of Best Available Scientific and Commercial Information

To conduct the assessment, NMFS examined an extensive amount of information from a variety of sources. Detailed background information on the biology and status of the listed species and critical habitat has been published in a number of documents including peer reviewed scientific journals, primary reference materials, and governmental and non-governmental reports. Additional information regarding the effects of the project's actions on the listed species in question, their anticipated response to these actions, and the environmental consequences of the actions as a whole was formulated from the aforementioned resources, and the following:

1. *Biological Assessment Addendum for the Upper Penitencia Creek Improvement Project.* Prepared for Santa Clara Valley Transportation Authority. Prepared by ICF International. August 8, 2011;

2. Planting plans titled: *Line, Track, Stations, and Systems; Upper Penitencia Improvements Planting Plan*. Submitted via email to NMFS by VTA on November 7, 2011;

3. Grading plans titled: *Line, Track, Stations, and Systems; Upper Penitencia Improvements*. Submitted via email to NMFS by HNTB for VTA on November 9, 2011 - resubmitted as final, signed plans, on May 3, 2012;

4. *Feasibility Study and Design Basis Memorandum for Mitigation Project – Upper Penitencia Creek at Berryessa Campus*. Prepared for Santa Clara Valley Transportation Authority. Prepared by Balance Hydrologics, Inc. November 11, 2011;

5. *Upper Penitencia Creek Work Plan* (Schedule and associated plans). Submitted via email to NMFS and the Corps by VTA on March 13, 2012; and

6. *BART Silicon Valley Berryessa Extension Project Mitigation and Monitoring Plan*. Prepared for Santa Clara Valley Transportation Authority. Prepared by ICF International. Submitted to NMFS by VTA as draft final on April 19, 2012 – resubmitted as final on May 8, 2012.

Information was also provided in emails messages, site visits, and telephone conversations between July 2011 and April 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 the NMFS North Central Coast Office (Administrative Record Number 151422SWR2011SR00552).

IV. STATUS OF THE SPECIES AND CRITICAL HABITAT

This biological opinion analyzes the effects of VTA's Upper Penitencia Creek Improvement Project on the CCC steelhead DPS and designated critical habitat for this species. CCC steelhead are listed as threatened under the Endangered Species Act of 1973 (ESA), as amended (71 FR 834, January 5, 2006). The CCC steelhead DPS includes steelhead in coastal California streams from the Russian River to Aptos Creek, and the drainages of Suisun Bay, San Pablo Bay, and San Francisco Bay. CCC steelhead occur in Upper Penitencia Creek and are likely to be present at the project site during construction. Upper Penitencia Creek, including the project area, is designated as critical habitat for CCC steelhead (70 FR 52488; September 2, 2005).

A. Species Description and Life History

General reviews for steelhead in California document much variation in life history (Shapovalov and Taft 1954; Barnhart 1986; Busby *et al*. 1996; McEwan 2001). Adult CCC steelhead are exclusively winter run fish, typically immigrating from the ocean to freshwater spawning streams between October and April, with immigration peaking in January and February. Although variation occurs, in Central California's coastal streams, rearing juvenile steelhead usually live in freshwater for 2 years and then migrate to the ocean from January through June, with peak emigration of smolts to estuaries and the ocean occurring in April and May (Fukushima and Lesh 1998). After ocean entry they spend 1 or 3 years maturing in the marine environment before returning to their natal streams to spawn. After spawning, steelhead adults may return to the ocean and then return to freshwater to spawn up to 4 times over their lifetime.

Juvenile 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 (Shirvell 1990, Meehan and Bjornn 1991). Steelhead juveniles tend to use riffles and other habitats not strongly associated with other cover types during summer rearing more so than coho and Chinook salmon juveniles. 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 7.2 to 14.4 Celsius (°C) and have an upper lethal limit of 23.9°C (Barnhart 1986, Bjornn and Reiser 1991). They can survive in water up to 27°C with saturated dissolved oxygen conditions and a plentiful food supply. Fluctuating diurnal water temperatures (Busby *et al*. 1996) and cold groundwater inflows also aid in survivability of steelhead juveniles in Mediterranean locales.

B. Species Status

In this biological opinion, NMFS assesses four population viability parameters to help us understand the status of CCC steelhead and the population's ability to survive and recover. These population viability parameters are: abundance, population growth rate, spatial structure,

and diversity (McElhany *et al.* 2000). NMFS has used existing information to determine the general condition of each population and factors responsible for the current status of the DPS.

We use these population viability parameters as surrogates for numbers, reproduction, and distribution, the criteria found within the regulatory definition of jeopardy (50 CFR 402.20). For example, the first three parameters are used as surrogates for numbers, reproduction, and distribution. We relate the fourth parameter, diversity, to all three regulatory criteria. Numbers, reproduction, and distribution are all affected when genetic or life history variability is lost or constrained resulting in reduced population resilience to environmental variation at local or landscape-level scales.

Historically, approximately 70 populations[1] of steelhead existed in the CCC steelhead DPS (Spence *et al.* 2008, Spence *et al.* 2012). Many of these populations (about 37) were independent, or potentially independent, meaning they had a high likelihood of surviving for 100 years absent anthropogenic impacts (Bjorkstedt *et al.* 2005). The remaining populations were dependent upon immigration from nearby CCC steelhead DPS populations to ensure their viability (McElhaney *et al*. 2000, Bjorkstedt *et al*. 2005).

While historical and present data on abundance are limited, CCC steelhead numbers are substantially reduced from historical levels. A total of 94,000 adult steelhead were estimated to spawn in the rivers of this DPS in the mid-1960s, including 50,000 fish in the Russian River - the largest population within the DPS (Busby *et al.* 1996). Recent estimates for the Russian River are on the order of 4,000 fish (NMFS 1997). Abundance estimates for smaller coastal streams in the DPS indicate low but stable levels with recent estimates for several streams (Lagunitas, Waddell, Scott, San Vincente, Soquel, and Aptos creeks) of individual run sizes of 500 fish or less (62 FR 43937). Some loss of genetic diversity has been documented and attributed to previous among-basin transfers of stock and local hatchery production in interior populations in the Russian River (Bjorkstedt *et al*. 2005). In San Francisco Bay streams, reduced population sizes and fragmentation of habitat has likely also led to loss of genetic diversity in these populations. For more detailed information on trends in CCC steelhead abundance, see: Busby *et al*. 1996, NMFS 1997, Good *et al*. 2005, Spence *et al*. 2008, and Williams *et al*. 2011.

CCC steelhead have experienced serious declines in abundance and long-term population trends suggest a negative growth rate. This indicates the DPS may not be viable in the long term. DPS populations that historically provided enough steelhead immigrants to support dependent populations may no longer be able to do so, placing dependent populations at increased risk of extirpation. However, because CCC steelhead remain present in most streams throughout the DPS, roughly approximating the known historical range, CCC steelhead likely possess a resilience that is likely to slow their decline relative to other salmonid DPSs or ESUs in worse

[1] Population as defined by Bjorkstedt *et al*. 2005 and McElhaney *et al*. 2000 as, in brief summary, a group of fish of the same species that spawns in a particular locality at a particular season and does not interbreed substantially with fish from any other group. Such fish groups may include more than one stream. These authors use this definition as a starting point from which they define four types of populations (not all of which are mentioned here).

condition. A 2005 status review concluded that steelhead in the CCC steelhead DPS remain "likely to become endangered in the foreseeable future" (Good *et al*. 2005). On January 5, 2006, NMFS issued a final determination that the CCC steelhead DPS is a threatened species, as previously listed (71 FR 834, January 5, 2006).

