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

August 27, 2013

In response, refer to:
2012/01258:DB

Colonel Mark Toy
District Commander
U.S. Army Corps of Engineers
Los Angeles District
P.O. Box 532711
Los Angeles, California 90053-2325

Dear Colonel Toy:

Enclosed is NOAA's National Marine Fisheries Service (NMFS) final biological opinion concerning the U.S. Army Corps of Engineers' (Corps) Santa Paula Creek Flood Control Project, and related effects on the Federally endangered Southern California Distinct Population Segment (DPS) of steelhead (*Oncorhynchus mykiss*) and designated critical habitat for this species, in accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq*.). This biological opinion is based on information provided in the Corps' biological assessment and referenced reports transmitted March 13, 2012, extensive correspondence between NMFS and the Corps leading to and throughout this consultation, and information and observations of the existing Santa Paula Creek Flood Control Project since construction was completed in 2002. An administrative record of this consultation is on file at the NMFS office located in Long Beach, California. Furthermore, NMFS' practice is to post biological opinions to the following website (http://swr.nmfs.noaa.gov/) after 15 business days. We post these opinions to increase transparency and provide interested parties an efficient way of obtaining the document.

Based on the best available scientific and commercial information, NMFS' final biological opinion concludes that the Corps' proposed operation, maintenance and repair of the Santa Paula Creek Flood Control Project is likely to jeopardize the continued existence of the endangered Southern California steelhead DPS, and destroy or adversely modify critical habitat for this species. NMFS first informed the Corps of this determination in its draft biological opinion and reasonable and prudent alternative of September 24, 2012.

The ESA provides that if NMFS has reached a jeopardy, or destruction or adverse modification conclusion, it must identify a reasonable and prudent alternative (RPA) to the proposed action that is expected to avoid the likelihood of jeopardy to the species, and avoid destruction or adverse modification of designated critical habitat, if such an alternative action can be offered. NMFS includes with this biological opinion an RPA that we believe meets all four regulatory requirements, as set forth in 50 CFR §402.02. Based on the Corps' replies of January 31, 2013,

and April 5, 2013, to NMFS' draft biological opinion and RPA of September 24, 2012, NMFS understands that the Corps believes that implementation of the RPA may be beyond its authority. In consideration of the information the Corps provided in its letter of April 5, 2013, namely the Rivers and Harbors Act of 1948 and the Corps' Water Resources Policies and Authorities—Modifications to Completed Projects (ER 1165-2-119), NMFS believes the Corps has the necessary authority or can obtain such authority to fully implement the RPA in this biological opinion. This is discussed in more detail in the reasonable and prudent alternative of this biological opinion under the subheading *Consistent with the Scope of the Action Agency's Legal Authority and Jurisdiction.*

Owing to this jeopardy biological opinion, the Corps is required under 50 CFR §402.15(b) to notify NMFS "…of its final decision on the action." NMFS, therefore, requests that the Corps provide NMFS with timely notification as to your agency's final decision.

Please contact Ms. Penny Ruvelas at (562) 980-4197 if you have any questions concerning this letter.

Sincerely,

William W. Stelle, Jr.
Acting Regional Administrator

cc: Josephine Axt, U.S. Army Corps of Engineers
Chris Jones, U.S. Army Corps of Engineers
Roger Root, U.S. Fish and Wildlife Service
Copy to: 151422SWR2012PR00100

FINAL BIOLOGICAL OPINION

AGENCY: U. S. Army Corps of Engineers
Los Angeles District, California

ACTION: Operation and Maintenance of the U. S. Army Corps of Engineers Santa Paula Creek Flood Control Project

CONSULTATION CONDUCTED BY: National Marine Fisheries Service

Tracking Number: 2012/01258

DATE ISSUED: AUG 2 7 2013

I. CONSULTATION HISTORY

The proposed action is located on Santa Paula Creek, Ventura County, California. The Santa Paula Creek Flood Control Project is an existing facility encompassing the lower 1.75 miles of Santa Paula Creek in the City of Santa Paula. Santa Paula Creek is a tributary to the Santa Clara River and provides habitat for the endangered Southern California Distinct Population Segment (DPS) of steelhead (*Oncorhynchus mykiss*) and is designated critical habitat for this species. Santa Paula Creek is one of three primary tributaries that provides spawning and rearing habitat for endangered steelhead in the Santa Clara River watershed, and is the closest to the ocean for migrating steelhead.

NOAA's National Marine Fisheries Service (NMFS) issued a biological opinion under Section 7 of the Federal Endangered Species Act (ESA) to the U.S. Army Corps of Engineers (Corps) on September 27, 2000, for the construction, operations, and maintenance of the Corps' Santa Paula Creek Flood Control Project. The presumed duration of the proposed action (operation and maintenance) was 50 years based on communication with the Corps. The conclusion of the September 2000 biological opinion was that the proposed action was not likely to jeopardize the continued existence of the endangered Southern California steelhead DPS or result in the destruction or adverse modification of designated critical habitat for this species. The basis of the determination was that the flood control channel and fish ladder would provide passage (upstream and downstream) for steelhead over the majority of the primary migration period (January through April). The fish ladder was expected to provide upstream adult steelhead passage at streamflows from 10 cfs to 150 cfs (10 percent exceedence value[1]), and anticipated to function, with decreasing efficiency, up to and in excess of 300 cfs. The flood control channel was designed, and expected to be maintained, with a low-flow channel providing the recommended minimum water depth (0.6 feet) at flows greater than 15 cfs (50 percent

[1] Corps (2000) identified flows less than 150 cfs had a probability of occurring 90 percent of the time from January through April based on the flow-duration data for the period of 1928 through 1992.

exceedence value[2]), and water velocities that were generally within the range of the prolonged swimming ability of adult steelhead reported in the literature (e.g., Powers and Orsborn 1985). Additionally, the constructed low-flow channel incorporated placement of boulders every few meters to simulate riffle-pool habitat features. The placement of boulders and associated habitat features were expected to provide low velocity resting areas for migrating steelhead.

At the Corps' request, NMFS amended the September 2000 biological opinion in September 2009. The purpose of the September 2009 amendment was to facilitate maintenance of the existing flood control channel (i.e., remove accumulated sediment) to restore flood capacity owing to the fact that the Corps had not maintained the facility as originally proposed and had not implemented the terms and conditions specified in the September 2000 biological opinion.

Subsequent to the September 2000 biological opinion and September 2009 amendment, NMFS determined that the effects of the Santa Paula Creek Flood Control Project may affect endangered steelhead and critical habitat in a manner or to an extent not considered in these biological opinions. NMFS notified the Corps of this determination on February 23, 2010, and again on February 25, 2011, and recommended the Corps request reinitiation of formal consultation under the ESA. Consultation under Section 7 of the ESA for the Corps' Santa Paula Creek Flood Control Project was reinitiated on March 13, 2012, including proposed repairs to the facility and implementation of a revised Operation and Maintenance Manual.

The following outlines key correspondence related to the consultation history. A complete record of the Project is on file at the NMFS office in Long Beach, CA.

- September 27, 2000: NMFS biological opinion for the U.S. Army Corps of Engineers construction, operation, and maintenance of the Santa Paula Creek Flood Control Project, including flood channel, inlet structure/fish ladder, and in-channel sediment basin, in Santa Paula Creek, Ventura County, CA.

- September 1, 2009: NMFS amendment to the September 27, 2000, biological opinion to address proposed sediment removal in 2009 and additional conservation measures and monitoring.

- December 28, 2009: Corps letter to NMFS regarding the Corps' planning effort to repair or replace the fish ladder, and request for NMFS technical assistance in order to expedite conceptual development, environmental documentation, design, and construction for the fish passage facility and to obligate the required funds by the end of March 2010.

- January 25, 2010: NMFS letter to Corps advising of data and analysis needs to support redesign of the fish ladder and formal ESA consultation.

- February 23, 2010: NMFS letter to Corps advising the Corps that new information indicates that the project elements considered in the biological opinions of September 27, 2000, and September 1, 2009, may affect endangered steelhead and designated critical habitat in a manner or to an extent not previously considered and that the full scope of the

[2] Corps (2000) identified flows equal to or greater than 15 cfs had a probability of occurring 50 percent of the time from January through April based on the flow-duration data for the period of 1928 through 1992.

project should be included in the forthcoming request for consultation regarding the proposed redesign of the existing fish ladder.

- February 24, 2010: Corps letter responding to NMFS' letter of January 25, 2010, and that the Corps' proposed action (redesign of the existing fish ladder) would be provided to NMFS in March 2010.

- March 15, 2010: Meeting between Corps and NMFS to discuss the Corps' proposed modification/redesign of the fish ladder and ESA consultation – Corps stated that a draft biological assessment would be submitted by late March or early April, 2010.

- April 9, 2010: Corps submitted (via e-mail) a preliminary draft biological assessment for the Santa Paula Creek Flood Control Project – Fish Passage Facility Repair.

- April 12, 2010: Corps provided (via e-mail) the final report of the Santa Paula Creek Flood Control Project Phase II – Alternative Evaluation and Conceptual Design for Fish Passage Improvement at the Santa Paula Creek Flood Control Channel Inlet. April 9, 2010.

- May 2010: Corps notified NMFS (phone conversation between Chris Yates (NMFS) and Josephine Axt (Corps)) that the Corps was postponing submittal of the draft biological assessment and request to reinitiate consultation for the Santa Paula Creek Flood Control Project.

- January 26, 2011: NMFS letter to Corps requesting an assessment of fish-passage conditions resulting from storm flows occurring in December 2010, and a description of proposed maintenance, including a schedule, as required by the September 27, 2000, biological opinion.

- February 25, 2011: NMFS letter to the Corps documenting non-compliance with terms and conditions specified in the September 27, 2000, biological opinion, and request for the Corps to reinitiate consultation under the ESA.

- April 1, 2011: Corps response (letter) to NMFS letters of January 26, 2011, and February 25, 2011, documenting fish-ladder conditions resulting from storm flows occurring between December 2010 and March 2011, and proposed maintenance to restore the fish ladder to design conditions as soon as practicable. Note: Maintenance (i.e. sediment removal) occurred June 23-28, 2011.

- March 13, 2012: Corps letter and attachments to NMFS requesting reinitiation of consultation on the Santa Paula Creek Flood Control Project, including proposed repairs to the existing fish ladder and long-term operation and maintenance.

- April 25, 2012: NMFS letter to the Corps acknowledging reinitiation of consultation, clarifying the scope of the consultation, and requesting additional information and clarification of the proposed action.

- August 3, 2012: Corps letter to NMFS documenting coordination and information exchanged through the consultation process, including response to NMFS' requested information of April 25, 2012.

- September 24, 2012: NMFS draft biological opinion for the Corps' proposed operation and maintenance of the Santa Paula Creek Flood Control Project concluding the Corps' proposed action is likely to jeopardize the continued existence of the federally endangered Southern California steelhead DPS, and is likely to destroy or adversely modify critical habitat for this species. The draft biological opinion included a draft reasonable and prudent alternative that is necessary and appropriate to avoid the likelihood of jeopardizing the continued existence of the DPS and destroying or adversely modifying critical habitat.

- January 31, 2013: Corps letter providing comments on NMFS' draft biological opinion of September 24, 2012.

- March 19, 2013: Teleconference between NMFS and Corps for the purpose of discussing Corps' questions and concerns regarding the September 24, 2012, draft biological opinion, and for seeking the Corps' expertise to inform revisions to the reasonable and prudent alternative described in the draft biological opinion.

- April 5, 2013: Corps letter to NMFS providing Corps' recommendations in regard to the reasonable and prudent alternative (draft biological opinion of September 24, 2012), and documentation in support of the Corps' belief that it may not have the authority to fully implement the reasonable and prudent alternative as defined in the draft biological opinion of September 24, 2012.

To produce this final biological opinion, the draft biological opinion was revised as necessary in response to the substantive comments received from the Corps on the draft biological opinion. The reasonable and prudent alternative was refined based on the comments and discussion on the draft biological opinion during the March 19, 2013, teleconference with the Corps. In addition to the revisions applied to the biological opinion in response to the Corps' comments, Appendices B and C of this biological opinion provides NMFS' detailed responses to the substantive elements of the Corps' comments.

II. DESCRIPTION OF THE PROPOSED ACTION AND ACTION AREA

What follows is a summary of the federal action, the proposed action and action area. For additional details, see the supporting documents as referenced (e.g., Corps 2012a).

A. Description of the Federal Action

The federal action involves the Corps undertaking maintenance and repair of the existing Santa Paula Creek Flood Control Project (Project), the infrastructure of which involves a flood control channel with a grouted rock apron and corresponding fish ladder located about 9,000 ft upstream of the Santa Paula Creek confluence with the Santa Clara River. Upon completing the proposed repairs to the fish ladder, the Corps will transfer the operation and maintenance responsibilities

of the existing Project to Ventura County Watershed Protection District (County), the non-federal sponsor. NMFS' understanding, which is based on information obtained from the Corps during meetings regarding the proposed action, is that while the County would be responsible for undertaking operation and maintenance of the Project following completion of the proposed fish-ladder repairs, the Corps would retain federal discretion over the Project and ensure the County implements the operation and maintenance activities consistent with the O&M manual.

The authority for the Corps to undertake the repair of the Project is granted through the Rivers and Harbors Act of 1948 (Act). This specific Act provides for not only the repair of the Project but is responsible for the original construction and continued preservation of the Project. Additionally, the Act specifies that the "local interests," presumably referring to the County, is responsible for "…perform[ing] any work necessitated by the effect of flood control on stream regimen…"

B. Description of the Proposed Action

The proposed action involves two principal elements: (1) repair and minor modification of the existing fish ladder and corresponding weirs, and (2) operation and maintenance activities of the existing Project's infrastructure for the remaining life of the facility (40 years). A summary description of the two principal elements of the proposed action follows.

1. Repair of Existing Fish Ladder and Weirs during 2012

To prepare the fish ladder for the proposed repairs, a temporary surface-water diversion would be installed to isolate the fish ladder from flowing water, and accumulated sediment in the weirs would be removed. A biologist would monitor the proposed installation and operation of the surface-water diversion with the intent of minimizing effects on endangered steelhead. Steelhead remaining in the dewatered section would be captured and then relocated to a predetermined instream location with suitable habitat conditions. The diversion would remain for the duration of the repair activities, about 60 to 105 days during the dry season (e.g., July – November).

With regard to the repairs, the weir tops would be reshaped and prepared to accept encapsulating steel plating to improve durability against high flows and corresponding debris. The steel plating and capping would be fabricated offsite, then transported to the site and affixed to the reshaped weirs with embedded dowels and epoxy. Construction was slated for completion no later than November 1, 2012.

The equipment and materials staging area would be located at the downstream end of the action area (see Description of the Action Area) adjacent to the Santa Paula Creek – Santa Clara River confluence. Access to the work area already exists along the right bank (facing downstream) of the river, and extends north from East Telegraph Road at the west side of the Santa Paula Creek Bridge.