A more recent viability assessment of CCC steelhead concluded that populations in watersheds that drain to San Francisco Bay are highly unlikely to be viable, and that the limited information available did not indicate that any other CCC steelhead populations could be demonstrated to be viable[2] (Spence *et al.* 2008). Research monitoring data from the 2008/09 and 2009/10 adult CCC steelhead returns shows a decline in returning adults across their range compared to the last ten years (Jeffrey Jahn, personal communication, 2010). The most recent status update concludes that steelhead in the 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 August 15, 2011, NMFS chose to maintain the threatened status of the CCC steelhead (76 FR 50447).

C. Status of Critical Habitat

In designating critical habitat, NMFS considers, among other things, the following requirements of the species: 1) space for individual and population growth, and for normal behavior; 2) food, water, air, light, minerals, or other nutritional or physiological requirements; 3) cover or shelter; 4) sites for breeding, reproduction, or rearing offspring; and, generally; and 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 PCEs and/or essential habitat features within the designated area that are essential to the conservation of the species and that may require special management considerations or protection.

PCEs for CCC steelhead critical habitat within freshwater include:

1. Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development;
2. Freshwater rearing sites with:
    a. Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility;
    b. Water quality and forage supporting juvenile development; and
    c. Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

[2] Viable populations have a high probability of long-term persistence (> 100 years).

3. Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

The condition of CCC steelhead critical habitat has been degraded from conditions known to support viable salmonid populations. NMFS has determined that present depressed population conditions are, in part, the result of the following human-induced factors affecting critical habitat[3]: logging, agricultural and mining activities, urbanization, stream channelization, dams, wetland loss, and water withdrawals, including unscreened diversions for irrigation. Impacts of concern include alteration of stream bank and channel morphology, alteration of water temperatures, loss of spawning and rearing habitat, fragmentation of habitat, loss of downstream recruitment of spawning gravels, loss of large woody debris, degradation of water quality, removal of riparian vegetation resulting in increased stream bank erosion, increases in erosion and sedimentation in streams from upland areas, loss of shade (higher water temperatures) and loss of nutrient inputs (Busby *et al.* 1996; 70 FR 52488, September 2, 2005). Water development has drastically altered natural hydrologic cycles in many of the streams. This alteration of flows results in migration delays; loss of suitable habitat due to dewatering and blockage; stranding of fish from rapid flow fluctuations; entrainment of juveniles into poorly screened or unscreened diversions, and increased water temperatures harmful to salmonids. Overall, current condition of CCC steelhead critical habitat is degraded, and across the range, does not provide the full extent of conservation value necessary for the recovery of the species.

D. Global Climate Change

Global climate change presents an additional potential threat to CCC steelhead and their critical habitat. Modeling of climate change impacts in California suggests that average summer air temperatures are expected to increase (Lindley *et al.* 2007). Heat waves are expected to occur more often, and heat wave temperatures are likely to be higher (Hayhoe *et al*. 2004). Total precipitation in California may decline; critically dry years may increase (Lindley *et al.* 2007, Schneider 2007). The Sierra Nevada snow pack may decrease by as much as 70 to 90 percent by the end of this century under the highest emission scenarios modeled (Luers *et al*. 2006). Wildfires are expected to increase in frequency and magnitude, by as much as 55 percent under the medium emissions scenarios modeled (Luers *et al*. 2006). Vegetative cover may also change, with decreases in evergreen conifer forest and increases in grasslands and mixed evergreen forests. The likely change in amount of rainfall in Northern and Central Coastal streams under various warming scenarios is less certain, although as noted above, total rainfall across the state is expected to decline.

[3] Other factors, such as over fishing and artificial propagation have also contributed to the current population status of this species. All these human induced factors have exacerbated the adverse effects of natural factors such as drought and poor ocean conditions.

For the California North Coast, some models show large increases (75 to 200 percent) in rainfall amounts while other models show decreases of 15 to 30 percent (Hayhoe *et al*. 2004). Many of these changes are likely to further degrade CCC steelhead habitat by, for example, reducing stream flows during the summer and raising summer water temperatures. 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, 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 action area for the Upper Penitencia Creek Improvement Project extends along 1,400 linear feet of Upper Penitencia Creek and includes the stream's bed, banks and riparian corridor. Laterally, the action area encompasses the left and right banks, the creek channel, and the associated floodplain and riparian corridor. The action area includes areas that may be affected by stream diversion, fish capture and relocation, and construction activities occurring in approximately 1,300 linear feet of the stream channel. The action area also includes 100 linear feet of stream channel downstream of the dewatered reach, because this area may be affected by turbidity and sedimentation arising from project construction, and changes to summer low-flow conditions. The total action area length is 1,400 feet (1,300 + 100 feet).

A. Action Area Overview

Upper Penitencia Creek is a tributary to Coyote Creek and located within Santa Clara County, California. The stream drains from the Diablo Mountain Range and the watershed encompasses approximately 24 square miles. It flows westward for approximately 11 miles into the Santa Clara Valley and through the City of San Jose, where it joins Coyote Creek. Coyote Creek flows for another 10 miles before entering the San Francisco Bay. Water from natural springs, a small (<500 acre-feet) reservoir (Cherry Flat Reservoir), operated by the City of San José, and a

perennial tributary, Arroyo Aguague, enable Upper Penitencia Creek to maintain perennial flow at its headwaters.

The climate is Mediterranean, with over 90 percent of annual precipitation occurring between November and April. Cool, moist coastal fog generally alternates with clear, warm weather during the months of May through September, and significant rainfall during that time is rare. Flows within the watershed are highly variable and can go quickly from low base flow conditions to high flows and then quickly recede again. Historically, stream flows within the valley-floor portion of Upper Penitencia Creek (downstream of Dorel Drive) became intermittent in the dry season due to the warm, dry climate, and highly permeable alluvial materials in the Santa Clara Valley (Will and Stern 2012; Stillwater Sciences 2006; Grossinger *et al.* 2006).

Significant alterations have occurred over the past 100 years in and along Upper Penitencia Creek to facilitate agriculture, and since the 1960's rapid urbanization has occurred in the valley-floor portion of the watershed (Jordan *et. al.* 2009). One of the most substantial modifications to Upper Penitencia Creek relate to a series of off-channel percolation ponds and adjacent levees constructed in 1934. The percolation ponds aim to recharge municipal water supply and impede valley subsidence from ground water extraction using imported water from the South Bay Aqueduct and diverted flows from Upper Penitencia Creek (Jordan *et al.* 2009).

The SCVWD currently operates the percolation ponds for both off-channel recharge and in-channel recharge. During periods of low natural stream flow, water stored within the Robert W. Gross percolation ponds is discharged via a turnout at Pond 1A (Creek Mile 3.5) to extend the duration of low flows in the natural channel of Upper Penitencia Creek. During periods of extensive rainfall and surges due to upstream operations of the South Bay Aqueduct, the percolation ponds also allow overflow to enter the creek further augmenting base flow. Discharges from the Pond 1A turnout, urban runoff from 14 outfalls, and a perched aquifer typically results in maintaining a perennial flow in the creek from the Pond 1A turnout to the confluence with Coyote Creek.

B. Status of Listed Species and Habitat in Action Area

Steelhead within Upper Penitencia Creek are part of the broader Coyote Creek population; historically a functionally independent population (Bjorkstedt *et al*. 2005). Information regarding steelhead within Upper Penitencia Creek and the action area is limited. Recent redd surveys conducted by NMFS (Will and Stern 2012) between December 2010 and April 2011 identified nine steelhead redds and 20 *O. mykiss* (including one adult steelhead) within Upper Penitencia Creek. No redds were encountered within the action area of this project. Redd density within Upper Penitencia Creek (including its tributary, Arroyo Aguague) was low (1.3 redds per river mile) (Will and Stern 2012). The closest site to the action area where Will and Stern (2012) identified steelhead redds during the 2010-2011 spawning season is approximately 1.3 miles upstream of the project.

The CDFG and SCVWD have conducted electrofishing surveys in Upper Penitencia Creek in recent years. Leicester (2008 and 2009) encountered *O. mykiss* in the vicinity of Mabury Road approximately 0.75 mile upstream of the action area. The results of Leicester (2008 and 2009) and other recent surveys (Li 2001; Porcella 2002; Moore *et al*. 2008; Moore *et al.* 2009; Leicester 2011) conducted within Upper Penitencia Creek and the broader Coyote Creek watershed, indicate steelhead densities are very low in Coyote Creek downstream of Anderson Dam, and within Upper Penitencia Creek. The highest densities of juvenile steelhead reported from the Coyote Creek watershed are in the upper reaches of Upper Penitencia Creek (*i.e*., Alum Rock Park), approximately 4+ miles upstream of the action area (Leicester 2007, 2008, 2009 and 2011).

PCEs of designated critical habitat for CCC steelhead include water quality and quantity, foraging habitat, natural cover including large substrate and aquatic vegetation, and migratory corridors free of obstructions (70 FR 52488). Within the action area of this project, PCEs of designated critical habitat are partially degraded and limited due to altered stream flows, warm water temperatures, channelization, urbanization, bank stabilization, and non-native invasive species. Upper Penitencia Creek in the action area is primarily represented by long, deep, uniform, pool-glide channel-form. The confined channel has no accessible floodplain areas. The riparian area is narrow and overly dense. Dense vegetation has armored the bank and likely exacerbates the impairment of natural stream processes in this reach.

Adequate cover for shelter to support juvenile steelhead and low velocity refuge habitat during high flow events are very limited. Creek substrate is dominated by fine sediment which likely precludes the use of this reach for adult spawning. Excessive levels of fine sediment and high embeddedness in the action area also limit the ability of the reach to support aquatic macroinvertebrates, an important food source for rearing juveniles. Due to poor habitat and substrate within the action area, this reach of Upper Penitencia Creek provides poor conditions for steelhead spawning and rearing. Conditions for migration are also impaired, because the reach is narrow and lacks resting pools. Although critical habitat in the action area is currently in poor condition, this habitat is important to CCC steelhead because the reach provides access to high quality spawning and rearing habitat upstream.

C. Factors Effecting the Species Environment in the Action Area

Historically, Upper Penitencia Creek in the vicinity of the action area flowed northwesterly through a poorly defined valley-floor marshland distributary system prior to its intermittent confluence with tidal wetlands through what is now Lower Penitencia Creek (Grossinger *et al*. 2006). In 1852 an artificial channel was cut to drain the wetlands and route the channel of Upper Penitencia Creek directly to Coyote Creek (Grossinger *et al*. 2006). The man-made excavation of a new channel for the lowermost reach of Upper Penitencia Creek required an abrupt redirection of the stream to the southwest. This point of redirection is located within the center of the action area. Areas adjacent to this channelized reach of Upper Penitencia Creek have been heavily developed. The San Jose Flea Market and a small business park are located along the

southern bank of the stream. To the north, Berryessa Road runs parallel to the channel. The artificial channel which now conveys the stream through much of the action area is narrow and characterized by a variety of riprap, concrete rubble, and debris functioning poorly as bank stabilization.

Adjacent to the action area of Upper Penitencia Creek, there is a narrow corridor of riparian vegetation between the stream and large areas of urbanized impervious surfaces. Several storm water drains discharge directly into Upper Penitencia Creek. Urbanization along the lower reaches of Upper Penitencia Creek have increased storm peak flows and increased the discharge of contaminants.

In addition to urban effects, SCVWD's water-system operations effect stream flows within the action area of Upper Penitencia Creek. The SCVWD operates a series of off-channel percolation ponds along the valley-floor portion of the creek. This system is operated to provide both off- and in-channel groundwater recharge to abate valley-floor subsidence related to groundwater over-extraction. The off-channel percolation ponds and the channel of Upper Penitencia Creek receive water imported from the Sacramento-San Joaquin Delta via the South Bay Aqueduct. During periods of low and dry natural stream flow conditions, water is discharged from the ponds via a turnout located approximately 3 miles upstream of the action area. Historically, it is likely stream flows within the action area were seasonally dry or intermittent during the summer and early fall months (Grossinger *et al*. 2006). With imported water discharged upstream by the SCVWD for in-channel groundwater recharge, Upper Penitencia Creek in the action area typically supports a perennial flow.

Water temperatures within the action area are also dominated by SCVWD operations during the summer and early fall period. Imported water releases to Upper Penitencia Creek at the SCVWD turnout approximately 3 miles upstream of the action area typically range in temperature from 20 to 26˚C between June and mid-October (SCVWD, unpublished data). Monitoring conducted by the SCVWD from 2000 through 2004 indicate water temperatures in Upper Penitencia Creek approximately 1,000 feet downstream of the action area generally range from 18 to 25°C during the period from May through September (SCVWD, unpublished data). These higher temperature conditions are marginal for juvenile steelhead rearing. Rearing steelhead juveniles prefer water temperatures of 7.2 to 14.4°C (Bjornn and Reiser 1991) and Barnhart (1986) reports steelhead may have an upper lethal limit of 23.9°C. Juvenile steelhead may survive in the summer warm water temperatures of the action area if the site provides adequate levels of dissolved oxygen, good instream cover, and a plentiful food supply. Based on the existing poor habitat conditions, the action area's water temperature conditions significantly reduce the suitability of this reach to support summer rearing for juvenile steelhead.

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

Pursuant to section 7 of the ESA, NMFS has conducted one previous interagency consultation that affected the action area of this project. In February 2010, NMFS and the Federal Transit Administration (FTA) completed consultation on the Silicon Valley Rapid Transit Corridor Project (NMFS administrative record #151422SWR2009SR00576). Within Upper Penitencia Creek the Silicon Valley Rapid Transit Corridor Project will demolish two wooden piers (at the existing Union Pacific Railroad trestle) and an existing double box culvert vehicular bridge, and replace these structures with an aerial guideway and a reconfigured vehicular bridge, respectively. By letter dated February 12, 2010, NMFS concurred with the FTA's determination that the Silicon Valley Rapid Transit Corridor Project was not likely to adversely affect CCC steelhead or its designated critical habitat. It is anticipated that portions of the Silicon Valley Rapid Transit Corridor Project, including portions of the guideway and the vehicular will be built at the same time as the Upper Penitencia Creek Improvement Project.

NMFS' Section 10(a)(1)(A) research and enhancement permits and section 4(d) limits or exceptions could potentially occur in the Upper Penitencia Creek watershed. Salmonid monitoring approved under these programs includes carcass surveys, smolt outmigration trapping, and juvenile density surveys. In general, these activities are closely monitored and require measures to minimize take during the research activities. The SCVWD currently holds a permit to conducted electrofishing for juvenile steelhead in Upper Penitencia Creek. In addition, the National Parks Service, CDFG, and the URS currently hold research and enhancement permits with permit coverage for steelhead sampling over a wide area in northern California including the Upper Penitencia Creek watershed. However, of these permittees, CDFG is the only permitee that has sampled fish in the watershed. CDFG's sampling efforts are reported in Leicester (2007, 2008, 2009, 2011) and summarized above. CDFG has continued its annual sampling efforts in the watershed, and would be expected to perform sampling efforts during the period in which this project and its associated post-project monitoring efforts are to occur.

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 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.

Construction activities associated with this instream habitat improvement project may affect steelhead through fish relocation, dewatering of stream reaches, and temporary increased sediment mobilization. Only juvenile steelhead are likely to be in the action area during the June 15 through October 15 construction period. As described above in Status of the Species and Critical Habitat, steelhead adults and smolts are not expected to be with the action area during this period. Effects to CCC steelhead critical habitat include the temporary impacts of dewatering and sediment mobilization noted above, and long-term beneficial effects expected through creation of floodplain areas, placement of rootwads and other structure in the channel to increase habitat complexity, and planting of native riparian vegetation. The potential effects of the project's proposed activities are presented in detail below.