2. Operation and Maintenance Activities of Existing Infrastructure

Under the proposed action, the Corps would maintain the existing flood control channel and appurtenant structures according to the O&M Manual (2012b) for the life of the existing Project (Corps 2012a). While the O&M Manual lists all foreseeable activities that could be undertaken, and which are the basis of this consultation, only a select few have the potential to create or perpetuate instream conditions that have relevance to endangered steelhead and designated critical habitat for this species. These specific activities involve: (1) removing sediment from the flood control channel to attain the new design invert, (2) maintaining existing grouted stone invert stabilizers, (3) maintaining the grouted stone channel side-slopes, (4) maintaining the existing pilot channel connecting the outflows from the invert stabilizer at station 10+00 to the Santa Clara River, (5) maintaining existing levees, (6) maintaining concrete channel walls, abutments, and piers, (7) maintaining the fish ladder, and (8) vegetation management. Although details regarding these activities are described in the source documents (Corps 2012a, b), NMFS has chosen to summarize here only information that is central for understanding the proposed sediment removal to attain the new design invert, maintenance and inspection of the fish ladder, and vegetation management. These specific activities in large part contribute to the basis of the effects analysis, described later in this biological opinion, and for this reason NMFS felt it illustrative to include a summary of these activities here.

Sediment Removal to maintain the New Design Invert of the Flood Control Channel

The Corps will refine the allowable sediment profile and design invert elevation of the flood control channel. To this end, the Corps proposes to remove sediment to attain the new design invert elevation for the specific purpose of ensuring flood capacity and protection against scour within the entire channel. The design invert profile defines the elevation of the channel invert throughout the action area after the process of sediment removal has been completed. The process for determining whether sediment removal is warranted is predicated on (1) rainfall producing river discharge of 5,000 cfs or more, (2) visual inspection of the river channel that indicate sediment removal is warranted, and (3) survey to compare the design invert elevations (i.e., elevation of the new design invert against the observed elevation). When the accumulation of sediment exceeds the allowable elevation at any location, sediment would be removed from the entire channel to restore the invert to the design invert elevations. Sediment removal is anticipated to be conducted every 3 to 4 years at a volume of 120,000 to 350,000 cubic yards.

Following sediment removal from the flood control channel, the Corps will construct a low-flow channel between the Santa Paula Creek-Santa Clara River confluence and downstream end of the fish ladder. All in-channel sediment removal activities would occur between June 30 and November 1, with flexibility to expand this period to include June 1 to June 30 and November 1 to December 31, when the Harvey Diversion Dam fish ladder (upstream of the action area) and Vern Freeman Diversion fish ladder (downstream of the action area) are not operating, respectively.

Maintenance and Inspection of the Fish Ladder

Sediment accumulated in the fish-ladder pools would be removed once annually with the intent of optimizing the operating capacity of the ladder. The fish ladder would be isolated from

flowing water using a surface-flow diversion and exclusion netting prior to using heavy equipment to remove and then haul the sediment for disposal offsite. A biological monitor would be onsite with the intent of avoiding or minimizing adverse effects on endangered steelhead. The removal of sediment is expected to be completed within one-week of initiation.

Although intended to be undertaken primarily between June 30 and November 1, removal of sediment from the fish ladder during the wet season would be undertaken if findings from observational inspections of the fish ladder during or shortly following rain-induced periods of elevated creek discharge (i.e., greater than or equal to 500 cfs) indicate the proposed maintenance triggers are met (i.e., greater than 3.3 feet of sediment accumulation in the fish-ladder weir pools, or greater than 1-foot hydraulic drop between fish-ladder pools). The Corps proposes to share the findings of the observational inspections with NMFS. Should sediment removal during the wet season be warranted, precautions are proposed for implementation (e.g., onsite biological monitor, positioning heavy equipment) to avoid or minimize effects to migrating steelhead. Sediment removal from the fish ladder and other necessary maintenance to restore the fish ladder function (i.e., design specifications) would generally occur after flows recede to less than 20 cfs, and require a minimum of one week and as much as several weeks to complete. Removal of boulders or debris from individual weir notches may be able to be conducted at higher flows (i.e., 30 cfs) and in a period of a few days.

Lastly, the Corps proposes to periodically inspect the Project facilities for the purpose of validating the capacity to provide passage of steelhead. In this context, the approach channel, the fish ladder, the low-flow channel, and the pilot channel will be inspected as part of the validation process. Such inspections would be undertaken when rain-induced discharge events produce 500 cfs or more in the creek, as well as during mid-April to mid-July. In accordance with the O&M Manual, corrective maintenance actions would be taken, as necessary, to restore the capacity of the fish ladder to provide passage (i.e., design specifications).

Vegetation Management

Vegetation that colonizes the bottom of the flood control channel between sediment removal events (i.e., every 3 to 4 years) and measures 2 to 3-inches in diameter at breast height or greater would be trimmed by hand crews to a height not to exceed 2 ft. The description of the proposed action does not describe the specific timing in which this work would be undertaken.

Measures to minimize effects on migrating steelhead

The Corps proposes the following measures to minimize effects to steelhead during operation and maintenance activities.

- Normal in-channel work period would occur between July 1 and October 31.
    - In-channel work period may be extended to include June 1 to June 30, if the Harvey Diversion fish ladder has been closed for at least one week, and the area has been surveyed for steelhead presence. If steelhead are found or expected to be present, work shall not proceed until either steelhead are no longer present, or

avoidance and relocation measures have been established in coordination with NMFS.

- In-channel work may be extended to include November 1 through December 31, if winter storm(s) have not generated flows that facilitate operation of the Vern Freeman Diversion fish ladder on the Santa Clara River.

- Flows shall be diverted or piped outside of the work area. Equipment shall avoid flowing water other than temporary crossing or diverting activities.
    - Residual surface water associated with the diverted channel shall be monitored for steelhead presence by a qualified biologist as soon as flows begin to recede.
    - Steelhead observed in the isolated channel shall be immediately relocated to the flowing reach with suitable habitat conditions by a qualified biologist or technician.

- If flowing water will be disturbed by construction or operation and maintenance activities (e.g., diverting water to isolate the work area, or removing boulders or debris from the fish-ladder during the migratory period), a qualified biologist/technician shall survey the complete area that may be disturbed within one week of the beginning of in-water work. The biologist shall be present during activities that occur within flowing water. If necessary, the biologist would coordinate with the construction representative to cease the work and provide recommended measures to avoid or reduce impacts to steelhead.
    - The biologist shall have knowledge and experience in anadromous steelhead biology and ecology, fish/habitat relationships, biological monitoring, and handling, collecting and relocating steelhead.
    - The biologist shall rescue any steelhead that may become stranded and relocate them to an appropriate location in Santa Paula Creek or the Santa Clara River depending upon the life stage of the fish and flow conditions in Santa Paula Creek and the Santa Clara River. One or more of the following methods shall be used to capture steelhead: dip net, seine, throw net, minnow trap, and hand.

C. Description of the Action Area

In accordance with 50 CFR §402.02, the "action area" refers to "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" and includes effects due to interrelated and interdependent activities. The action area considered in this biological opinion involves the entire flood control channel (i.e., the fish ladder plus the 500-ft reach of creek extending upstream from the upstream end of the fish ladder and the reach extending from the downstream terminus of fish ladder 1.65 miles downstream to the Santa Paula Creek-Santa Clara River confluence).

III. STATUS OF THE SPECIES AND CRITICAL HABITAT

This biological opinion considers the potential effects of the proposed action on the Southern

California DPS of steelhead and their designated critical habitat. The status of this species, their life history and habitat requirements, value of critical habitat, and recent factors affecting populations are described as follows.

A. Status of Southern California Steelhead

The endangered Southern California DPS of steelhead extends from the Santa Maria River in Santa Barbara County to the Mexican border (inclusive). NMFS characterized the abundance of steelhead in the DPS when the species was originally listed (NMFS 1997) and cited this information as the basis for the re-listing of the Southern California DPS of steelhead as endangered (NMFS 2006). Estimates of historical (pre-1960s) and more recent (1997) abundance show a precipitous drop in numbers of spawning adults for major rivers in the Southern California DPS. A 2005 status report states that the chief causes for the numerical decline of steelhead in southern California include urbanization, water withdrawals, channelization of creeks, human-made barriers to migration, and the introduction of exotic fishes and riparian plants (Good *et al*. 2005), and the most recent status review indicates these threats are essentially unchanged (NMFS 2011). Historical data on steelhead numbers for this region are sparse. The historic and recent steelhead abundance estimates, and percent decline are summarized in Table 1. The run size estimates illustrate the severity of the numerical decline for the major rivers in the Southern California DPS of steelhead (Good *et al*. 2005, NMFS 2011).

Table 1. Historical and recent abundance estimates of adult steelhead in the Southern California DPS. Data are from Good *et al.* 2005, NMFS 2011 and NMFS SWR redd surveys 2009-2011 (R. Bush, NMFS, pers. comm.).

	Pre-1950	**Pre-1960**	**1990s**	**2000s**	**Percent Decline**
Santa Ynez River	20,000-30,000		< 100		99
Ventura River		4,000-5,000	< 100	< 100	96
Santa Clara River		7,000-9,000	< 100	< 10	99
Malibu Creek		1,000	< 100		90

Recent stream surveys to document the species' current pattern of occurrence have concluded that of the 46 watersheds in the DPS which steelhead occupied historically, *O. mykiss* currently occupy only about 40% to 50% of these watersheds (Boughton *et al.* 2005). Fish surveys by NOAA Southwest Fisheries Science Center (SWFSC), direct observations by NMFS biologists, and anecdotal information from local biologists working on major rivers and creeks throughout the DPS suggest that although steelhead populations continue to persist in some coastal watersheds, the population numbers are exceedingly small (Good *et al*. 2005). On a positive note, there have been recent observations of steelhead recolonizing vacant watersheds during

years with abundant rainfall, notably San Mateo Creek and Topanga Creek (Good *et al*. 2005). NMFS reviews the status and viability of the Southern California DPS of steelhead on the basis of available information (including new information) about the species abundance, population growth rate, spatial structure, and diversity (McElhany *et al.* 2000) every five years as required by the ESA. In the last two status reviews, NMFS concluded that the risk of extinction of the Southern California DPS of steelhead was unchanged (Good *et al*. 2005, Williams *et al*. 2011, NMFS 2011).

B. Life History and Habitat Requirements

The major freshwater life history stages of steelhead involve spawning, incubation of embryos, freshwater rearing, emigration of juveniles, smoltification, and upstream migration of adults. Steelhead juveniles typically rear in freshwater for 1 to 4-years before migrating to the ocean, usually in the spring, and spend 1 to 3-years in the marine environment before returning to spawn. Steelhead grow and reach maturity at age 2 to 5 while in the ocean. This life-history pattern, known as anadromy, leads to more rapid growth than can be accomplished by nonanadromus individuals that spend their entire life in freshwater. The discussion of the steelhead life history begins with the adults that are about to enter freshwater for spawning purposes.

In Southern California, adults typically immigrate to natal streams for spawning during December through May. Spawning adults enter freshwater during winter and spring freshets when streamflow is sufficient to breach sandbars that form at river mouths. Adults may migrate several miles to hundreds of miles in some watersheds to reach their spawning grounds. Although spawning may occur during December to June, the specific timing of spawning may vary a month or more among streams within a region. Steelhead exhibit an iteroparous life history type, unlike many of the other Pacific salmon, which means that adult steelhead can survive after spawning and have the ability to migrate downstream (i.e., kelts) to the ocean and make subsequent spawning migrations. Steelhead have been documented repeating their spawning migration up to four times (Shapovalov and Taft 1954), but the degree to which steelhead exhibit this behavior is unknown in the Southern California DPS.

Female steelhead select spawning sites based on a variety of factors, including substrate size, water velocity, depth, and temperature. Females dig their nests (i.e., redds) in the riffle crests that form at the tailouts of complex pool habitat with suitable gravel substrate and adequate instream cover. Spawning involves courtship between the female constructing the redd and one or more suitable males. Egg pockets are excavated in gravel-cobble substrates. When the depth of the redd and the coarseness of the gravel meet the female's criteria, and she is courted by an acceptable male, she will be ready to spawn her eggs. Successful egg burial occurs immediately following fertilization by the male. The female then digs upstream of the pocket containing the fertilized eggs to cover the embryos with a layer of clean gravel. Depending on the size of the female and the number of eggs deposited in each pocket, the spawning pair may continue to excavate new egg pockets in an upstream fashion enlarging the overall size of the redd. The developing embryos incubate in the gravel for a period of 3 – 8 weeks prior to hatching, depending on water temperature.

Streams are the initial rearing habitat for juvenile steelhead from fry emergence to the pre-smolt

stage when juveniles have grown large enough for their seaward migration. The yolk-sac fry emerge from the redd about 2 – 6 weeks after hatching, and forage along low velocity channel margins and utilize gravel-cobble substrate and instream vegetation for cover. At first they tend to congregate in schools, but as time passes and the fish grow these schools break up and the fish (now called parr) spread throughout the stream, selecting individual territories with access to adequate cover and food (Shapovalov and Taft 1954). Preferred territories are commonly associated with deep pools, instream large woody debris, boulder clusters, undercut stream banks and deeper riffle/run feeding habitats. During the summer and fall low-flow season, parr make seasonal movements in search of perennial stream reaches with suitable water quality. Stream habitats formed by scour (i.e., pools) associated with boulders, large woody debris, and intact rootwads are the habitats where Southern California steelhead parr over-summer (Spina et al. 2003, Spina et al. 2005, Boughton and Goslin 2006). During winter high-flow events, juvenile salmonids seek low velocity, off-channel habitats such as backwater pools, side channels, and inundated woody riparian vegetation that serve as refugia (Shapovalov and Taft 1954).

The physiology of salmonids prepares them for seaward migration (i.e., smolt emigration) and estuary rearing. Steelhead have the most flexible freshwater life history of any of the Pacific salmonids such that the emigration instinct is not obligate in the species. While most steelhead go to sea before maturing, some individuals of both sexes spawn (with anadromous or resident life forms) before going to sea, while still others complete their life cycles without going to sea at all. The transformation of steelhead parr into smolts is the preparation for ocean existence and includes changes in shape and color, osmoregulation (salt balance) and energy storage. Larger individuals in good condition tend to migrate to the ocean in the spring, whereas smaller individuals are more likely to remain in freshwater or reside in estuarine habitats. Estuaries encompass a wide range of habitat types including edge, bottom, and open water environments. Estuaries play an important role in steelhead life history prior to ocean entry, providing nutrient rich feeding areas, transition to seawater, and predator avoidance. Some steelhead populations have been shown to rear in estuaries for months, but patterns of estuarine entry and use probably differ between watersheds based on estuary size, habitat complexity, smolt size, tidal influence, water quality and food availability.

This complex life cycle gives rise to multifaceted habitat needs, particularly during the freshwater phase. Southern California steelhead habitat consists of water, substrate, and riparian vegetation of estuarine and riverine habitat types (i.e., pools, riffles and glides). Spawning gravels must be of a certain size and free of sediment to allow successful incubation of the eggs. Eggs require cool, clean, and well-oxygenated waters for proper development. Juveniles often feed on insects that drift in the current, so fish orient upstream and defend feeding positions adjacent to instream cover and take drifting prey items. The same instream cover used as feeding territories double as places to hide from predators, such as under logs, root wads, instream boulders, and beneath overhanging vegetation. Juveniles need places to seek refuge from periodic high flows (side channels and off channel areas) and occasionally from high summer water temperatures (cold-water springs and deep pools). Low streamflow, high water temperature, physical barriers, low dissolved oxygen, and high turbidity can delay or halt downstream migration of juveniles and subsequent entry into estuary, lagoon, or ocean. Returning adults generally do not feed in fresh water but instead rely on limited energy stores to migrate, mature, and spawn. Like juveniles, they also require cool water and places to rest and hide from predators. During all life stages steelhead require cool water that is free of

contaminants. They also require rearing and migration corridors with adequate passage conditions to allow access to the various habitats required to complete their life cycle (NMFS 2005).