A. Fish Collection, Relocation, and Monitoring

The project proposes to collect and relocate fish during dewatering for construction activities, and sample fish during post-project fisheries monitoring. 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 unintentional injury and mortality attributable to fish capture varies widely, depending on the method used, the ambient conditions, and the expertise and experience of the field crew.

The project proposes to use electrofishing as a method to collect fish prior to construction and during post-project monitoring. Electrofishing is a process by which an electrical current of 30 Hz (continuous or pulsed) is passed through water in order to stun fish and facilitate capture. Two or three biologists work together while sampling with backpack electrofishers. One person carries the backpack and searches the target habitats with the anode, while one or two others net stunned fish. The use of electricity to capture fish is one of the most intrusive and risky methods. This method of capture can result in a variety of effects from simple harassment to injury of fish and death.

There are two major forms of injuries from electrofishing; hemorrhages in soft tissues and fractures in hard tissues. Only a few studies have examined the long-term effects of electrofishing on salmonid survival and growth (Dalbey *et al*. 1996, Ainslie *et al*. 1998). Dalbey *et al*. (1996) reported that the growth of resident *O. mykiss* was markedly reduced following moderate to severe electrofisher-induced spinal injury. Electrofishing can also result in trauma to fish from stress. The stress caused by electrofishing is usually not recognized because the fish often appear normal upon release. Recovery from this stress can take up to several days, and during this time the fish are more vulnerable to predation, and less able to compete for resources. Stress related deaths may occur within minutes or hours of release, with respiratory failure usually the proximal cause.

VTA proposes to use multiple-pass backpack electrofishing to relocate and, if part of monitoring, sample juvenile ESA-listed salmonids in stream habitats. During electrofishing, some fish could

potentially be exposed to electric current three or four times before being captured. There is evidence to suggest that multiple exposures to electric current may cause more severe injury and the effects of the associated stress may last longer (Mesa and Schreck 1989, Ainslie *et al*. 1998). Ainslie *et al*. (1998) suggest that juvenile *O. mykiss* that are exposed to three electrofishing attempts experience a lower rate of growth than fish that are exposed to a single electrofishing attempt; however, this difference was not statistically significant. The potential additional adverse effects associated with multiple exposures to electric current will affect far fewer individuals than the number of ESA-listed salmonids authorized for capture by backpack electrofishing during sampling activities. Data collected by the National Park Service (NPS) biologists during multiple-pass backpack electrofishing studies in Marin County, California, indicate that the majority of juvenile ESA-listed salmonids are captured on the first pass and, therefore, are not exposed to electrical current multiple times. For example, in 2004, NPS captured 4,306 juvenile coho salmon and steelhead during multiple-pass electrofishing surveys. 3,406 juveniles (79 percent) were captured on the first pass; 899 juveniles (21 percent) were captured on the second pass; and 1 juvenile (less than 1 percent) was captured on the third pass (Reichmuth *et al*. 2005).

1. Construction Related Fish Collection and Relocation

To facilitate construction of the project, the streambed will be temporarily dewatered at the project site. To avoid fish stranding and exposure associated with construction activities, the project proposes to collect and relocate fish in the work area prior to dewatering. Before and during dewatering of the construction site, juvenile steelhead and other fish will be captured. Seining or dip netting will be utilized first to keep stress and injury to fish at a minimum. Electrofishing will be used in areas where seines and dip netting is not effective to collect fish.

Electrofishing, seining, and dip netting will only occur from June 15 – October 15 when there is no potential for adult steelhead or redds to be present as described above. Electrofishing efforts will be conducted only by, or under the supervision of, NMFS-approved, qualified individuals following *National Marine Fisheries Service Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act* (NMFS 2000). Fish within the 1,300 linear feet of channel in the immediate project area will be captured and then transported by a qualified fisheries biologist. Collected fish will be relocated away from the work site to Upper Penitencia Creek upstream or downstream of the dewatered work area.

Although sites selected for relocating fish should have similar water temperature as the capture sites and should have ample habitat, in some instances relocated fish may endure short-term stress from crowding at the relocation sites. Relocated fish may also have to compete with other fish causing increased competition for available resources such as food and habitat. Frequent responses to crowding by steelhead include emigration and reduced growth rates (Keeley 2003). Some of the fish released at the relocation sites may choose not to remain in these areas and move either upstream or downstream to areas that have more vacant habitat and a lower density of steelhead. 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 adversely affect the survival chances of individual steelhead because crowding is not anticipated based on the small area that will likely be affected and the small number of juvenile steelhead likely to be relocated.

Since fish relocation activities will be conducted by qualified fisheries biologists following both CDFG and NMFS Electrofishing guidelines (NMFS 2000), direct effects to, and mortality of juvenile salmonids during capture will be minimized. Data on fish relocation efforts since 2004 for similar project types shows most injury and mortality rates are below three percent for steelhead (Collins 2004; CDFG 2005, 2006, 2007, 2008, 2009, 2010a, 2010b). Based on this information, NMFS estimates injury and mortalities will be less than three percent of those steelhead that are captured.

Surveys of juvenile steelhead numbers in the action area have not been conducted in the past. To estimate the number of juvenile steelhead present in the action area, NMFS used data from summer/fall electrofishing surveys performed on Upper Penitencia Creek by Leicester (2007 and 2008). These survey years were selected because they included surveys at Mabury Road, the closest electrofishing site to the action area (located approximately 0.75 miles upstream of the action area). During these surveys, juvenile *O. mykiss* were encountered at densities of 1.5 fish per 100 feet, and 2.5 fish per 100 feet, in 2007and 2008, respectively. Given the above, steelhead densities within the action area during project implementation would be expected to be between 1.5 and 2.5 fish per 100 feet of stream. We used the higher density value of 2.5 fish per 100 feet of stream to avoid underestimating the number of steelhead present in the action area. Based on this value (2.5 fish per 100 feet), we estimate that as many as 33 juvenile steelhead are likely to be present within the 1,300-foot reach to be dewatered (1,300/100*2.5). As described above, NMFS expects injury and mortality of juvenile steelhead associated with electrofishing to be less than three percent of the total amount of steelhead captured. Given our assumption of 3 percent injury or mortality, NMFS expects no more than one juvenile steelhead will be harmed or killed by construction related fish collection and relocation efforts.

Fish that avoid capture during construction related relocation efforts may be exposed to risks described in the following section on dewatering (see B. Project Site Dewatering).

2. Fisheries monitoring Program

To evaluate post-project aquatic habitat quality and utilization by native fish, the monitoring program may sample fish, including steelhead juveniles, during the summer/fall period. Electrofishing, dip nets, and seine nets may be used to capture juvenile steelhead. As with electrofishing associated for construction related fish collection and relocation (see 1. Construction Related Fish Collection and Relocation, above), no effects will occur to adult steelhead, eggs or larval fish because they will not be present during summer/fall sampling efforts. As with the construction dewatering activities, electrofishing will be conducted only by,

or under the supervision of, NMFS-approved, qualified individuals following NMFS guidelines, dated June 2000.

If implemented, up to 1,000 linear feet within the action area would be sampled on an annual basis for 5 years. Annual post-project fisheries monitoring related summer/fall electrofishing efforts would be expected to encounter similar or greater densities of juvenile steelhead, as those evaluated for construction activities, because the restored site is anticipated to enhance habitat conditions for steelhead rearing. Effects to juvenile steelhead associated with sampling would be similar to those evaluated for construction activities (see 1. Construction Related Fish Collection and Relocation, above); however, the monitoring program effects would occur annually for five years, rather than having a one-time effect as with construction.