C. Status of the Species' Critical Habitat

Critical habitat for the endangered Southern California DPS of steelhead was designated on September 2, 2005 (NMFS 2005). Critical habitat has a lateral extent defined as the width of the channel delineated by the ordinary high-water line as defined by the Corps in 33 CFR 329.11, or by its bankfull elevation, which is the discharge level on the streambank that has a recurrence interval of approximately 2 years (NMFS 2005). NMFS' Critical Habitat Analytical Review Teams (Review Teams) developed a list of Primary Constituent Elements (PCEs) specific to steelhead and their habitat, and relevant to determining whether occupied stream reaches within a Hydrologic Subarea (HSA) watershed fit the definition of critical habitat. The PCEs within these streams are essential for the conservation of the endangered Southern California DPS of steelhead, and involve those sites and habitat components that support one or more steelhead life stages and in turn contain physical or biological features essential to steelhead survival, growth, and reproduction, and the conservation[3] of the DPS. These include:

1. **Freshwater spawning sites** with sufficient water quantity and quality and adequate substrate (i.e., spawning gravels of appropriate sizes) to support spawning, incubation and larval development.

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

3. **Freshwater migration corridors** free of obstruction 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.

4. **Estuarine areas** free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and salt-water; natural cover; and juvenile and adult forage supporting growth and maturation.

5. **Nearshore marine areas** free of obstruction with sufficient water quality and quantity conditions and forage to support salmonid growth and maturation; and natural cover.

6. **Offshore marine areas** with sufficient water quality and forage, including marine invertebrates and fishes, to support salmonid growth and maturation.

[3] ESA Section 3 (3): The terms "conserve", "conserving", and "conservation" mean to use and the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary.

Anthropogenic activities have reduced the amount of habitat available to steelhead (Nehlsen *et al*. 1991, NMFS 1997, Boughton *et al*. 2005, Good *et al*. 2005, NMFS 2006). In many watersheds throughout the Southern California DPS, the damming of streams has precluded steelhead from hundreds of miles of historical spawning and rearing habitats (*e.g.*, Vaquero Dam within the Santa Maria River watershed, Bradbury Dam within the Santa Ynez River watershed, Matilija Dam within the Ventura River watershed, Rindge Dam within the Malibu Creek watershed, Pyramid Dam and Santa Felicia Dam on Piru Creek within the Santa Clara River watershed). These dams created physical barriers and hydrological impediments for adult and juvenile steelhead migrating to and from spawning and rearing habitats. Likewise, construction and ongoing impassable presence of highway projects have rendered habitats inaccessible to adult steelhead (Boughton *et al*. 2005). Within stream reaches that are accessible to this species (but that may currently contain no fish), urbanization has in many watersheds eliminated or dramatically reduced the quality and amount of living space for juvenile steelhead.

The extensive loss and degradation of habitat is one of the leading causes for the decline of steelhead abundance in southern California and listing of the species as endangered (NMFS 1997, 2006). Steelhead over-summering habitat is thought to be the most geographically limited of all the habitats that are necessary for essential life history function (Boughton et al. 2006).

As part of the process to gather and analyze information to finalize the designation of critical habitat, several of NMFS' Review Teams compiled all available information regarding the distribution and habitat use of steelhead within the endangered Southern California DPS of steelhead, as well as habitat condition. The Review Teams performed conservation assessments for all occupied watersheds, including riverine reaches and estuarine areas within each DPS. Essential features of critical habitat for steelhead spawning, rearing, and migration were designated as critical habitat in 708 miles (1,132 km) of occupied stream habitat within watersheds of the Southern California Steelhead DPS. Streams with high conservation value were found to have most or all of the PCEs of critical habitat and extensive areas that were suitable for steelhead spawning, rearing, and migration, despite negative effects of anthropogenic factors. Streams with medium or low conservation value were less suitable for steelhead in terms of spawning, rearing and migration, and had fewer of the PCEs necessary for steelhead survival, growth and reproduction, generally due to anthropogenic factors.

D. Regional Climatic Variation and Trends

For the Southwest region (southern Rocky Mountains to the Pacific Coast), the average temperature has already increased roughly 1.5^{o}F compared to a 1960-1979 baseline period. By the end of the century, average annual temperature is projected to raise approximately 4^{o}F to 10^{o}F above the historical baseline, averaged over the entire region (U.S. Global Change Research Program (USGCRP) 2009). The southern California region is also experiencing an increasing trend in droughts, measured by the Palmer Drought Severity Index from 1958 to 2007 (USGCCRP 2009). The Southwest region, including the state of California, showed a 16% increase in the number of days with very heavy[4] precipitation from 1958 to 2007. In general, for

[4] Defined as the heaviest one percent of all events.

most areas of the country, the fraction of precipitation falling as rain versus snow has increased during the last 50 years (USGCCRP 2009).

Addressing climate trends and projections on an ecoregional scale within southern California provides a focused summary of expected trends (PRBO Conservation Science 2011). The action area lies within the Southwestern California Ecoregion where a collection of regional climate models have projected trends in temperature and precipitation, among other parameters. Regional climate models project mean annual temperature increases of 1.7–2.2°C by 2070 (PRBO Conservation Science 2011). Using regional climate models, Bell et al. (2004) projected a significant increase in extreme temperature events on the South Coast. Regional climate models projected impacts of climate change on thermal conditions in Southwestern California will be warmer winter temperatures, earlier warming in the spring, and increased summer temperatures. However, there is relatively little consensus about projected effects of climate change on precipitation patterns, no consensus on how climate change will influence fire, and no published information on projected effects of climate change on streamflow in Southwestern California (PRBO Conservation Science 2011).

Climatic trends and projections regarding increased temperature are likely to further degrade Southern California steelhead habitat by raising summer water temperatures (Eaton and Scheller 1996). Impacts to steelhead will likely result in increased thermal stress even though this species has shown to already endure higher body temperatures than are reportedly preferred or tolerated for the species as a whole (Spina 2007).

Although uncertainty exists in precipitation projections, some scientists (e.g., Madsen and Figdor 2007) report observed and projected trends of increased frequency of high-intensity storm events, with southern California among the areas of the largest increase. A demonstration of this trend may include recent hydrology studies in the Santa Clara River watershed indicating the current 100-year discharge in Santa Paula Creek is 39,400 cfs, whereas the original (1995) Project design 100-year flood discharge was 28,000 cfs, which is now considered the 50-year event (Corps 2011). Increased storm intensity coupled with little to no change in total annual precipitation suggests fewer and shorter duration rain-induced flow events. Impacts to steelhead are likely to result from such conditions through a reduction in annual migration opportunities necessary for upstream migrating adults to reach suitable spawning and rearing habitats and downstream migrating smolts and kelts to reach the ocean.

E. Population Viability

One prerequisite for predicting the effects of an action on a species, including establishing a point of reference for the effects analysis, involves an understanding of whether the broad population is likely to experience a reduction in the likelihood of being viable (i.e., the hypothetical state(s) in which extinction risk of the broad population is negligible and full evolutionary potential is retained (Boughton et al. 2006)). By definition, a viable salmonid population (VSP) is an independent population of any Pacific salmonid (genus *Oncorhynchus*) that has a negligible risk of extinction due to threats from demographic variation (random or directional), local environmental variation, and genetic diversity changes (random or directional) over a 100-year time frame. Other processes contributing to extinction risk (catastrophes and large-scale environmental variation) are also important considerations, but by their nature they

need to be assessed at the larger temporal and spatial scales represented by DPSs or other entire collections of populations.

Four principal parameters are used to evaluate the long term viability and conversely the extinction risk for the endangered Southern California DPS of steelhead. They are: (1) abundance; (2) population growth rate; (3) population spatial structure; and (4) population diversity. These specific parameters are important to consider because they are predictors of extinction risk and reflect general biological and ecological processes that are critical to the growth and survival of steelhead populations, and they are measurable (McElhany et al. 2000). The bases for these concepts can be found in the many publications regarding population ecology, conservation biology, and extinction risk (e.g., Berger 1990, Primack 2004, see also McElhany et al. 2000 and Boughton et al. 2006). The four concepts are outlined below.

1. Abundance

Information about a population's size or abundance provides an indication of the sort of extinction risk a population faces. Small populations face a host of risks intrinsic to their low abundance; conversely, large populations exhibit a greater degree of resilience. Small populations tend to be at greater risk of extinction than large populations primarily because several processes that affect population dynamics operate differently in small populations than they do in large populations. Generally, the greater the size of a steelhead population, the greater the chance it will remain viable in the long term. Within the endangered Southern California DPS of steelhead, abundance has been severely reduced from historic levels (Good et al. 2005) and this has negative implications for long term viability for this DPS.

2. Population Growth Rate

Population growth rate and factors that affect population growth rate provide information on how well a population is "performing" in the habitats it occupies during the life cycle. These parameters, and related trends in abundance, reflect conditions that drive a population's dynamics and thus determine its abundance. Changes in environmental conditions, including ecological interactions, can influence a population's intrinsic productivity or the environment's capacity to support a population, or both. In regard to steelhead, the greater the productivity of a steelhead population the greater its ability to recover from environmental disturbance and the greater its viability. Because of the very low abundance of steelhead in southern California, the population growth rate has also been reduced, making the DPS less resilient to disturbance, and this has further reduced the long term viability of the DPS.

3. Spatial Structure

A population's spatial structure is made up of both the geographic distribution of individuals in the population and the processes that generate that distribution. A population's spatial structure depends fundamentally on habitat quality, spatial configuration, and dynamics as well as the dispersal characteristics of individuals in the population. Understanding the spatial structure of a population is important because the population structure can affect evolutionary processes and, therefore, alter the ability of a population to adapt to spatial or temporal changes in the species' environment over the long term (McElhany et al. 2000). Generally, steelhead populations that

are thinly distributed over space are susceptible to experiencing poor population growth rate and loss of genetic diversity which result in lowered viability. Within the endangered Southern California DPS of steelhead, anthropogenic activities such as the introduction of migration barriers have substantially reduced the number of watersheds (or portions of watersheds) that are currently accessible to steelhead. This has significantly reduced the spatial structure of the DPS (Boughton et al. 2005).

4. Diversity

Steelhead populations possess a suite of life history traits that exhibit considerable diversity within and among populations, and this variation has important effects on population and DPS viability. Some of these varying traits are anadromy, timing of spawning, emigration, immigration, fecundity, age-at-maturity, behavior, physiological and genetic characteristics, to mention a few. In terms of steelhead population viability, the more diverse the assortment of life history traits (or the more these traits are not restricted), the more likely the steelhead population is to survive a spatially and temporally fluctuating environment over the long term. Because anthropogenic activities have severely reduced and eliminated the expression of some life history traits of steelhead in southern California, the long term viability of the DPS has declined as well.

In summary, the endangered Southern California DPS of steelhead has been severely impacted by anthropogenic factors, and this has negatively affected the abundance, productivity, spatial structure, and diversity of the entire DPS. The endangered Southern California DPS of steelhead is currently not viable and is at a high risk of extinction (Good et al. 2005, NMFS 2006, and NMFS 2011).

F. Description of the Population Units

The Southern California DPS comprises several population units (steelhead-bearing watersheds). While 46 drainages support this DPS (Boughton *et al*. 2005), only 10 population units possess a high and biologically plausible likelihood of being viable and independent (Boughton *et al*. 2006). Although the geographic area of the DPS is broad, the individual population units are sparsely and unevenly distributed throughout the DPS with extensive spatial breadth often existing between nearest-neighbor populations (Boughton *et al*. 2005, NMFS 2005, Boughton *et al*. 2006). Widespread extinctions of population units have been observed as well as contraction of the southern extent of the species' geographic range (Boughton *et al*. 2005, Gustafson *et al*. 2007). One reason for the extensive spatial gaps between neighboring population units and the range contraction involves man-made barriers to fish migration (Boughton *et al*. 2005). The Santa Clara River population unit (of which the Santa Paula Creek subpopulation in the action area is a part) is important to the viability and recovery of the endangered Southern California DPS of steelhead, as described in the following section.

G. Contribution of Population Units in the Action Area to DPS Viability and Relationship to Recovery

The Santa Paula Creek subpopulation of steelhead contributes to the viability of the Santa Clara River population, and is discussed in this context below regarding contribution to viability of the Southern California DPS as a whole. The characteristics contributing to the viability of the

Southern California DPS include the "independence" of the Santa Clara River population, and the functional value and contribution of the steelhead-bearing sub-basins within the watershed – Santa Paula Creek.

1. Independence of the Santa Clara River population

The Santa Clara River population is considered an independent population (Boughton *et al*. 2006), and is therefore expected to function as a source population supporting formation of steelhead numbers in several adjacent population units (Figure 1). The ability of individual population units to contribute to the viability of their overall broader population can vary (Thomas and Kunin 1999), and this is true for the population units making up the Southern California DPS (Boughton *et al*. 2006). The Santa Clara River steelhead population is one of only a few population units in this DPS that have been determined to have a high assurance of being independent and therefore is expected to contribute substantively to the viability of the DPS and recovery of the species. The creation and maintenance of populations in several adjacent population units, which is expected of the Santa Clara River population, effectively increases numbers of individuals in the broad population. Given the risk of extinction that small populations face (e.g., Pimm *et al*. 1988, Primack 2004), a larger number of individuals decrease the risk that the broad population would possess weakened viability.

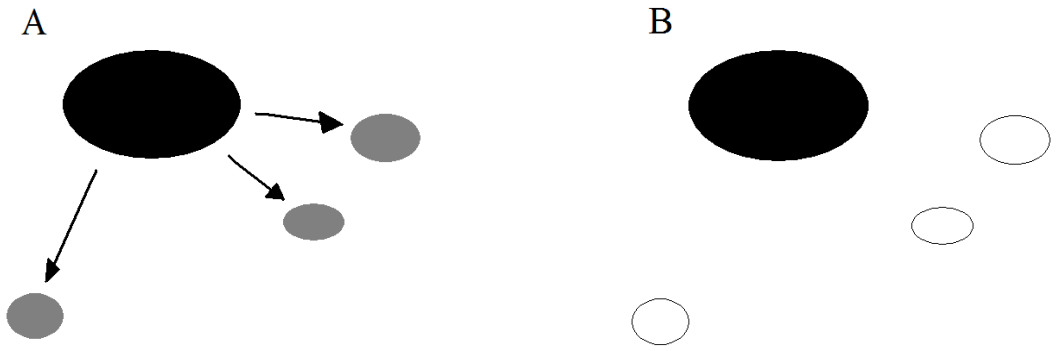


Figure 1. Concept of source-sink dynamic (after McElhany *et al*. 2000, Primack 2004). Circles represent habitats (e.g., watersheds) with the size of the circle indicating the size of the population unit and habitat capacity (large circles represent source or core population units, whereas small circles represent sink or non-core population units). Shading represents population density: white indicates an empty habitat, black indicates high density, and grey indicates intermediate density. Arrows indicate migration. In favorable years, source populations show relatively stable numbers and several sink populations show arrival of immigrants (A). Populations in sink areas may become extinct in unfavorable years (B), but sinks or non-core populations can be recolonized by migrants from source populations when conditions are favorable.

If restored to an "unimpaired" condition, the Santa Clara River population unit is expected to be

stable (i.e., able to withstand environmental stochasticity) (Boughton *et al*. 2006) and serve as a source population. Population units in strictly coastal or inland areas of the DPS do not appear to be different in terms of their innate stability over the long term (Boughton *et al*. 2006), but some population units exist in areas where surface water can be perennial and where winter discharge (and therefore migration opportunities for steelhead) is more dependable. This has led to the identification of certain population units in the DPS that are expected to be more stable over the long term than other units not sharing such environmental features. The Santa Clara River was identified as such a population unit (Boughton *et al*. 2006).

The Santa Clara River population unit possesses ecologically significant attributes not found in most other population units. Examples of these attributes are as follows. The population unit represents a large distributional component of the overall range of the DPS (i.e., makes up a large part of the DPS), and the Santa Clara River population unit is the largest steelhead-bearing watershed in the DPS. Without this population unit, the number of large population units would be reduced to two: the Santa Ynez River and the Ventura River. The remaining units are small coastal populations, which by themselves, do not appear to favor viability and recovery of the DPS (Boughton *et al*. 2006). Larger river systems are important for a variety of reasons including that steelhead genetic diversity can be higher in larger versus smaller systems (Heath *et al*. 2001). The Santa Clara River population unit is an inland population, whereas the vast majority of population units are coastal. The value of inland populations lies in their innate habitat characteristics and conditions; inland population units extend into areas that are drier and warmer than those experienced by coastal population units, and inland population units also have longer migration routes. Such environmental features are expected to promote diversity (genetic, phenotypic, and ecological) and specific life-history traits (e.g., the ability to migrate long distances, and tolerate elevated temperatures and low flows during the dry season) that favor survival of the species (for evidence of variation in life history traits and adaptations to environmental characteristics, see Withler 1966, Schaffer and Elson 1975, and review by Nehlsen *et al*. 1991). The inland populations of steelhead appeared to have been the largest within southern California particularly during favorable water years (Boughton *et al*. 2006, Boughton *et al*. 2007).

2. Functional value of the steelhead-bearing sub-basins within the watershed

The independence of the Santa Clara River population unit is related to subpopulations within the watershed (individual steelhead-bearing streams in the watershed) and the quality and quantity of habitats available for the subpopulations.[5] The Santa Paula Creek subpopulation possesses certain attributes that signify its ecological importance to the Santa Clara River population unit. These attributes must be represented and maintained to promote long-term viability of the species (Boughton *et al*. 2007). A review of these attributes is as follows.

The Santa Paula Creek subpopulation occupies a watershed reported to contain the least amount (12%) of historic spawning and rearing habitat relative to the other subpopulations (i.e., Sespe

[5] Key concepts in population theory are presented in this biological opinion, including a detailed discussion of the concepts at the beginning of section III, subsection E. Understanding these concepts is crucial for appreciating the importance of the subpopulations to the viability of the population unit (and likewise the value of the population units to the viability or independence of the DPS), and the relationship among steelhead abundance, habitat quality and quantity, fluctuations in environmental conditions, and extinction risk.

Creek (60%) and Piru Creek (28%)) in the Santa Clara River watershed (Moore 1980). However, the majority of historic spawning and rearing habitat in Piru Creek is currently not accessible to anadromous *O. mykiss* owing to the presence of Santa Felicia Dam, increasing the importance of the Santa Paula Creek subpopulation. Furthermore, Stillwater (2007) observed higher densities of rearing *O. mykiss* compared to neighboring subpopulations of the Santa Clara River during recent surveys, and suggested that Santa Paula Creek has some of the highest potential for restoring anadromous *O. mykiss* in the Santa Clara River watershed. While NMFS recognizes that not all of the stream network may be suitable given the seasonality of flows, as observed in Stillwater (2007), the function and value of ephemeral or seasonal drainages should not be discounted because adult *O. mykiss* actively seek out and spawn in seasonal streams, producing young that would otherwise not be produced (Erman and Hawthorne 1976). Given the relative amount of available habitat and observed densities of rearing juveniles in the Santa Paula Creek sub-basin, the potential to produce a large number of steelhead is considered high.

The upper habitat reaches of the Santa Paul Creek lie on U. S. Forest Service land, where anthropogenic activities are more restricted. As a result, much of this habitat is expected to be high quality and least disturbed.

The Santa Paula Creek watershed is expected to buffer the species against extirpation, particularly during periods of extended drought that are common to the region. Prolonged rain-free periods can cause streams to become intermittent, sometimes over extensive areas (e.g., Spina *et al*. 2005, Boughton *et al*. 2006, Boughton *et al*. 2007). Migration of steelhead to and from spawning and rearing areas and the ocean is not likely under such conditions. Perennial waterways, as such exist often in protected areas within upper basins, can serve as refuges for fish during drought conditions and may be the only place where reproduction of native steelhead is occurring. With regard to the Santa Paula Creek drainage, the tributaries in the upper drainage can possess flowing water even during dry periods further emphasizing the importance of a functioning migratory corridor in the downstream reach (e.g., action area) providing access to suitable spawning habitat and persistent rearing habitat.

IV. ENVIRONMENTAL BASELINE

In this section we review the environmental baseline, which:

> "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).

Specifically, this section reviews the effects of past and ongoing factors leading to the current status of the endangered Southern California DPS of steelhead and critical habitat within the action area. The effects of past and present activities leading to the current status of steelhead and critical habitat within the action area constitute the environmental baseline. Past and ongoing factors have created conditions that continue into the future, and therefore an understanding of how the factors have altered the environment is necessary to know the effects that contribute to the current environmental baseline.

A. Status of Critical Habitat and Steelhead in the Action Area

The historical function of the action area could have included steelhead rearing because past accounts indicate water was at times in mainstem rivers (e.g., Outland 1971, Mann 1975, pp 98 Boughton *et al*. 2006), and juvenile anadromous salmonids are known to rear in mainstem habitats (Leider *et al*. 1986, Hartman and Brown 1987, Loch *et al*. 1988, Murphy *et al*. 1997, Spina *et al.* 2005). Today, due to a variety of anthropogenic activities, the functional value of critical habitat in the action area has been diminished, and some functions appear to have been eliminated (e.g., spawning and rearing is not expected in the action area). Therefore, the habitat in the action area is considered a migratory corridor for upstream and downstream migrating steelhead.

Recent information on the abundance of steelhead in the action area is not available. However, in spring 1999, seven steelhead smolts were observed in Santa Paula Creek a few miles upstream of the confluence with the Santa Clara River (A. Spina, pers. obs., NMFS, fishery biologist). A survey conducted in May 2007 infrequently encountered juvenile steelhead in mainstem Santa Paula Creek upstream of the action area, observing the highest abundance in upstream tributaries (Sisar Creek and Little Santa Paula Creek (Stillwater Sciences 2007)). Overall, the abundance of steelhead in Santa Paula Creek is presumed to be very small, representing a portion of the estimated <10 adult steelhead annually returning to the Santa Clara River watershed. Although current abundance is a minor fraction of the estimated historic abundance, the Santa Clara River population unit, including Santa Paula Creek, is considered a source population and critical to the survival and recovery of the Southern California DPS of steelhead.

B. Threats to Steelhead in the Action Area

Threats to endangered steelhead in the action area involve the past and present effects of the Corps' operation and maintenance of the flood control channel and fish ladder, past and ongoing operation of Harvey Diversion Dam, land-use activities, and environmental stochasticity.

Maintaining and operating the Corps' flood control channel has resulted in a straightened creek channel and corresponding reduction in the quality and availability of essential habitat features necessary for growth and survival of endangered steelhead, owing to effects of channelization (e.g., Brooks 1998). In particular, maintaining the channel for the purpose of promoting efficient conveyance of flood waters is counter to establishing and maintaining a properly functioning freshwater migration corridor and freshwater rearing site for endangered steelhead. Channelization and related habitat alteration is a key factor in the original listing of endangered steelhead (NMFS 1997).

Existence and maintenance of the Corps' fish ladder obstructs migration of endangered steelhead. Upstream migrating steelhead (adults) are delayed or precluded from accessing suitable spawning (and rearing) habitat confined to the reaches upstream of the fish ladder. Downstream migrating steelhead (smolts and kelts) are likely injured by being forced across the grouted-rock apron adjacent to the fish ladder when the fish ladder is blocked by sediment. The Alternatives Evaluation and Conceptual Design for Fish Passage Improvements at the Santa Paula Creek Flood Control Channel Inlet (Corps 2010a) summarized the following key observations regarding the existing fish ladder:

- Clogging of the weir notches and partial filling of the fishway pools by heavy bedload and debris can reduce fishway performance;

- Scour and downstream channel degradation resulted in poor fish passage conditions leading up to the ladder; and

- Pummeling of weirs by bedload, the filling of the fishway with substantial bedload, and aggradation of the channel immediately upstream of the fishway caused significant damage to the weir crests, severely impaired the fish passage performance of the ladder, and caused the flow to flank the fishway, respectively.

Furthermore, the Corps (2010a) report states that "*With a limited window of migration flows each year and with most migration occurring in the receding flows of a storm event, a fish passage facility needs to have the ability to pass the sediment load during peak flows and be ready to pass fish immediately by meeting fish passage hydraulic criteria. Wedged boulders and resting pools completely filled with sediment severely impact migration potential and it is likely that the required sediment clean out effort to alleviate these threats would come too late and too infrequent*."

Harvey Diversion Dam, near the Mud Creek-Santa Paula Creek confluence, redirects surface water (6 cfs) from Santa Paula Creek causing a reduction in the amount and extent of surface water in the creek, particularly during the dry season. In addition to Harvey Diversion Dam, other surface water diversions in or upstream of the action area can reduce the amount and extent of surface flow in the action area. The exploitation of surface water can adversely affect the physical, chemical and biological characteristics of streams (Poff *et al*. 1997) and is believed to have contributed to the population decline of anadromous salmonids throughout much of their range (Hedgecock *et al*. 1994, Moyle 1994).

Land-use activities, including conversion of wildlands, can increase input rates of nitrogen and sand and smaller particles to receiving waters and therefore critical habitat for steelhead. This can lead to reductions in the quality of habitat and abundance of desirable aquatic species, and increased eutrophication of receiving waters (Weaver and Garman 1994, Bowen and Valiela 2001, Quist *et al*. 2003). The past and ongoing conversion and development of lands have increased the potential for runoff of pollutants and sand and smaller particles to surface water and therefore steelhead critical habitat.

Lastly, the influence of environmental stochasticity within the action area is expected to be high (Boughton *et al*. 2006). The expected sources of environmental stochasticity involve drought (and associate features such as high temperatures, low streamflow), floods, and wildfire. Extended rain-free periods, which are fairly common in southern California, can lead to dramatic reductions in the amount and extent of surface flow during both the dry and wet season. At times, the reductions can be severe enough to cause dewatering over extensive instream areas, intolerably low concentrations of dissolved oxygen, and kills of steelhead, based on NMFS' observations and experience. Wildfire can increase inputs of sand and smaller particles to streams, and reduce the amount of habitat available to steelhead (e.g., Spina and Tormey 2000 and references therein). Climate change is expected to influence the action area, particularly

through increases in air (and therefore water) temperature, which in turn may decrease the amount of suitable habitat for steelhead.

V. ANALYTICAL APPROACH FOR ASSESSING THE EFFECTS OF THE PROPOSED ACTION

A. Jeopardy Assessment

Our analytical approach involves an exposure-response-risk model, which in general evaluates how the proposed action overlaps with the life history and habitat requirements of the species, the reaction of the species at the individual and population level to the exposure to the proposed action, and the reaction consequences for the extinction risk to the species. Inherent in this approach involves consideration of the factors that cause species to go extinct, which was already described in the section *Population Viability*.

The approach to assess whether the proposed action would jeopardize the continued existence of the endangered Southern California DPS of steelhead relied on information about the status and current viability of the species at the DPS scale (presented earlier in the Status of the Listed Species and Critical Habitat section and the Environmental Baseline section), information on how the proposed action is expected to adversely affect steelhead at the individual and population level, and integration of the foregoing information in the section Integration and Synthesis of Effects. The information regarding the status and current viability of the species under the environmental baseline, and the species' status provides reference conditions at the population scale to which NMFS adds the effects of the proposed action in the Integration and Synthesis of Effects section. In the Effects on Steelhead section, NMFS identifies the effects that individual steelhead are expected to experience as a result of the proposed action, and the expected response of steelhead to the effects based on the life history and habitat requirements of this species. Finally, NMFS assesses whether the conditions that result from, or are perpetuated by, the proposed action, in combination with conditions influenced by other past and ongoing activities as described in the Environmental Baseline, and cumulative effects will affect steelhead at the individual fitness level in terms of their growth, survival, or reproduction. Once we have determined if the proposed action when added to environmental baseline conditions will affect the fitness of individual steelhead, the final steps in NMFS' jeopardy assessment are to evaluate first whether these fitness consequences are reasonably likely to result in changes in the likelihood of viability of the Santa Clara River steelhead population unit and the entire endangered Southern California DPS of steelhead. We complete this assessment by relying on the information available on the species and the specific population in terms of its current and needed abundance, productivity, diversity, and spatial structure characteristics, as presented in the Status of the Listed Species and Critical Habitat and Environmental Baseline sections.

A conclusion of "jeopardize the continued existence of" is intended to mean that the federal agency has failed to insure that it is not likely "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of [steelhead] in the wild by reducing the reproduction, numbers, or distribution of [steelhead]" (50 CFR §402.02). In other words, the jeopardy analysis assesses whether a proposed action increases the probability or potential of extinction to a species, not whether a proposed action would cause a species to become extinct solely as a result of the action.

B. Adverse Modification Risk Assessment

The approach to determine if the proposed action is likely to result in the destruction or adverse modification of designated critical habitat involved consideration of how the proposed action would affect elements of critical habitat identified as essential to the conservation of the species. In the Status of the Listed Species and Critical Habitat section, our critical habitat adverse modification risk assessment begins with a discussion of the biological and physical features (primary constituent elements or essential features) in the entire designated critical habitat that are essential to the conservation of the endangered steelhead DPS, the current conditions of such features, and the factors responsible for the current conditions. In the Environmental Baseline section, we discuss the current condition of critical habitat in the action area, the factors responsible for that condition, the conservation role of those specific areas, and the relationship of critical habitat designated in the action area to the entire designated critical habitat at the scale of the DPS to the conservation of the endangered Southern California DPS of steelhead. In the Effects on Critical Habitat section, NMFS characterizes the effects of the proposed action on critical habitat designated in the action area and evaluates whether the designated critical habitat and primary constituent elements in the action area will continue to provide those features and functions that support the biological requirements of the species, or retain the current level of ability to establish those features and functions.

When assessing effects on critical habitat, this biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR §402.02, which was invalidated by *Gifford Pinchot Task Force v. USFWS*, 378 F.3d 1059 (9th Cir. 2004), amended by 387 F.3d 968 (9th Cir. 2004). Instead, NMFS has relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat. Therefore, in considering effects on critical habitat in the final steps of NMFS' assessment, NMFS assessed whether implementation of the proposed action would reduce the ability of critical habitat to remain functional or allow for primary constituent elements to be functionally established for the purpose of serving the intended conservation role for the species.