Assuming the project effectively enhances habitat conditions with the action area of Upper Penitencia Creek, we have used a higher density value than reported by Leicester (2007 and 2008) to estimate the number of juvenile steelhead that may be encountered by the post-project monitoring program. Based on sampling results from locations further upstream and higher habitat quality in Upper Penitencia Creek (Li 2001; Porcella 2002; Leicester 2007; Moore *et al*. 2008; Leicester 2008; Moore *et al.* 2009; Leicester 2009; Leicester 2011), we estimated juvenile steelhead densities could be as high as 5 fish per 100 feet of channel. Therefore, the monitoring program has the potential to collect as many as 50 juvenile steelhead on an annual basis and a total of 250 steelhead over the duration of the 5-year monitoring effort. Because data from mortality rates associated with electrofishing undertaken by biologists with NMFS-issued research permits (Jeffrey Jahn, personal communication, 2010) shows an injury and mortality rate of 3 percent or less, NMFS will use this mortality rate for this project's monitoring program. We calculate that no more than 8 steelhead, total, are expected to be injured or killed throughout the duration of the proposed 5-year fisheries monitoring period.

A potential alternative to post-construction fish sampling is installation of two PIT tag antenna readers. Under this alternative, post-construction monitoring would be performed by PIT tag readers which would detect juvenile steelhead entering and exiting the restored reach of Upper Penitencia Creek. The installation of PIT tag antenna (reader) stations is not expected in affect steelhead or critical habitat, since this project will only install antennas to detect fish tagged through other programs, does not propose to handle or tag fish associated with this effort, and will result in very minor, localized impacts to channel substrate and adjacent riparian and upland habitat associated with the placement of antennas and reader stations. Because the PIT tags will be deployed by the SCVWD under their ESA Section 10(a)(1)(A) research permit, this project's monitoring program will provided useful information regarding utilization by steelhead without handling or other adverse effects on the fish.

B. Project Site Dewatering

Cofferdams with sand bags and a pipeline bypass system will be used to temporarily divert flows around the work site during construction. The project will require dewatering of approximately 1,300 linear feet of Upper Penitencia Creek in the action area.

NMFS anticipates temporary changes to instream flow within and downstream of the project site during dewatering prior to construction. These fluctuations in flow are anticipated to be small, gradual, and short-term because continuous flow downstream of the work site will be maintained at all times during construction. Thus, only small, gradual changes in flow are anticipated to occur downstream of project sites during dewatering activities. These fluctuations in flow are not anticipated to result in harm to steelhead. Once the actual dewatering operation is completed, stream flow above and below the work sites should be the same as free-flowing pre-project conditions except within the dewatered reach where stream flow is bypassed.

Stream flow diversion and project work area dewatering are expected to cause temporary loss, alteration, and reduction of aquatic habitat. Stream flow diversions could harm individual rearing juvenile steelhead by concentrating or stranding them in residual wetted areas before they are relocated. Rearing steelhead could be killed or injured if crushed during construction of the water bypass system; however, fish relocation efforts are expected to remove the majority of fish in the area and direct mortality is expected to be minimal.

Juvenile steelhead that avoid capture in the project work area will likely die during dewatering activities due to desiccation or thermal stress. Due to the pre-dewatering fish relocation efforts to be performed by qualified biologists, NMFS expects that the number of juvenile steelhead that will be killed as a result of stranding during dewatering activities will be less than one percent of the fish within the action area prior to dewatering. Using the data from Upper Penitencia Creek described above, NMFS estimates no more than one juvenile steelhead will remain in the action area and be subject to these effects.

The temporary cofferdams and water diversion structure in the stream are not expected to impact juvenile steelhead movements in Upper Penitencia Creek beyond typical summer low-flow conditions. The cofferdams and sand bags could restrict movement of juvenile steelhead in a manner similar to the normal seasonal isolation of pools by intermittent flow conditions that typically occur during summer in Upper Penitencia Creek. Due to discharges of imported water associated with SCVWD ground water recharge operations, steelhead probably do not experience intermittent flows in the action area in all summers. However, the limited duration of water diversion (16 weeks) is unlikely to adversely affect individual steelhead rearing upstream or downstream of the dewatered reach. NMFS expects these fish will be able to find food and cover upstream or downstream of the project reach as needed during the duration of project construction.

Benthic (bottom dwelling) aquatic macroinvertebrates are an important food source for salmonids. Benthic aquatic macroinvertebrates within the project site may be killed, or their

abundance reduced, when creek habitat is dewatered (Cushman 1985). However, effects to aquatic macroinvertebrates resulting from stream flow diversions and dewatering will be temporary because construction activities will be relatively short-lived (approximately 16 weeks) and the dewatered reach is relatively small (approximately 1,300 feet). Rapid recolonization (typically one to two months) of disturbed areas by macroinvertebrates is expected following rewatering (Cushman 1985, Thomas 1985, Harvey 1986). In addition, the effect of macroinvertebrate loss on juvenile salmonids is likely to be negligible because food from upstream sources (via drift) would be available downstream of the dewatered areas since stream flow, if present, will be bypassed around the project work site. Based on the foregoing, the loss of aquatic macroinvertebrates as a result of dewatering activities is not expected to adversely affect threatened CCC steelhead.

C. Toxic Chemicals

Construction in and adjacent to Upper Penitencia Creek will involve the use of heavy machinery in close proximity to the channel or in the dry channel bed. The use of heavy machinery in creek channels creates the potential for toxic materials associated with mechanical equipment, such as fuels, motor oils, and antifreeze to enter the stream or channel. Oils and similar substances from construction equipment can contain a wide variety of polynuclear aromatic hydrocarbons and metals. Both can result in adverse impacts to salmonids. Polynuclear aromatic hydrocarbons can alter salmonid egg hatching rates and reduce egg survival as well as harm the benthic organisms that are a salmonid food source (Eisler 2000). Some of the effects that metals can have on salmonids are: immobilization and impaired locomotion, reduced growth, reduced reproduction, genetic damage, tumors and lesions, developmental abnormalities, behavior changes (avoidance), and impairment of olfactory and brain functions (Eisler 2000).

The project has included several measures which reduce the chances of toxins entering streams. These measures would ensure that instream construction work only occurs during the dry season (June 15 - October 15) and that heavy equipment will only be operated in a dry creek bed. Pollution control measures, such as keeping spill containment and remediation material nearby, and refueling and servicing vehicles outside of the stream bed will be implemented. Due to these measures, NMFS expects that accidents will be minimized and toxic chemical contamination of the action area will be minimized to levels which are unlikely to adversely affect fish.

D. Sedimentation and Turbidity

The proposed action will result in the disturbance of the streambed and banks for equipment access and construction. Instream and near-stream construction activities may cause temporary increases in turbidity (reviewed in Furniss *et al*. 1991, Reeves *et al*. 1991, and Spence *et al*. 1996). NMFS anticipates these activities will result in small short-term increases in turbidity during rewatering and subsequent higher flows caused by winter storms after construction is completed.

Sediment may affect fish by a variety of mechanisms. High concentrations of suspended sediment can disrupt normal feeding behavior and efficiency (Cordone and Kelley 1961, Bjornn *et al.* 1977, Berg and Northcote 1985), reduce growth rates (Crouse *et al.* 1981), and increase plasma cortisol levels (Servizi and Martens 1992). High turbidity concentrations can reduce dissolved oxygen in the water column, result in reduced respiratory functions, reduce tolerance to diseases, and can also cause fish mortality (Sigler *et al.* 1984, Berg and Northcote 1985, Gregory and Northcote 1993, Velagic 1995, Waters 1995). Even small pulses of turbid water will cause salmonids to disperse from established territories (Waters 1995), which can displace fish into less suitable habitat and/or increase competition and predation, decreasing chances of survival. Increased sediment deposition can fill pools and reduce the amount of cover available to fish, decreasing the survival of juveniles (Alexander and Hansen 1986).