C. Information Review and Synthesis

To develop an understanding of how the proposed action would affect endangered steelhead and critical habitat for this species, NMFS reviewed the U.S. Army Corps of Engineers biological assessment (Corps 2012a), Operation and Maintenance Manual (2012b), and supporting information contained or referenced in these documents, namely project monitoring reports and the Santa Paula Creek Flood Control Project Phase II – Alternatives Evaluation and Conceptual Design for Fish Passage Improvement at the Santa Paula Creek Flood Control Channel Inlet (Corps 2010a). Additionally, the Southern California Steelhead Recovery Plan (NMFS 2012) identifies physical modification of the existing Santa Paula Creek Flood Control Project to allow steelhead natural rates of migration to upstream spawning and rearing habitats, and passage of smolts and kelts downstream to the estuary and ocean as a critical recovery action. Critical recovery actions are identified as essential to preventing the extinction or irreversible decline of Southern California steelhead.

Information regarding the migratory behavior and ecology of steelhead, and the influence of environmental factors and anthropogenic activities on species migration, was obtained from

articles published in peer-reviewed scientific journals and agency documents. Information was integrated with the findings and information from the hydrologic analyses and the biological assessment. A general knowledge of physical, ecological, and biological processes, population dynamics and theory, and the life history and habitat requirements of steelhead supplemented the information review.

Based on the location of the Santa Paula Creek Flood Control Project and modeled and observed conditions of the Project (e.g., Corps 2010a and 2012a), effects of the proposed action are expected to be confined to one primary constituent element of critical habitat – the freshwater migration corridor.

PCE	Description[a]
Freshwater migration corridor	Freshwater migration corridors free of obstruction 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. These features are essential to conservation because without them juveniles cannot use the variety of habitats that allow them to avoid high flows, avoid predators, successfully compete, begin the behavioral and physiological changes needed for life in the ocean, and reach the ocean in a timely manner. Similarly, these features are essential for adults because they allow fish in a nonfeeding condition to successfully swim upstream, avoid predators, and reach spawning areas on limited energy stores.

[a] Description taken from the critical-habitat designation (NMFS 2005).

When assessing effects of the proposed action at the Santa Clara River population unit and the entire endangered Southern California DPS of steelhead, NMFS included consideration of: (1) the factors that cause population abundance to collapse and become extinct, (2) the fact that the loss of individuals in a population is only one of several factors that can cause population abundance to collapse to the point of extinction, (3) the variety of factors that cause population collapse and extinction, (4) the type, extent, and amount of effects (and exposure and response of steelhead and critical habitat) due to the proposed action, (5) the environmental baseline, (6) the status and distribution of steelhead (and critical habitat), spatial structure, and population dynamics in the Santa Clara River, (7) the value of the Santa Clara River population unit of steelhead and its critical habitat to the viability of the Southern California DPS, and (8) how the proposed action would affect the likelihood of recovery of the Southern California DPS. Evidence that anthropogenic barriers to fish migrations can reduce fish population abundance, increase the risk of extinction, and cause extinctions of populations, can be found in Nehlsen *et al*. (1991), National Research Council (1996), Morita and Yamamoto (2002), Rieman and McIntyre (1993), Dunham *et al*. (1997), Boughton *et al*. (2005), and Gustafson *et al*. (2007).

With regard to population collapse and extinction, certain population attributes can create risk for a species (Pimm *et al*. 1988, Berger 1990, Primack 2004). A small population has a higher risk of extinction than a population made up of a large number of individuals. NMFS considers the number of steelhead in the Santa Clara River watershed and the endangered Southern California DPS of steelhead to be small (NMFS 1997, Good *et al*. 2005, NMFS 2006, NMFS 2011). The principal reasons why small populations are particularly susceptible to a rapid decrease of individuals and local extinction involve loss of genetic variability (and related genetic problems), demographic fluctuations in birth and death rates, and environmental variation (e.g., biotic interactions, food availability, fires, drought). Large population sizes minimize the effects due to loss of genetic variability and population and environmental fluctuations (Pimm *et al*. 1988, McElhany *et al*. 2000). Another attribute that can increase risk involves population variability.

Populations whose number of individuals are susceptible to large temporal variations are more likely to become extinct than populations whose numbers are not inclined to large fluctuations over time. Steelhead abundance in southern California can vary substantially over time. Lastly, species that are short lived can exhibit a greater risk of extinction than long-lived species (Pimm *et al*. 1988). Steelhead are short lived, with a generation time of 3 to 4 years.

D. Assumptions

In addition to assumptions stated elsewhere in this biological opinion, NMFS made the following critical assumptions regarding the proposed action and the ecology and behavior of steelhead in Santa Paula Creek. The basis for these assumptions generally involves NMFS' understanding of the proposed action, the flow and channel dynamics of Santa Paula Creek within the action area, and the migratory behavior, ecology, and habitat requirements of steelhead.

1. In the Santa Paula Creek watershed, adult and juvenile steelhead primarily migrate from December 1 through May 31, with juvenile emigration continuing into June. While we believe this migration window represents the principal migration period for the species in this river, this window is not likely inclusive. The assumed migration window may be an abbreviation of the true migration window because investigators report a slightly broader migration period for steelhead in the Santa Clara River and tributaries (i.e., November to June) (Fukushima and Lesh 1998). Given our knowledge on the timing of steelhead migration, which includes observations on adult steelhead in streams and estimated time of entry, we believe the migration period defined above is reasonable.

2. The precipitation[6] and stream discharge records[7] reviewed for Santa Paula Creek (water-years 2003 through 2012), representing the period of observed conditions since the fish ladder was constructed, encompass the range of below normal, normal and above normal water-years for this watershed and are assumed to be a reasonable representation of future hydrologic conditions as would occur under the proposed project life (i.e., next 40 years). However, as presented under the section *Regional Climatic Variation and Trends*, some scientists report projected trends of increased frequency of high-intensity storm events without necessarily increasing the total annual precipitation. Potential consequences of this for Santa Paula Creek are a reduction in steelhead migration opportunities (e.g., reduction in number of days associated with storm-induced flows) and an increase in the amount and size of sediment transported during storm-induced flow events.

3. The hydraulic design criteria applied to the existing fish ladder (Corps 2000) summarized below, generally represent agency accepted fish-passage guidelines (e.g., NMFS 2001

[6] Based on the Santa Paula Canyon-Ferndale Ranch (Station No. 173) annual precipitation record (water-years 1957-2012), water-years 2003 through 2012 resulted in 2 years of average precipitation (within 5 percent of average), 4 years below average precipitation (31 to 66 percent of average), and 4 years above average precipitation (112 to 266 percent of average), including the minimum (2007) and maximum (2005) annual precipitation records.

[7] Based on the Santa Paula Creek USGS Gaging Station (1113500) annual peak discharge record (water-years 1933-2012), water-years 2003 through 2012 resulted in 4 years below the median peak annual discharge (1,230 cfs) (ranging from 72 to 803 cfs) and 6 years above the median peak annual discharge (ranging from 2,410 to 27,500 cfs).

and CDFG 2009) and hydraulic conditions necessary to provide volitional upstream migration for steelhead in Santa Paula Creek.

a. Hydraulic drop (between weir pools) of less than or equal to 12 inches;

b. Average water velocity through weir pools of less than or equal to 1.0 feet per second; and

c. Energy dissipation factor of less than or equal to 4.0 ft-lbs/s/ft^3.

4. The proposed repairs, including minor modifications, to the fish ladder are not expected to change the hydraulic conditions of the existing fish ladder.

5. Because stream discharge in Santa Paula Creek is naturally "flashy" (rises and falls relatively quickly), and the migration behavior and ecology of steelhead evolved under such conditions, we expect adult steelhead must be able to volitionally migrate swiftly through lower Santa Paula Creek.

VI. EFFECTS OF THE PROPOSED ACTION

The purpose of this section is to identify the direct and indirect effects of the proposed action, and any interrelated or interdependent actions, on the endangered Southern California DPS of steelhead and designated critical habitat. Interrelated actions are those actions that are part of larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the proposed action (50 CFR § 402.02). There are no known actions interrelated or interdependent to the proposed action.

The principal issue related to the Project is whether steelhead can volitionally[8] migrate (upstream and downstream) through the flood control channel and past the fish ladder to satisfy life history requirements of this species. Given the location of the action area is within in the lower 2 miles of Santa Paula Creek, all steelhead attempting to enter or leave the Santa Paula Creek watershed must pass the Project facilities. Adult and juvenile steelhead migrate during the wet season particularly during and shortly after periods of rain-induced pulses in discharge (Shapovalov and Taft 1954, Spina *et al*. 2005). Because the proposed action, and associated effects, overlaps with the wet-season migration of adult and juvenile steelhead, most of NMFS' analyses reported here are confined to the winter-spring seasons, i.e., December through May.

A. Effects on Critical Habitat

In this section, we describe the effects of the proposed action on designated critical habitat in Santa Paula Creek for the endangered Southern California DPS of steelhead. Knowing the effects to habitat, including critical habitat, is necessary to adequately predict effects of the proposed action on endangered steelhead, which we do in the subsequent section (*Effects on Steelhead*). Effects of the proposed action (i.e., operation and maintenance of the existing flood control channel and fish ladder) are expected to be confined to the freshwater migration corridor

[8] Volitional passage: A form of fish passage whereby the fish's opportunity and choice to move freely past some impediment is continuously available, and the aquatic conditions are within the swimming ability of the target life stage and species intended for passage, such that all healthy individuals of the population can pass at will, or..."of their own volition."

from the Santa Paula Creek-Santa Clara River confluence to approximately 500 feet upstream of the fish ladder. We emphasize that this is a reinitiated consultation for an existing facility and that the effects created by the proposed action are not new, but are a continuation of the existing effects of operating and maintaining the flood control channel and fish ladder on critical habitat for steelhead. The proposed action is anticipated to continue to affect the function of the freshwater migration corridor for endangered steelhead through lower Santa Paula Creek resulting from operation and maintenance of the flood control channel (i.e., perpetuating simplified habitat conditions (stream channelization) through removal of sediment and vegetation every 3 to 4 years) and the fish ladder (i.e., design functionality given the observed sediment (gravels, cobbles and boulders) accumulation and timing of maintenance to restore migratory function).

Flood Control Channel

The analysis of steelhead migratory conditions through the flood control channel compares the Corps' hydraulic modeling output (Table 2) to published salmonid swimming abilities used for assessing fish passage (Table 3) and hydraulic design guidelines (e.g., NMFS 2001 and CDFG 2004). The analysis focuses on upstream migrating adult steelhead which would be most affected by the hydraulic conditions (i.e., velocity and depth) encountered in the flood control channel. While the NMFS (2001) guidelines are in reference to road crossings and culverts, they provide general direction for other hydraulic design features (e.g., constructed stream channel) when considering fish passage. NMFS (2001) specifies a minimum depth of 1 foot, and that an average velocity (cross-section) of 2 feet per second (ft/sec) should not be exceeded for facilities greater than 300 feet in length for adult salmonids. NMFS recognizes that the referenced guidelines are conservative in order to provide for a broad range of adult steelhead swimming abilities (i.e., weaker swimmers). However, given the extremely limited numbers of upstream migrating adult steelhead and the short duration of migratory opportunities encountered in Santa Paula Creek, NMFS finds conservative guidelines are appropriate for consideration.

The proposed action is expected to maintain the lower reach of Santa Paula Creek, approximately 9,000 feet, in a disturbed and unstable state through frequent (i.e., every 3 to 4 years) removal of sediment and vegetation from the stream channel. The frequent anthropogenic disturbance to the streambed limits or precludes the natural development or reestablishment of habitat features expected to occur in this reach of Santa Paula Creek (e.g., in-channel/overhanging vegetation, boulders, woody debris, and pools). The lack of or limited distribution of these habitat features, particularly hiding and resting areas, reduces the ability of migrating steelhead to avoid predators and reduce fatigue.

The Corps' hydraulic modeling estimates the average water velocity and maximum water depth at 139 channel cross-sections for a range of stream discharges (i.e., 10 to 1,700 cfs) for the reach between the Santa Paula Creek-Santa Clara River confluence and the downstream end of the fish ladder. Applying the CDFG (2004) prolonged swimming speed (6.0 ft/sec) to the median value of predicted water velocities, indicates that upstream migrating adult steelhead are likely to experience fatigue (time to exhaustion) while migrating through the flood control channel (Table 4), particularly at flows greater than 50 cfs which approaches the reported upper limit (4.6 ft/sec) of adult steelhead sustained swimming speed (i.e., normal function without fatigue) (Powers and Orsborn 1985, as reported by Bell 1973). NMFS recognizes that upstream migrating steelhead

likely encounter similar velocities in an unaltered environment and adapt by seeking lower velocity areas, such as in-channel resting areas (e.g., boulders or woody debris) and vegetated stream margins. However, the extent of habitat simplification owing to the proposed action is expected to limit or preclude the availability of such habitat features.

Table 2. U.S. Army Corps of Engineers predicted depth and velocity for the Santa Paula Creek Flood Control Project channel including the constructed low-flow channel dimensions: depth (3.28 ft), bottom width (9.84 ft), top width (22.97 ft), and Manning's roughness (0.035).

Stream Flow (cfs)	Maximum Channel Depth (ft)				Average Cross-Section Velocity (ft/s)			
	Min	Max	Mean	Median	Min	Max	Mean	Median
10	0.3	2.5	0.4	0.4	0.3	3.1	2.4	2.6
25	0.6	2.6	0.7	0.7	0.7	4.1	3.4	3.5
50	0.9	2.7	1.0	1.0	1.2	5.0	4.3	4.4
75	1.1	2.8	1.3	1.2	1.5	5.6	4.9	5.0
100	1.3	3.1	1.5	1.4	1.7	6.0	5.4	5.5
125	1.5	3.3	1.7	1.6	1.9	6.4	5.8	5.9
150	1.7	3.5	1.9	1.8	2.0	6.7	6.0	6.1
200	2.0	4.0	2.2	2.1	2.3	7.2	6.6	6.7
250	2.3	4.3	2.4	2.4	2.5	7.6	7.0	7.2
500	3.2	5.7	3.4	3.3	3.1	8.9	6.5	6.4
1000	3.7	6.8	4.1	4.0	4.7	9.5	8.2	8.1
1250	3.9	7.4	4.3	4.2	5.1	10.7	8.8	8.8
1500	4.1	8.0	4.6	4.5	5.3	11.1	9.3	9.3
1600	4.2	8.3	4.6	4.6	5.1	11.2	9.6	9.5
1700	4.3	8.6	4.7	4.6	4.9	11.4	9.8	9.7

Table 3. California Salmonid Stream Habitat Restoration Manual (CDFG 2004) minimum water depth requirements and swimming ability inputs for *FishXing*.

Species or Lifestage	Minimum Water Depth	Prolonged Swimming Mode		Burst Swimming Mode	
		Maximum Swim Speed	Time to Exhaustion	Maximum Swim Speed	Time to Exhaustion
Adult anadromous salmonid	0.8 feet	6.0 ft/sec	30 minutes	10.0 ft/sec	5 seconds

Table 4. Estimated swimming distance for upstream migrating adult steelhead before exhaustion for the Santa Paula Creek flood control channel (approximately 9,000 feet) based on CDFG (2004) maximum prolonged swimming speed (6.0 ft/sec) to exhaustion (30 min).

Stream Flow (cfs)	Water Velocity (ft/sec)[a]	Swimming Distance (ft)[bc]
10	2.6	6120
25	3.5	4500
50	4.4	2880
75	5.0	1800
100	5.5	900
125	5.9	180
150	6.1	0
500	6.4	0
1000	8.1	0
1500	9.3	0

a. Median value of 139 cross-sectional average stream velocities from U.S. Army Corps of Engineers hydraulic modeling data.

b. Swimming Distance = (Swimming Speed (6.0 ft/sec) – Water Velocity) X Time to Exhaustion (1,800 seconds)

c. Negative values converted to 0.