Although sediment and turbidity may affect listed salmonids, turbidity levels associated with this project are not expected to rise to the levels discussed in the previous paragraph. Monitoring of newly replaced culverts within Humboldt County noted temporary increases in turbidity following winter storm events (County of Humboldt 2002, 2003, 2004); the measured turbidity increase was generally less than the turbidity threshold commonly cited as beginning to cause minor behavioral changes (Henley *et al*. 2000; Newcombe 2003), and the turbidity increase was always less than turbidity levels necessary to injure or kill salmonids.

During construction, sediment input to the creek is expected to be minimal, because the project proposes to use erosion control methods to hold soil and sediment in place on the bank. NMFS does not anticipate elevated suspended sediment levels associated this project to result in harm, injury, or behavioral impacts that could reduce the survival chances for threatened CCC steelhead within the action area.

E. Critical Habitat Effects

The anticipated effects of the Upper Penitencia Creek Improvement Project on designated critical habitat for CCC steelhead are primarily beneficial. Project construction activities are expected to result in short-term disturbance to the channel and the adjacent streambank areas as described above. Localized impacts to water quality may occur in the form of increased levels of turbidity and suspended sediment, but these effects are expected to be minor, localized, and short-term.

Upon completion, the Project will rehabilitate some natural geomorphic conditions within the action area. Excavation of streamside areas will create enough space to construct suitable floodplain terraces that will minimize the need for ongoing channel stabilization and maintenance work. Floodplain areas will assist with re-establishing some natural geomorphic and hydrologic processes and this will support the restoration of native riparian vegetation.

This reach of creek currently lacks instream habitat complexity and diversity for steelhead. Project implementation will improve habitat quality with the installation of in-stream structures that benefit steelhead rearing, foraging, and migration. The project's placement of instream

cover and structure will also assist in the creation of low velocity refugia for both adult and juvenile steelhead during high flow events. As a result of these project elements, rehabilitated conditions in and adjacent to the action area are expected to increase habitat quality for native fish species including steelhead and productivity of invertebrates in the action area. Overall, the project's rehabilitation of habitat is expected to increase the value of PCE's of steelhead critical habitat.

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". 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 does not expect to see significant improvement in habitat conditions in the near future due to existing land and water development in the watershed. In the long term, climate change may produce temperature and precipitation changes that may adversely affect steelhead habitat in the action area. Because this project will improve habitat, it may provide some increased resilience to climate change.

VIII. INTEGRATION AND SYNTHESIS

CCC steelhead have experienced serious declines in abundance within the range of this DPS. Populations that historically provided enough steelhead immigrants to support dependent populations may no longer be able to do so, placing dependent populations at increased risk of extirpation. Long-term population trends suggest a negative growth rate and indicate that the DPS may not be viable in the long term. Threatened CCC steelhead occur in Upper Penitencia Creek in densities and abundance lower than historic conditions. Due to the timing of the proposed action, no adult steelhead or steelhead smolts will be adversely affected by project construction. However, the project is expected to provide significant long-term benefits to steelhead and designated critical habitat through the restoration of floodplain areas and placement of in-stream habitat enhancement structures.

The number of individual CCC steelhead within the action area during construction is expected to be low due to the low steelhead densities previously observed in the lower portions of Upper Penitencia Creek (Leicester 2007, 2008, 2009, and 2011). Existing habitat quality is poor and summer water temperatures are typically too warm for juvenile steelhead rearing. Any steelhead present would likely make up a very small proportion of steelhead in the Upper Penitencia Creek watershed.

Steelhead within the action area during the construction period will be temporarily disturbed by fish collection and relocation. Prior to dewatering for construction, fish will be collected and relocated from the work area. Experienced fish biologists are expected to work effectively and have low injury and mortality rates during fish collections. Fish that elude capture and remain in the project area during construction activities will likely be lost to thermal stress or crushed by heavy equipment. However, based on the low mortality rates for similar relocation efforts, NMFS anticipates few, if any, juvenile listed salmonids may be harmed or killed by fish relocation and construction activities during implementation of this project. Anticipated mortality from electrofishing and dewatering combined are expected to be less than 3 percent of the fish in the area dewatered. Because no more than 33 juvenile steelhead are likely to be present within the 1,300-foot dewatering reach, NMFS expects no more than one juvenile steelhead will be harmed or killed by construction related dewatering and fish relocation.

Annual post-construction monitoring may be performed by the project with the installation of two PIT tag antenna arrays. These PIT tag readers will detect PIT tagged juvenile steelhead entering and exiting the restored reach of Upper Penitencia Creek. Because the PIT tags will be deployed by the SCVWD under their ESA Section 10(a)(1)(A) research permit, this project's monitoring program will provided useful information regarding utilization by steelhead without handling or other adverse effects on the fish. Alternatively, the post-project monitoring program may consist of annual sampling for a 5-year period by electrofishing, dip nets and seines if the SCVWD's PIT tag program is not implemented. No more than 50 steelhead are expected to be collected within the restored reach of stream annually and no more than 8 steelhead are expected to be harmed or killed by these efforts over the 5-year duration of the fisheries monitoring effort.

Due to the relatively large number of juveniles produced by each spawning pair, spawning in the Upper Penitencia Creek watershed in future years is likely to produce enough juveniles to replace the few that may be lost at the project site due to relocation and dewatering, and post-project fisheries monitoring. It is unlikely that the small potential loss of juveniles by this project will impact future adult returns in Upper Penitencia Creek. Because the number, distribution, and reproduction of CCC steelhead in Upper Penitencia Creek is unlikely to be appreciably reduced, NMFS does not expect appreciable reduction in the number, distribution, or reproduction of the CCC steelhead DPS from this proposed project.

When construction is completed, the project is expected to and enhance instream and riparian habitat conditions in the action area. Riparian vegetation plantings will enhance the action area's existing streamside habitat conditions by creating shade over the stream and instream cover along the waterline. The project is expected to improve habitat conditions and survival rates for all life history stages of threatened CCC steelhead in the action area. Based on the foregoing, NMFS anticipates that the value of critical habitat for the conservation of CCC steelhead will be enhanced by project actions within the action area.

Regarding future climate change effects in the action area, California could be subject to higher

average summer air temperatures and lower total precipitation levels. The Sierra Nevada snow pack may decrease by as much as 70 to 90 percent by the end of this century under the highest emission scenarios modeled. Reductions in the amount of snowfall and rainfall would reduce stream flow levels in Northern and Central Coastal rivers. Estuaries may also experience changes in productivity due to changes in freshwater flows, nutrient cycling, and sediment amounts. For this project, construction would be completed no later than 2013 and the above effects of climate change will not be detected within that time frame. The short-term effects of project construction will have completely elapsed prior to initiation of climate change effects. Long-term benefits to habitat in the action area through the project's restoration actions may provide some increased resilience to climate change.

IX. CONCLUSION

After reviewing the best available scientific and commercial data, the current status of CCC steelhead, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is NMFS' biological opinion that VTA's proposed Upper Penitencia Creek Improvement project located on Upper Penitencia Creek is not likely to jeopardize the continued existence of threatened CCC steelhead.

After reviewing the best available scientific and commercial data, the current status of the 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 VTA's proposed Upper Penitencia Creek Improvement project located on Upper Penitencia Creek is not likely to adversely modify or destroy critical habitat for CCC steelhead.

X. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by NMFS as an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not 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 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 its designees to adhere to the terms and conditions of the incidental take statement, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps must report the progress of the actions 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.

Take of listed CCC steelhead may occur during fish relocation and dewatering in a 1,300- foot reach at the project site between June 15 and October 15, and during 5 years of annual post-project fisheries monitoring-related electrofishing efforts. The number of threatened CCC steelhead that may be incidentally taken during project activities is expected to be small, and limited to the pre-smolt juvenile life history stage. NMFS expects that no more than 3 percent of the fish within the 1,300 linear foot dewatering area will be injured, harmed or killed during fish relocation and dewatering activities. Because no more than 33 juvenile steelhead are likely to be present within the 1,300-foot dewatering reach, NMFS expects no more than 1 juvenile steelhead will be harmed or killed by construction related electrofishing and relocation efforts. Similarly, NMFS expects no more than 1 steelhead to avoid capture and be harmed or killed during dewatering activities. As discussed above (see VI. EFFECTS OF THE ACTION) improved post-project habitat conditions could result in increased fish densities, resulting in the potential for post-project fisheries monitoring efforts to encounter higher densities of fish than expected during construction operations. Over the proposed 5-year fisheries monitoring period, no more than 250 steelhead are expected to be affected by monitoring related electrofishing efforts within the proposed 1,000 linear foot monitoring reach; thus no more than 8 steelhead, total, are expected to be harmed or killed by the 5-year fisheries monitoring effort. Total amount of steelhead subject to harm or mortality by both project construction and post-project fisheries monitoring is not expected to exceed 10 juvenile steelhead.

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 CCC steelhead.

C. Reasonable and Prudent Measures

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

1. Undertake measures to ensure that harm and mortality to steelhead resulting from construction related fish relocation and dewatering, and post-project fisheries monitoring activities is low.

2. Undertake measures to minimize harm to steelhead resulting from construction activities.

3. Prepare and submit plans and reports to document the effects of construction and relocation activities and post-project site 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 present reporting/monitoring requirements. These terms and conditions are nondiscretionary.

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

    a. Screens used on dewatering pumps must be in accordance with the *NMFS Addendum for Juvenile Fish Screen Criteria for Pump Intakes* [available at: http://swr.nmfs.noaa.gov/hcd/pumpcrit.pdf].

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

    c. The qualified biologist shall monitor the construction sites during placement and removal of cofferdams, channel diversions, and access ramps to ensure that any adverse effects to salmonids are minimized. The biologists shall be on site during all dewatering events to capture, handle, and safely relocate steelhead. The Corps, permitee, or the biologist shall notify NMFS biologist Darren Howe at (707) 575-3152 or Darren.Howe@noaa.gov one week prior to capture activities in order to provide an opportunity for NMFS staff to observe the activities.

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

e. If any salmonids are found dead or injured, the biologist shall contact NMFS biologist Darren Howe by phone immediately at (707) 575-3152 or the NMFS Santa Rosa Area Office at 707-575-6050. The purpose of the contact is to review the activities resulting in take and to determine if additional protective measures are required. All salmonid mortalities shall be retained, placed in an appropriately-sized sealable plastic bag, labeled with the date and location of collection, fork length, and be frozen as soon as possible. Frozen samples shall be retained by the biologist until specific instructions are provided by NMFS. The biologist may not transfer biological samples to anyone other than the NMFS Santa Rosa Area Office without obtaining prior written approval from the NMFS Santa Rosa Area Office, Supervisor of the Protected Resources Division. Any such transfer will be subject to such conditions as NMFS deems appropriate.

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

a. The Corps and permitees shall 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.

b. Fill material for cofferdams will be fully confined with the use of plastic sheeting, sheetpiles, sandbags, or with other non-porous containment methods, such that sediment does not come in contact with stream flow or in direct contact with the natural streambed. All loose fill material for cofferdams or access ramps shall be completely removed from the channel by October 15, and the creek must be returned to a natural grade and substrate condition.

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

d. Sediment shall be removed from sediment controls once it has reached one-third of the exposed height of the control. Whenever straw bales are used, they shall be

staked and dug into the ground 12 centimeters (cm). Catch basins shall be maintained so that no more than 15 cm of sediment depth accumulates within traps or sumps.

e. Construction equipment used within the creek channel will be checked each day prior to work within the creek channel (top of bank to top of bank) and, if necessary, action will be taken to prevent fluid leaks. If leaks occur during work in the channel (top of bank to top of bank), the Corps, the permit holders, or their contractor will contain the spill and remove the affected soils.

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

g. A biologist shall monitor in-channel activities and performance of sediment control or detention devices during construction for the purpose of identifying and reporting to the applicant, the Corps, and NMFS any condition that could adversely affect steelhead or their habitat beyond the conditions described in the preceding biological opinion.

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

a. The Corps and VTA shall provide written reports to NMFS documenting the result of project construction and post-project monitoring. The reports shall be addressed to: NMFS Santa Rosa Area Office, Attention: Supervisor of Protected Resources Division, c/o Darren Howe, 777 Sonoma Avenue, Room 325, Santa Rosa, California, 95404-6528. Electronic copies shall also be provided to Darren Howe by email: Darren.Howe@noaa.gov.

i. **Project Construction and Fish Relocation Report --** The report is due no later than the first January 31st after construction is completed, and shall include the following contents:

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

2. **Fish Relocation –** The report shall include a description of the location from which fish were removed and the release site including photographs; the date and time of the relocation effort; a description of the equipment and methods used to collect, hold, and transport salmonids; if an electrofisher was used for fish collection, a copy of the logbook must be included; the number of fish relocated by species; the number of fish injured or killed by species and a brief narrative of the circumstances surrounding ESA-listed fish injuries or mortalities; and a description of any problems which may have arisen during the relocation activities and a statement as to whether or not the activities had any unforeseen effects.

ii. **Vegetation, Hydrologic and Geomorphic –** These reports will be sent to the address above in 3a.

b. Post Construction Fisheries Monitoring Plan

Prior to January 1, 2013, VTA will develop a draft monitoring plan and provide the draft to NMFS for review and approval. The program must be sufficient to evaluate the post-project use of the site by fish. Annual reporting will be required.

XI. REINITIATION NOTICE

This concludes formal consultation for VTA's proposed Upper Penitencia Creek Improvement Project on Upper Penitencia Creek. 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 shall be reinitiated immediately.

XII. LITERATURE CITED

Ainslie, B.J., J.R. Post, and A.J. Paul. 1998. Effects of pulsed and continuous DC electrofishing on juvenile rainbow trout. North American Journal of Fisheries Management 18:905-918.

Alexander, G.R., and E.A. Hansen. 1986. Sand bed load in a brook trout stream. North American Journal of Fisheries Management 6:9-23.

Barnhart, R.A. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest), steelhead. United States Fish and Wildlife Service Biological Report 82 (11.60). 21 pages.

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. Canadian Journal of Fisheries and Aquatic Sciences 42:1410-1417.

Bjorkstedt, E.P, B.C. Spence, J.C. Garza, D.G. Hankin, D. Fuller, W.E. Jones, J.J. Smith, and R. Macedo. 2005. An Analysis of Historical Population Structure For Evolutionarily Significant Units of Chinook Salmon, Coho Salmon, and Steelhead in the North-Central California Coast Recovery Domain. NOAA Technical Memorandum NOAA-TM-NMFS_SWFSC-382. 210 pages.

Bjornn, T.C., M.A. Brusven, M.P. Molnau, J.H. Milligan, R.A. Klamt, E. Chacho, and C. Schaye. 1977. Transport of granitic sediment in streams and its effect on insects and fish. University of Idaho, Forest, Wildlife, and Range Experiment Station, Bulletin 17, Moscow, Idaho.

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.

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

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

CDFG (California Department of Fish and Game). 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.

CDFG (California Department of Fish and Game). 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.

CDFG (California Department of Fish and Game). 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.

CDFG (California Department of Fish and Game). 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.

CDFG (California Department of Fish and Game). 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.

CDFG (California Department of Fish and Game). 2010a. Unpublished data documenting history of fish trapped at Warm Springs Hatchery (Dry Creek) between 1980/81 and 2009/10.

CDFG (California Department of Fish and Game). 2010b. 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.

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.

Cordone, A.J., and D.W. Kelley. 1961. The influences of inorganic sediment on the aquatic life of streams. California Fish and Game 47:189-228.