Review of the maximum channel depths from the hydraulic modeling output indicates that the flood control channel does not meet CDFG or NMFS guidelines for minimum water depth when flows are less than 50 cfs. Additionally, Thompson (1972) identifies a minimum water depth of 0.6 feet over riffles (shallowest segments of a stream reach) for at least a continuous 10 percent and cumulative 25 percent of the riffle cross-section. Considering the uncertainties regarding locations (i.e., not necessarily riffles) and extent of channel width represented by the hydraulic modeling output, the data suggests that the minimum depth criteria for migrating steelhead, according to Thompson (1972), may not be met until flows approach or exceed 50 cfs. The proposed action is expected to result in shallow water depth (i.e., <1.0 foot) over the majority of the flood control channel at flows of 50 cfs or less. Stream flows of 50 cfs or less, and therefore, insufficient water depth, have a probability of occurring about 85 percent of the time during the migratory period based on flow exceedence values presented in Corps (2010a). Furthermore, the hydraulic modeling output incorporates a low-flow channel design (see Table 2) that is constructed following sediment removal every 3 to 4 years. The low-flow channel configuration has been observed to be altered by the first storm event following construction (Corps 2010b). Channel conditions following alteration by storm flows appear wider and shallower relative to

stream flow than predicted by the hydraulic modeling output, suggesting even shallower depths until flows exceed 50 cfs. Shallow water depth can obstruct fish passage and increase exposure of steelhead to predation and poaching, particularly when combined with limited to no overhead cover (i.e., riparian vegetation).

Therefore, the proposed action reduces the attributes and function of the freshwater migration corridor (NMFS 2005), the PCE of designated critical habitat in the action area, resulting in obstruction of upstream migrating adult steelhead through fatigue when flows are greater than 50 cfs and increased exposure of migrating juvenile and adult steelhead to predation and poaching when flows are less than 50 cfs.

Fish Ladder

The analysis of steelhead migratory conditions at the fish ladder, under the proposed action, is based on qualitative performance categories assigned to storm flow magnitude. Using the Corps' hydraulic modeling output, sediment transport modeling output, and qualitative monitoring data (photos and inspection reports), NMFS delineated fish-ladder performance into four categories (Table 5). The development of the fish-ladder performance categories is described in Appendix A, including applied references. Given that the existing fish ladder does not meet published design criteria for the range of design flows (10 cfs to 150 cfs) and that the range of design flows does not encompass the full range of flows when steelhead are likely to be migrating in Santa Paula Creek, the highest level of anticipated fish passage performance is qualified as slightly impaired.

Table 5. Anticipated fish-passage performance for the Santa Paula Creek Flood Control Project fish ladder following storms having various peak discharge values.

Fish Passage Performance Category*	**Peak Flow (cfs)**	**Mobilized Sediment Size (ft)**	**Observed Fish Ladder Condition**
Slightly Impaired Passage	<500	sand and gravel (<0.1)	Accumulation of silt, sand and gravel at weir pool margins.
Moderately Impaired Passage	500 – 1,500	coarse gravel (0.1) to large cobble (1.0)	Accumulation of gravel and large cobble in weir pools.
Significantly Impaired Passage	1,500 – 5,000	medium boulders (2.0)	Boulder occlusion of 1 to 3 fish ladder weir notches and accumulation of cobbles and boulders in weir pool(s). Hydraulic flanking of ladder caused by aggradation at upstream end of ladder.
Severely Impaired/No Passage	>5,000	boulders (>2.0)	Ladder partially (3 or more weir pools) or fully covered with boulders. Hydraulic flanking of ladder caused by aggradation at upstream end of ladder.

*Given that the existing fish ladder does not meet published design criteria (surrogate for unimpaired passage) for the range of design flows (10 cfs to 150 cfs) and that the range of design flows does not encompass the full range of flows when steelhead are likely to be migrating in Santa Paula Creek, the highest level of anticipated fish passage performance is qualified as slightly impaired.

Santa Paula Creek hydrologic data[9] corresponding with the steelhead migration period (December 1 through May 31) were examined for water-years 2003 through 2012[10], the period following construction of the fish ladder. These water-years represent a full range of hydrologic conditions demonstrated by below normal, normal and above normal annual rainfall, and storm flow magnitudes, and are expected to represent hydrologic conditions over the duration of the proposed action (i.e., 40 years). The fish-ladder performance categories were applied to each of these water-years to assign individual storms (rain-induced pulses in stream flow) to the corresponding performance category. Multiple flow peaks occurring within a few days of one another were considered as a storm series with the performance category determined by the highest flow.

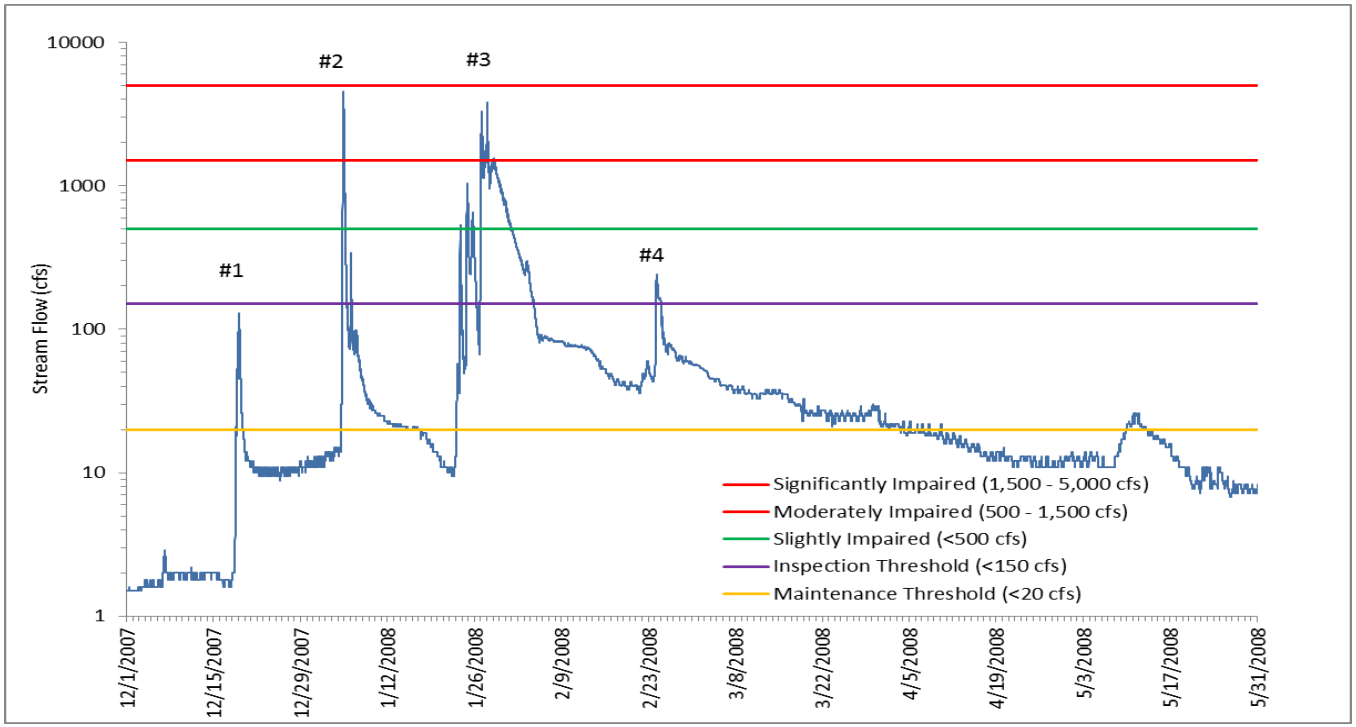
Maintenance thresholds (i.e., minimum flow conditions and response time for maintenance), based on the proposed action[11] and outlined below, were applied to each storm hydrograph to determine if fish-ladder maintenance would occur prior to the subsequent storm event or before flows receded below the minimum design flow (10 cfs). Individual storms were adjusted in whole or part by either a) reducing the relative portion of the individual storm flow period (number of days) within the assigned performance category when maintenance thresholds were met and maintenance was presumed to restore the fish ladder to design conditions (i.e., Slightly Impaired Passage) prior to the next storm, or b) elevating the performance category to the previous performance category (if higher) when maintenance thresholds were not met (e.g. adjusting Moderately Impaired to Significantly Impaired). Figure 2 provides an example of adjusted fish-ladder performance and Table 6 summarizes the results of this analysis for all water-years (2003 through 2012). The flow conditions and response time for maintaining the fish ladder applied to this analysis are as follows:

- Inspection of the fish ladder to assess maintenance needs would occur within 2 days of stream flow receding below 150 cfs; and
- Maintenance of the fish ladder would be completed 14 days following average daily flow receding below 20 cfs.

[9] USGS gaging station 11113500 located approximately 3.5 miles upstream of the Santa Paula Creek Flood Control Project.

[10] Available data for this analysis consisted of daily average and annual peak discharge for water-years 2003, 2004 and 2005, and instantaneous discharge (i.e., 5-minute interval) for water-years 2006, 2007, 2008, 2009, 2010, 2011, and 2012.

[11] The thresholds for conducting maintenance of the fish ladder (i.e., minimum flow conditions and response time) applied to the fish-ladder performance assessment are NMFS' interpretation and summarization of the Corps' project description (Corps 2012a) and subsequent descriptions provided during the consultation (see Corps letter of August 3, 2012).



Storm #	Peak Flow (cfs)	Fish-Ladder Performance Category (days)	Adjusted Fish-Ladder Performance Category (days)	Percent of Total Storm Days per Performance Category	
				Significantly	Slightly
#1	129	Slightly Impaired **(17)**	N/A	0%	11%
#2	4,580	Significantly Impaired **(19)**	N/A	12%	0%
#3	3,840	Significantly Impaired **(32)**	N/A	21%	0%
#4	240	Slightly Impaired **(86)**	Significantly **(54)**[a] / Slightly **(32)**[b]	35%	21%
Total		**154 storm days**	**Significantly (105) / Slightly (49)**	**68%**	**32%**

Figure 2. Summary of water-year 2008 fish-ladder performance assessment representing adjusted fish-ladder performance categories for storm #4: (a) although the storm peak represents a "slightly impaired" category, the storm event assumed the previous (higher) fish-ladder performance category ("significantly impaired") since the minimum flow threshold for maintenance (<20 cfs) was not attained prior to the onset of storm #4, and (b) following 14 days of flows less than 20 cfs, maintenance was assumed to be performed and the remaining storm period (≥10 cfs daily average flow) was adjusted to the "slightly impaired" category.

Table 6. Cumulative anticipated fish ladder performance for water-years 2003 through 2012.

Fish-Ladder Performance Category	Cumulative Migration Days[a]	Percent of Total Migration Days
Slightly Impaired	172	19%
Moderately Impaired	124	14%
Significantly Impaired	368	42%
Severely Impaired / No Passage	218	25%
Total	882	100%

a. Number of days average daily flows were ≥10 cfs associated with a storm event (migration flow) per category after adjusting for maintenance thresholds: 2 days at average daily flows of <150 cfs for inspection and 14 days at average daily flow <20 cfs for maintenance.

The Corps' hydraulic modeling output used in the development of the existing fish ladder indicates that fish-passage design criteria are generally met at flows between 10 and 150 cfs when the fish ladder is operating in a "clean condition" (i.e., free of sediment). However, the accumulation of sediment in the fish ladder, particularly associated with rain-induced pulses in flows (storm events) that correspond with the steelhead migration period, has been observed to reduce or eliminate fish ladder function. Based on observed and anticipated conditions of the fish ladder associated with the categorized flow values, this analysis assumes that stream flows ranging between 10 and 150 cfs (i.e., fish-ladder design flows) and occurring under conditions equivalent to the "Slightly Impaired Passage" or "Moderately Impaired Passage" fish-ladder performance categories represent the period when steelhead are likely capable of migrating (upstream and downstream) past the fish ladder. Stream flows occurring under conditions equivalent to the "Significantly Impaired Passage" or "Severely Impaired/No Passage" categories represent the period when upstream migration of adult steelhead past the fish ladder is precluded or appreciably diminished (i.e., fish-ladder weir notches become blocked by boulders and weir pools fill with gravel, cobble and boulders), and downstream migrating steelhead are exposed to injury from the fish ladder (i.e., stream flows flanking the fish ladder and flowing down the grouted-rock apron).

NMFS understands the qualitative nature of the fish-ladder performance categories and that volitional passage may be disrupted or precluded under the Slightly Impaired and Moderately Impaired performance categories (i.e., weaker swimmers), and that some fish passage may be provided under the Significantly Impaired and Severely Impaired/No Passage performance categories (i.e., stronger swimmers). However, for purposes of evaluating the anticipated effects of the fish ladder and proposed maintenance on the freshwater migration corridor based on the available information, NMFS assumes that adult steelhead will volitionally migrate through and past the fish ladder under conditions equivalent to the Slightly Impaired and Moderately Impaired performance categories, and not volitionally migrate (precluded migration) under the Significantly Impaired and Severely Impaired/No Passage performance categories. As summarized in Table 6, the freshwater migration corridor through the action area, under the proposed action, would be obstructed 67 percent (42 percent Significantly Impaired plus 25

percent Severely Impaired) of the available migration period[12], based on the past 10 years. Furthermore, individual analysis of the water-years above the median annual cumulative storm-flow duration of 93.5 days (i.e., 2005, 2006, 2008, 2010 and 2011), likely representing greater opportunities for migration and spawning success, resulted in 58 to 99 percent of the available annual migration period being precluded or appreciably diminished.

Therefore, the proposed action reduces the attributes and function of the freshwater migration corridor (NMFS 2005), the PCE of designated critical habitat in the action area, resulting from sediment accumulation (gravels, cobbles and boulders) in the fish ladder during the majority of the steelhead migratory period.

B. Effects on Steelhead

The principal effects on steelhead are in regard to the functional capacity of the flood control channel and the fish ladder to provide volitional passage through and past the facility, as described in the above section, *Effects on Critical Habitat*. The proposed action is anticipated to affect steelhead migrating through lower Santa Paula Creek resulting from operation and maintenance of the flood control channel (i.e., perpetuating simplified habitat conditions (stream channelization) through removal of sediment and vegetation every 3 to 4 years) and the fish ladder (i.e., design functionality given the observed sediment (gravels, cobbles and boulders) accumulation and timing of maintenance to restore migratory function). The indirect effects of maintenance on the migratory function of the facility are incorporated into the analysis of the flood control channel and fish ladder that follows. The direct effects of maintenance follow under the subheading *Maintenance*.

Because steelhead migrate during the wet season and periods of elevated river discharge (e.g., Shapovalov and Taft 1954, Spina *et al*. 2005), the primary period with regard to the effects analysis is December 1 through May 31.

Flood Control Channel

The flood control channel is an existing facility that was previously analyzed regarding effects to steelhead (i.e., NMFS' biological opinion of September 2000), under the assumption that the constructed low-flow channel would maintain the proposed design configuration intended to simulate natural conditions (less disturbed) observed in Santa Paula Creek upstream of the project area, including placement of boulders to simulate riffle-pool sequence. Although, the September 2000 biological opinion based the analysis on the assumption that the constructed low-flow channel would generally retain the design configuration, terms and conditions requiring monitoring and maintenance of the low-flow channel were included in that biological opinion. The Corps did not conduct the required monitoring and maintenance following construction in 2002. However, following reconstruction of the low-flow channel associated with sediment removal from the flood control channel in 2009, the Corps conducted qualitative monitoring that verified the low-flow channel did not retain the design configuration following the first storm

[12] As presented in Table 6, the available migration period (days) is based on average daily flows ≥10 cfs associated with storm events. The total number of migration days for water-years 2003 through 2012 was 882, representing a fraction (48%) of the total period when steelhead migration is anticipated to occur (December 1 through May 31).

flow event, resulting in multiple channels rather than a single-thread channel and areas of shallower depth (Corps 2010b).

The present analysis of the flood control channel, as discussed in *Effects on Critical Habitat*, applies fish-passage guidelines published subsequent to the September 2000 biological opinion (e.g., NMFS 2001, CDFG 2004), and considers the changes to the proposed action, namely: a) boulders would not be incorporated into the constructed low-flow channel that would be expected to provide low velocity resting areas and pool habitat for migrating steelhead, and b) the low-flow channel would not be maintained to design specifications except during sediment removal from the flood control channel occurring every three to four years. The effects to steelhead are relative to the effects to critical habitat, discussed in the previous section, and are summarized as follows.

- Simplification of stream habitat features throughout the flood control channel in the form of extended distances of shallow water depths, high water velocities and limited to no resting and hiding cover, reduces individual steelhead physical fitness (fatigue), and ability to avoid predators.

- Fatigue and associated reduction of fitness that upstream migrating adult steelhead encounter while migrating through the flood control channel (e.g., flows of 50 cfs or greater, Table 4) likely reduce their ability to migrate past subsequent challenges (e.g., the fish ladder) to reach suitable spawning and rearing habitat.

- Shallow water depth coupled with limited to no cover increases exposure of upstream migrating adult steelhead to predation and poaching that would likely result in injury or death. Based on predicted water depths in the flood control channel (i.e., Table 2), steelhead would be most susceptible during flows of 50 cfs or less which have a probability of occurring 85 percent of the migratory period.

- Downstream migrating steelhead (i.e., smolts and kelts) are likely to be adversely affected by increased exposure to predation (resulting in injury or death) associated with limited to no in-stream or overhanging cover in the flood control channel, particularly during periods of shallow flow (i.e., 50 cfs or less) which have a probability of occurring 85 percent of the migratory time period.

The anticipated effects from the flood control channel may reduce or prevent individual steelhead from completing critical life history requirements, thus reducing their contribution and conservation role to the Santa Paula Creek steelhead subpopulation. Given the location of the action area, the effects to individual steelhead extends to the Santa Paula Creek subpopulation as a whole (i.e., all migrating steelhead (upstream and downstream) pass through the approximately 9,000-foot flood control channel).

Fish Ladder

As summarized in the *Consultation History* of this biological opinion, the fish ladder is an existing facility that was previously analyzed regarding effects to steelhead (i.e., NMFS' biological opinion of September 2000) based on the assumption the fish ladder would function as

designed. The fish ladder was designed to provide upstream fish passage (i.e., meet or approximate the specified hydraulic design criteria (depth, velocity and turbulence)) at flows ranging from 10 cfs to 150 cfs (10 percent flow exceedence value), and anticipated to function, with decreasing efficiency, up to and in excess of 300 cfs. Therefore, disruption or delay of upstream migrating adult steelhead at the fish ladder was expected to occur less than 10 percent of the functional migration period.

Under the proposed action, the fish ladder is estimated to appreciably diminish or preclude upstream migration of adult steelhead 67 percent of the cumulative migration period during the past ten years, as presented in the above analysis, *Effects on Critical Habitat*. This condition is facilitated by the excessive accumulation of sediment in the fish ladder and limitations of maintenance to restore fish-ladder function. Furthermore, during water-years that produced greater opportunities for upstream migration of steelhead (i.e., multiple storms (3 or more) and longer duration of flows), the fish ladder conditions were estimated to preclude (or appreciably diminish) upstream migration between 58 and 99 percent of the available time (i.e., water-years 2005, 2006, 2008, 2010 and 2011). For example, water-year 2008 resulted in the highest number of anadromous adult steelhead observed in the Santa Ynez River (Southern California DPS) since monitoring began in 2000. During water-year 2008, the Santa Paula Creek Flood Control Project fish ladder was estimated to preclude or limit upstream passage opportunity 68 percent of the available migration period under the proposed action (see Figure 2).

Precluding or delaying upstream migration of adult steelhead at the fish ladder may cause (or require) selection of nonpreferred spawning habitats (Fleming and Reynolds 1991) that, in turn, may reduce or eliminate spawning success. Santa Paula Creek and the Santa Clara River in the vicinity of the Project do not provide suitable steelhead spawning habitat. For example, the degree of scour and fill of streambed material (gravel and cobble) observed in and associated to the Project during the steelhead spawning season (i.e., winter storm flows) would likely result in the destruction (scour) or burial (fill) of steelhead redds.

The accumulation of sediment in the fish ladder also results in stream flows flanking the fish ladder and flowing down the adjacent grouted-rock apron on either side of the fish ladder. Observations (i.e., monitoring and inspection photos) indicate that flows over the grouted-rock apron are high velocity and shallow. Downstream migrating steelhead (smolts and kelts) are likely to be forced along this path and come into contact with the abrasive grouted-rock apron, at high velocity, resulting in injury or death.

The above anticipated effects on steelhead from the fish ladder are likely to reduce or prevent individual steelhead from completing critical like history requirements, thus reducing their contribution and conservation role to the Santa Paula Creek steelhead subpopulation. Given the location of the action area, the effects to individual steelhead extends to the Santa Paula Creek subpopulation as a whole (i.e., all migrating steelhead (upstream and downstream) pass through the approximately 9,000-foot flood control channel).

Maintenance

The effects of maintenance activities on steelhead are in the context of actually conducting the proposed maintenance (i.e., direct effects), and not in regard to the purpose or result of such

maintenance (i.e., sediment and vegetation removal from the flood control channel to maintain design invert elevations and flood capacity, and restoring the fish ladder to design parameters) which were previously addressed. The direct effects on steelhead associated with maintenance of the fish ladder and flood control channel are assessed based on the timing of the activity and application of measures to avoid or minimize impacts to steelhead, summarized in the *Description of the Proposed Action*.

The effects on steelhead associated with maintaining the fish ladder during the migratory period (i.e., December 1 to May 31) are in regard to the proposed timing and flow restrictions (i.e., maintenance thresholds) to restore fish-ladder function and include migration delay and injury from being forced across the grouted rock apron. These indirect effects are incorporated in the above section regarding the effects of the fish ladder. The direct effect of proposed maintenance during this period is potential injury or death of adult and/or juvenile steelhead by stranding and desiccation associated with dewatering activities (i.e., diverting flows away from the work area) or coming into contact with equipment (e.g., crushed) during sediment removal from the fish ladder if not observed, captured and relocated as proposed.

Maintenance activities conducted between July 1 and October 31 have a limited likelihood of affecting steelhead due to timing. Adult and juvenile steelhead are not expected to be present in the action area at this time. Furthermore, the measures described above (see Description of the Proposed Action – Measures to minimize effects on migrating steelhead) would be expected to confirm the assumption that steelhead are either not present or facilitate implementation of measures to avoid or minimize affecting the species. Therefore, no direct effects to steelhead are anticipated from maintenance activities conducted between July 1 and October 31.

Maintenance activities conducted between June 1 and June 30, and November 1 and December 31 (i.e., proposed work-period extensions) have an increased likelihood of affecting steelhead over maintenance conducted between July 1 and October 31. The timing overlaps with the reported Santa Clara River, including Santa Paula Creek, steelhead migratory period. Proposed minimization measures would reduce potential interaction with steelhead, but these measures do not ensure that juvenile steelhead or kelts would not be present in the action area during this maintenance period. If present, individual steelhead would be at risk of injury by maintenance equipment, and stranding and desiccation (death) associated with dewatering activities. Additionally, the act of capturing and relocating individual steelhead to reduce impacts can result in injury or death. Furthermore, consideration of operations at the Vern Freeman Dam fish ladder for extending the in-channel work period from November 1 to December 31, as considered in the September 2000 biological opinion, was in regard to upstream migrating adult steelhead and not downstream migrating juvenile steelhead. During the Corps' maintenance actions (i.e., sediment removal) in late 2009, which extended into early January 2010, juvenile steelhead were captured and relocated from portions of the stream that were being dewatered in the action area during the first week of January indicating juvenile steelhead are likely to be present during the proposed extended maintenance period of December. Based on recent observations in lower Santa Paula Creek and the Santa Clara River at the Vern Freeman Diversion Dam (approximately 4 miles downstream of the action area) during the periods that correspond with proposed extensions (June 1 to June 30, and December 1 to December 31), NMFS does not anticipate more than 1 adult and 20 juvenile steelhead to be taken annually during maintenance activities over the next few years. The estimated number of individuals that

may be taken is based on observations over the past 4 years and presumed valid for the immediate future (i.e., next few years) and not the life of the proposed action (i.e., next 40 years). As restoration and recovery efforts are implemented in the Santa Clara River watershed, the number of individuals in the action area during proposed maintenance is expected to increase, particularly for the portion of the proposed extension period of December 1 through December 31.

Overall, the proposed action (i.e., flood control channel, fish ladder, and associated operation and maintenance) is expected to preclude or reduce migration (upstream and downstream) of steelhead in Santa Paula Creek over the majority of the available migration period, thus limiting or precluding successful completion of their critical life history requirements (Table 7).

Table 7. Summary of the primary stressors and associated effects on endangered steelhead resulting from the proposed operation and maintenance of the Santa Paula Creek Flood Control Project.

Stressor	Effect	Life History Stage
Fish-ladder weir notch(es) blocked by boulders and weir pools fully or partially filled with sediment – Blockage (full or partial) of access to spawning habitat	Death (stranding) and reproduction failure	Adult (spawning) – upstream migration
Streamflows flanking fish ladder and flowing over grouted-rock apron – Exposure to high velocity flow over abrasive surface	Injury and/or death	Adult (post-spawning) – downstream migration Juvenile (smolt) – downstream migration
Lack of resting cover in flood control channel – Exposure to continuous water velocities approaching or exceeding prolonged swimming ability	Fatigue/reduced fitness; compounds effects of fish-ladder performance	Adult (spawning) – upstream migration
Lack of hiding cover in flood control channel – Exposure to predators and poaching	Injury and/or death	Adult (spawning) – upstream migration Adult (post-spawning) – downstream migration Juvenile (smolt) – downstream migration

VII. CUMULATIVE EFFECTS

Cumulative effects include the effects of future state, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. The only non-Federal action NMFS is aware of in the action area is the Limoneira Company's proposed Santa Paula East Area 1 and 2 community development.

The proposed Santa Paula East Area 1 and 2 development encompasses 523 acres of land adjacent to Santa Paula Creek and includes development of 1,500 single and multiple-family homes, 500,000 ft^2 of commercial property, and 150,000 ft^2 of light-industrial property.

These future actions are expected to increase the potential for adverse effects to steelhead. Increasing the amount of impervious surfaces within the watershed would be expected to increase the potential for dry and wet-season runoff and input of nutrients and potentially toxic elements to surface water where steelhead are present.

VIII. INTEGRATION AND SYNTHESIS OF EFFECTS

This section combines the effects of the environmental baseline with effects of the proposed action and cumulative effects. The purpose of this assessment is to develop an understanding of how the added effects of the proposed action may affect steelhead and critical habitat for this species, the likelihood of survival and recovery of this species, and the functionality of critical habitat to serve the intended conservation role for the species.

The larger river systems are believed to have been the historical foundation for the endangered Southern California DPS of steelhead (Boughton *et al.* 2007b). The Santa Clara River watershed, including the Santa Paula Creek subwatershed, is one such system because of the watershed's large size, spawning and rearing habitat quality, relatively reliable winter river discharge, and greater potential for being independently viable (Boughton *et al*. 2006). This drainage is the largest steelhead-bearing watershed within the Southern California DPS, and up to the mid-1940s, steelhead were abundant in this system (e.g., Moore 1980). Over time, the abundance of steelhead in the Santa Clara River, like other drainages throughout the DPS, has declined dramatically (500 adult steelhead have been estimated for the entire DPS) due to anthropogenic alterations of the watershed and waterways (NMFS 1997, Good *et al*. 2005, NMFS 2006). Presently, the number of steelhead in the Santa Clara River watershed is small. Likewise, the number of steelhead comprising the DPS is small. Because the viability of small populations is especially tenuous, and such populations are susceptible to prompt decreases in abundance and possess a greater risk of extinction relative to large populations (Pimm *et al*. 1988, Berger 1990, Primack 2004), activities that reduce the quality and quantity of habitats, or that preclude formation of population units, are expected to compel the species toward extinction as individual population units become extinct (McElhany *et al*. 2000). Consequently, activities harming steelhead or destroying habitat, including critical habitat, within a population unit have implications for the DPS.

With regard to distribution, of the 46 drainages that currently support the Southern California DPS, only 10 population units possess a high and biologically plausible likelihood of being viable and independent, including the Santa Clara River population unit. Although the geographic area of the DPS is broad, the individual population units are sparsely and unevenly distributed throughout the DPS with extensive spatial breadth often existing between nearest-neighbor populations. Extinction of some population units has been observed as well as contraction of the southern extent of the species' geographic range. With regard to diversity, steelhead anadromy has been either eliminated or reduced in many drainages (including the Santa Clara River drainage) within the Southern California DPS due to a variety of anthropogenic factors including the construction of fish-passage impediments. The loss or

reduction in anadromy and migration of juvenile steelhead to the estuary or ocean has reduced gene flow. The presence of physical impediments to migration has diminished the function of the freshwater migration corridor by limiting or precluding the ability of steelhead to successfully access habitats necessary to complete critical life history requirements.

Population growth rate of the Southern California DPS of steelhead has declined to dangerously low levels. Evidence indicates abundance of steelhead in the DPS has declined dramatically (Busby *et al*. 1996, Good *et al.* 2005), and many watershed-specific extinctions of this species have been reported (Nehlsen *et al*. 1991, Boughton *et al*. 2005, Gustafson *et al*. 2007). The number of adults in the subject DPS (estimated at 500 individuals, Busby *et al*. 1996, Good *et al.* 2005) is considerably less than the minimum number of adults needed to maintain the viability of independent populations within the DPS (4,150 adults per independent population, Boughton *et al*. 2007). Recent genetic studies document a decrease in effective population size and genetic diversity (Girman and Garza 2006), both of which indicate a reduction in freshwater productivity.

Overall, the Southern California DPS of steelhead is at a high risk of becoming extinct in the foreseeable future.

A. Summary of Effects of the Environmental Baseline

Evidence indicates past and present activities have caused habitat loss and fragmentation, and severely reduced migratory opportunities for the Southern California steelhead DPS within the action area and the species ability to access suitable spawning and rearing habitat. The only suitable spawning and rearing habitats in Santa Paula Creek are located upstream of the action area. Anthropogenic activities are believed to have contributed to declines in steelhead abundance within the action area, Santa Paula Creek, and the Santa Clara River watershed. Because human-made obstructions (e.g., dams, diversion and grade-control features) completely block or reduce upstream passage of steelhead to historical spawning and rearing habitat, abundance of this species has declined. Effects of past and present activities are expected to extend into the future.