County of Humboldt. 2002. Memo from Ann Glubczynski, County of Humboldt Public Works, to Margaret Tauzer, National Marine Fisheries Service, titled "2002 Monitoring Report – Five Fish Passage Enhancement Projects". June 27, 2002. 1 page.

County of Humboldt. 2003. Memo from Ann Glubczynski, County of Humboldt Public Works, to Margaret Tauzer, National Marine Fisheries Service, titled "2003 Monitoring Report – Eleven Culvert Replacements for Fish". June 23, 2003. 2 pages.

County of Humboldt. 2004. Memo from Ann Glubczynski, County of Humboldt Public Works, to Margaret Tauzer, National Marine Fisheries Service, titled "2002 Monitoring Report – Eleven Culvert Replacements for Fish Passage". June 10, 2004. 2 pages.

Cox, P., and D. Stephenson. 2007. A changing climate for prediction. Science 113:207-208.

Crouse, M.R., C.A. Callahan, K.W. Malueg, and S.E. Dominguez. 1981. Effects of fine sediments on growth of juvenile coho salmon in laboratory streams. Transactions of the American Fisheries Society 110:281-286.

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.

Dalbey, S.R., T.E. McMahon, and W. Fredenberg. 1996. Effect of electrofishing pulse shape and electrofishing-induced spinal injury on long-term growth and survival of wild rainbow trout. North America Journal of Fisheries Management 16:560-569.

Eisler, R. 2000. Handbook of Chemical Risk Assessment: Health Hazards to Humans, Plants, and Animals. Volume 1, Metals. Lewis Press, Boca Raton, FL.

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.

Fukushima L., and E.W. Lesh. 1998. Adult and juvenile anadromous salmonid migration timing in California streams. California Department of Fish and Game 84(3):133-145.

Furniss, M.J., T.D. Roelofs, and C.S. Lee. 1991. Road construction and maintenance. Pages 297-323 *in* W.R. Meehan, editor. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Society Special Publication 19. 751 pages.

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 pages.

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

Grossinger, R. M., R. A. Askevold, C. J. Striplen, *et al*. 2006. Coyote Creek Watershed Historical Ecology Study: historical condition, landscape change, and restoration potential in the Eastern Santa Clara Valley, California. Prepared for the Santa Clara Valley Water District. A report of SFEI's Historical Ecology, Watersheds, and Wetlands Science Programs, SFEI Publication 426, San Francisco Estuary Institute, Oakland, CA.

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

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.

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.

Henley, W.F., M.A. Patterson, R.J. Neves, and A. Dennis Lemly. 2000. Effects of sedimentation and turbidity on lotic food webs: a concise review for natural resource managers. Reviews in Fisheries Science 8(2):125-139.

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.

Jordan, B.A., W.K. Annable, C.C. Watson, and D. Sen. 2009. Contrasting stream stability characteristics in adjacent urban watersheds: Santa Clara Valley, California. River Research and Applications. DOI:10.1002/rra.1333

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

Leicester, M. 2007. Results of Steelhead Sampling on Upper Penitencia Creek, California Department of Fish and Game.

Leicester, M. 2008. Upper Penitencia Creek 2008 Fish Sampling Results, California Department of Fish and Game.

Leicester, M. 2009. Upper Penitencia Creek Fish Sampling, California Department of Fish and Game.

Leicester, M. 2011. Upper Penitencia Creek Fish Resources and Environmental Monitoring for 2010, California Department of Fish and Game.

Li, S. 2001. Draft electrofishing surveys on Guadalupe Creek, Stevens, Coyote and Penetentia Creeks: catch results. Loomis, CA, Aquatic Systems Research.

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.

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.

McEwan, D.R. 2001. Central Valley steelhead. California Department of Fish and Game, Fish Bulletin 179(1):1-44.

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.

Mesa, M.G., and C.B. Schreck. 1989. Electrofishing mark-recapture and depletion methodologies evoke behavioral and physiological changes in cutthroat trout. Transactions of the American Fisheries Society 118:644-658.

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. 751 pages.

Moore, M., L. Porcella, D. Salsbery, and K. Sibley. 2008. Mid-Coyote Flood Protection Project. Baseline Fisheries Monitoring Report Year 1 (2007). Santa Clara Valley Water District. April 1, 2008. 71 pages

Moore, M., L. Porcella, D. Salsbery, and V. Stevens. 2009. Mid-Coyote Flood Protection Project. Baseline Fisheries Monitoring Report Year 2 (2008). Santa Clara Valley Water District.

Newcombe, Charles P. 2003. Impact assessment model for clear water fishes exposed to excessively cloudy water. Journal of the American Water Resources Associations. 39(3): 529-544.

NMFS (National Marine Fisheries Service). 1997. Status review update for West Coast steelhead from Washington, Idaho, Oregon, and California. United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. 68 pages.

NMFS (National Marine Fisheries Service). 2000. Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act. June 2000. United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. 5 pages.

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.

Porcella, L. 2002. Memo - Fish Trapping, Summary 1998-2001 upmigrant trapping and 1998-2000 outmigrant trapping, Guadalupe River and Coyote Creek, Santa Clara Valley Water District (SCVWD): 26.

Reeves, G.H., J.D. Hall, T.D. Roelofs, T.L. Hickman, and C.O. Baker. 1991. Rehabilitating and modifying stream habitats. Pages 519-557 *in* W.R. Meehan, editor. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Society Special Publication 19. 751 pages.

Reichmuth, M.L., B.J. Ketcham, and D. Fong. 2005. 2004 coho salmon section 10 permit report. Annual report submitted to National Marine Fisheries Service on activities conducted under section 10(a)(1)(A) scientific research Permit 1046. PORE-NR-WR-05/05. National Park Service, Point Reyes National Seashore. September, 2005.

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

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

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

Shapovalov, L., and A.C. Taft. 1954. The life histories of the steelhead rainbow trout (*Salmo gairdneri gairdneri*) and silver salmon (*Oncorhynchus kisutch*) with special reference to Waddell Creek, California, and recommendations regarding their management. California Department of Fish and Game, Fish Bulletin 98:1-375.

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.

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

Smith, D.M., Cusack, S., Colman, A.W., Folland, C.K., Harris, G.R., and Murphy, J.M. 2007. Improved surface temperature prediction for the coming decade from a global climate model. Science 317:796-799.

Spence, B.C., G.A. Lomnicky, R.M. Hughes, R.P. Novitzki. 1996. An ecosystem approach to salmonid conservation. Management Technology. Corvallis, Oregon.

Spence, B., G., E. P. Bjorkstedt, J. C. Garza, J. J. Smith, D. G. Hankin, D. Fuller, W. E. Jones, R. Macedo, T. H. Williams, and E. Mora. 2008. A framework for assessing the viability of threatened and endangered salmon and steelhead in the North-Central California Coast Recovery Domain. U.S. Department of Commerce, NOAA, National Marine Fisheries Service, Southwest Fisheries Science Center. 194 pp.

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

Stillwater Sciences. 2006. Upper Penitencia Creek limiting factors analysis final technical report. Prepared for Santa Clara Valley Urban Runoff Pollution Prevention Program.

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

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

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

Waters, T. F. 1995. Sediment in Streams: Sources, Biological Effects, and Control. American Fisheries Society Monograph 7. 249 pages.

Will, L.A., and G. Stern. 2012. Upper Penitencia Creek Steelhead (*Oncorhynchus mykiss*) Redd Survey Report 2010-2011. U.S. Department of Commerce, NOAA, National Marine Fisheries Service, Protected Resources Division, Southwest Region. February 2012. 29 pages.

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.

Federal Register Notices Cited

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

70 FR 52488: National Marine Fisheries Service. Final critical habitat designations for 19 West Coast salmon and steelhead ESUs. Federal Register 70:52488–52627. September 2, 2005.

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

Personal Communication

Jahn, Jeffrey. NMFS, November 2010.