B. Summary of Effects of the Proposed Action

With regard to critical habitat, the effects due to the proposed repair of the fish ladder and future operation and maintenance of the flood control project are expected to continue to obstruct (reduce or eliminate) access to suitable spawning and rearing habitats located upstream of the action area, and perpetuate simplified habitat conditions lacking in natural features, such as in-channel and overhanging vegetation, boulders, woody debris, and deep pools, that provide suitable resting and hiding cover. Therefore, the effects of the proposed action are expected to continue to appreciably reduce or eliminate the conservation value (i.e., function) of the freshwater migration corridor in Santa Paula Creek.

With regard to the species, the proposed action is expected to appreciably reduce or eliminate the opportunity for upstream migrating adult steelhead to access the available spawning habitat in Santa Paula Creek, likely causing complete or partial reproductive failure in most years. Downstream migrating smolts and kelts are subject to injury when flows flank the fish ladder.

Upstream migrating adult steelhead, and downstream migrating smolts and kelts when migration and spawning is successful, are exposed to increased risk of predation and poaching likely resulting in injury or death. Given the location of the proposed action, these effects extend to the entire Santa Paula Creek subpopulation of endangered steelhead.

C. Combined Effects

The proposed action is expected to reduce, and in some years eliminate, the reproductive success of endangered steelhead in Santa Paula Creek owing to the effects on the function (conservation value) of the freshwater migration corridor. These effects include a) reduced or eliminated access to suitable spawning habitat for upstream migrating adult steelhead at the fish ladder, b) reduced physical fitness (e.g., fatigue) of upstream migrating adult steelhead ascending the flood control channel, exacerbating migratory challenges encountered at the fish ladder, c) increased exposure to physical injury (or death) to downstream migrating smolts and kelts forced down the grouted-rock apron during periods when stream flows flank the fish ladder; and d) increased exposure to predation and poaching for steelhead migrating (upstream or downstream) through the flood control channel.

As previously discussed, the Santa Paula Creek subpopulation is necessary for the viability and recovery of the Santa Clara River steelhead population unit, which is necessary for the viability and recovery of the Southern California DPS. Therefore, given the functional value of the Santa Clara River population, and associated reliance on the Santa Paula Creek subpopulation, to the viability of the Southern California DPS and the extremely limited abundance at the population and DPS level, the continued suppression of steelhead production in Santa Paula Creek is expected to reduce the viability of the DPS and prospects for its recovery.

IX. CONCLUSION

After reviewing the best available scientific and commercial information, the status of the Southern California steelhead DPS and its critical habitat, the environmental baseline, expected effects of the proposed action, and cumulative effects, NMFS concludes the proposed action is likely to jeopardize the continued existence of the Federally endangered Southern California steelhead DPS, and is likely to destroy or adversely modify critical habitat for this species.

X. REASONABLE AND PRUDENT ALTERNATIVE

Regulations (50 CFR §402.02) implementing section 7 of the ESA define reasonable and prudent alternatives as alternative actions, identified during formal consultation, that: (1) can be implemented in a manner consistent with the intended purpose of the action; (2) can be implemented consistent with the scope of the action agency's legal authority and jurisdiction; (3) are economically and technically feasible; and (4) would, as NMFS believes, avoid the likelihood of jeopardizing the continued existence of a listed species or destroying or adversely modifying critical habitat. NMFS believes the following reasonable and prudent alternative will avoid the likelihood of jeopardizing the continued existence of the endangered Southern California DPS of steelhead or destroying or adversely modifying critical habitat for this species:

> Implement an operation plan (facility design and maintenance) for the Santa Paula Creek Flood Control Project that restores and maintains a continuous,

unobstructed, and properly functioning freshwater migration corridor in lower Santa Paula Creek *to provide or approximate unimpeded migration (upstream and downstream) of steelhead during winter and spring over a broad range of hydrologic events* (hereafter referred to as the *fish-passage goal*).

NMFS recognizes that the Santa Paula Creek Flood Control Project is an existing facility requiring continued operation and maintenance to meet its intended purpose of reducing flood risk (i.e., risk to life and property) and that planning and implementation of any structural modifications necessary for the conservation of endangered steelhead while also meeting the intended purpose of the Project will not be immediate. Therefore, NMFS developed the reasonable and prudent alternative in the context of short-term and long-term actions necessary to alleviate the primary stressors (see Table 7) identified in this biological opinion that resulted in a determination that the Corps had not insured that the proposed action was not likely to jeopardize the continued existence of endangered Southern California steelhead or destroy or adversely modify critical habitat for this species.

To ensure that the operation and maintenance of the Project under this reasonable and prudent alternative does not jeopardize the continued existence of the species or adversely modify designated critical habitat, the reasonable and prudent alternative, both short-term and long-term actions, must be implemented in full. Because this biological opinion has determined the proposed action is likely to jeopardize the continued existence of the Federally endangered Southern California DPS of steelhead, and is likely to destroy or adversely modify critical habitat for this species, the Corps is required to notify NMFS of its final decision on the implementation of this reasonable and prudent alternative.

A. Short-term Component

The short-term component of this reasonable and prudent alternative involves developing and implementing strategies and actions to reduce the frequency and duration of effects resulting from the above identified stressors (Table 7) by maintaining the existing fish ladder at or near its specified design criteria (Corps 2000)[13] to the maximum extent practicable[14] and by providing and maintaining resting and hiding cover for migrating steelhead throughout the existing flood-control channel. In recognition of the County's experience and expertise regarding the Project and the Corps' expectation that the County will assume operation and maintenance of the Project, NMFS considers the Corps' coordination with the County critical to the development and implementation of the short-term component of the reasonable and prudent alternative.

[13] Memorandum for Record: Santa Paula Creek Plans and Specifications – Revised Design of the Fish Ladder for Santa Paula Creek Flood Control Project (Corps 2000) identifies the following design criteria and flow ranges for the existing fish ladder:

Flow range: 10 cfs to 150 cfs
Maximum drop between weir pools: 1 foot
Minimum depth in weir pools: 2 feet
Average velocity through weir pools ≤1 ft/sec
Average weir-notch velocity: between 4.0 to 8.0 ft/sec
Energy dissipation factor: less than or equal to 4 ft-lbs/s-ft^3, with maximum upper limit of 6 ft-lbs/s-ft^3

[14] Maintenance requirements are predicated on the Corps' development of a maintenance strategy that provides for personnel safety.

These strategies and actions are interim measures to be taken until the long-term action is fully implemented to attain the fish-passage goal as defined in this reasonable and prudent alternative.

1. The Corps shall develop and implement an interim maintenance strategy, including a monitoring plan, no later than December 15, 2013, that reduces the extent and duration that the fish ladder blocks upstream migration of steelhead to spawning and rearing habitats. This interim maintenance strategy, and any subsequent revisions, requires written agreement from NMFS that the proposed strategy is expected to result in timely and effective maintenance of the fish ladder by incorporating the objectives identified below. Therefore, the Corps shall provide the proposed interim maintenance strategy to NMFS no later than November 1, 2013, to facilitate any necessary discussions and revisions. This interim strategy shall be revised, as necessary, based on monitoring and information and recommendations that may be provided through the process defined under element B (long-term component) of this reasonable and prudent alternative. The objectives of the interim maintenance strategy are as follows:

    a. The Corps shall annually remove all accumulated sediment and debris from the fish ladder during the non-migratory season (e.g., between July 1 and October 31), as specified in the proposed action, to maximize performance of the fish ladder at the onset of the migratory season.

    b. The Corps shall expedite removal of boulders and/or debris from the fish-ladder weir notches (within or adjacent) following individual storm peaks beyond the level described or suggested in the proposed action (i.e., at flows greater than 20 cfs). The objective shall clearly define response thresholds (i.e., maximum flow and timing) and consider any and all mechanisms to safely perform this task without diverting flows from the fish ladder, including but not limited to a) type and size of mechanized equipment for removal, b) equipment staging and readiness, c) equipment operator availability and responsiveness, d) personnel and equipment access (i.e., both sides of fish ladder), and e) early detection of blockages at high stream flows (i.e., greater than 150 cfs). The plan shall incorporate the following:

        i. Inspect the fish-ladder weir notches for blockage or potential blockage (i.e., boulders and/or debris) within 24 hours of a storm peak that is greater than 500 cfs, and each subsequent 24-hour period until confirmation that all weir notches are clear of boulders or debris.

        ii. Remove boulders and/or debris from all weir notches within 24 hours of detection or when average daily streamflow recedes to 150 cfs,[15] whichever occurs first.

2. The Corps shall develop and implement an interim maintenance strategy, including a monitoring plan, no later than December 15, 2013, that reduces the frequency and duration that stream flows flank the fish ladder over the grouted-rock apron. This interim

[15] Inspection of the fish ladder during daily average streamflows of 173 cfs detected boulders blocking the fish-ladder weir notches (Corps 2010b).

maintenance strategy, and any subsequent revisions, requires written agreement from NMFS that the proposed strategy is expected to result in timely and effective maintenance necessary to direct stream flows into the fish ladder by incorporating the objectives identified below. Therefore, the Corps shall provide the proposed interim maintenance strategy to NMFS no later than November 1, 2013, to facilitate any necessary discussions and revisions. This interim strategy shall be revised, as necessary, based on monitoring and information and recommendations that may be provided through the process defined under element B (long-term component) of this reasonable and prudent alternative.

a. The objective shall clearly define response thresholds (i.e., maximum flow and timing) and consider any and all mechanisms to safely perform this task, including but not limited to a) type of material suitable for deflecting flows away from grouted-rock apron and toward the fish ladder, b) type and size of mechanized equipment for installing any flow deflection device, c) equipment and material staging and readiness, d) equipment operator availability and responsiveness, and e) personnel and equipment access (i.e., both sides of fish ladder). The plan shall incorporate the following:

    i. Inspect the inlet structure to determine if streamflows are flanking or likely to flank the fish ladder as streamflows recede (e.g., fish-ladder weir notches blocked by boulders and/or debris) within 24 hours of a storm peak that is greater than 500 cfs, and each subsequent 24-hour period until confirmation that streamflows are not flanking the fish ladder.

    ii. Upon determining that streamflows are flanking or likely to flank the fish ladder, divert streamflows away from the grouted-rock apron and into the fish ladder in conjunction with removing boulders and/or debris from the fish-ladder weir notches, or within 24 hours of average daily streamflow receding to 150 cfs[16], whichever occurs first.

3. The Corps shall develop and implement an interim strategy, including a monitoring plan, no later than July 1, 2014, to provide and maintain resting and hiding cover for steelhead migrating through the flood control channel. The interim strategy should incorporate structural elements (e.g., boulders) at a frequency and configuration to a) provide a water depth of approximately 1-foot throughout the length of the low-flow channel at 10 cfs (lower design flow for the fish ladder), and b) provide a combination of average water velocities and resting areas (e.g., pool habitat) that prevent upstream migrating steelhead from reaching the point of exhaustion, as described in CDFG (2004), at flows of 150 cfs (upper design flow for the fish-ladder) and less. This interim plan, and any subsequent revisions, requires written agreement from NMFS that the proposed strategy is expected to result in stream channel conditions that minimizes the likelihood of exhaustion of upstream migrating adult steelhead and minimizes exposure of migrating adult and juvenile steelhead to predation and poaching.(i.e., depth and velocity, and hiding and

[16] Inspection of the fish ladder during daily average streamflows of 173 cfs detected flows flanking the fish ladder (Corps 2010b).

resting cover). Therefore, the Corps shall provide the proposed interim plan to provide and maintain resting and hiding cover to NMFS no later than April 1, 2014, to facilitate any necessary discussions and revisions to the proposed interim plan, and completion of in-channel work by October 31, 2014. This interim plan shall be revised, as necessary, based on monitoring and information and recommendations that may be provided through the process defined under reasonable and prudent alternative element B (long-term component).

B. Long-term Component

The long-term component of this reasonable and prudent alternative involves an interdisciplinary and interactive process to develop design alternatives, including any necessary structural modifications, for the Santa Paula Creek Flood Control Project (Project) to attain the fish-passage goal as defined in this reasonable and prudent alternative. Following written acceptance from NMFS of the Corps' final design, including an operation, maintenance and monitoring plan, the revised Project shall be fully implemented and operational no later than December 1, 2019. The Corps, or the non-federal sponsor through formal agreement with and oversight by the Corps, shall monitor and maintain the Project in a manner that ensures attainment of the fish-passage goal throughout the life of the Project.

Identification of design-specific objectives for obtaining the fish-passage goal shall be based on established geomorphic and/or hydraulic design guidelines (e.g., STREAM SIMULATION (U.S. Forest Service 2008), and California Salmonid Habitat Restoration Manual—Fish Passage Design and Implementation (CDFG 2009)) and tailored to Santa Paula Creek watershed climate, hydrology, and sediment regimes. The high-flow design objective for attaining the fish-passage goal shall, at a minimum, equate to the 1 percent annual flow-exceedence value (NMFS 2001) with preference for approaching the 2-year recurrence interval flow (CDFG 2009)[17]. Furthermore, based on observations of the existing Project and the analysis in this biological opinion, objectives for the design alternative(s) shall include developing a design that:

- Does not require frequent maintenance of the channel bed and banks (e.g., response to less than a 5-year storm-flow event[18]) to maintain fish-passage or flood control design parameters, and

- Does not require maintenance during the steelhead migration season (December through June) by providing a naturalized fish-migration corridor (e.g., self-forming flow paths) under conditions resulting from high storm-flow events (e.g., 5-year storm-flow event).

The Corps shall apply the following process, or similar process that is agreeable to NMFS, for implementing the long-term component of the reasonable and prudent alternative. The

[17] Corps (2010a) states that the maximum fish-passage design flows may range from 1,300 to 2,900 cfs; this range encompasses the 2-year recurrence interval flow of 1,700 cfs referenced in Corps (2012a).

[18] The 5-year event is chosen here because the local climatic driver for large sediment delivery episodes is the El Nino/Southern Oscillation (ENSO) cycle which on average produces 'wet' years 1 in 5 (Schonher and Nicholson, 1989).

responsive dates are provided to ensure timely initiation of a design process and may be revised through mutual agreement between the Corps and NMFS:

1. The Corps shall convene, no later than March 1, 2014, a cadre of qualified professionals (design team) that possess practical experience in natural channel fish-passage performance and design approaches where debris flow processes occur. Expertise of the design team shall include geomorphology, hydrology, fish-passage engineering, hydraulic engineering, sediment transport, and salmonid biology and ecology.

    a. The Corps shall develop a list of candidates[19], and their respective qualifications, possessing expertise in the above disciplines and provide to NMFS no later than November 1, 2013. Following coordination with NMFS, the Corps shall solicit prospective design team members.

    b. The Corps shall, as part of the candidate selection process, solicit a facilitator possessing expertise in one or more of the above disciplines with experience in leading an interdisciplinary team to oversee the conduct of the design team.

    c. The design team shall perform science-based analyses, as necessary, to identify the specific modifications to the Project that are necessary to attain the fish-passage goal.

2. The Corps shall direct the facilitator and design team to draft an operating framework and schedule to guide the design team's process for completing the tasks outlined below. The draft framework and schedule shall be submitted to the Corps and NMFS, simultaneously, no later than 45 days after convening the design team. The framework and schedule must be agreed to in writing by both the Corps and NMFS before the design team undertakes the substantive technical steps outlined below in 2(a) through 2(e), including any recommended modification to these proposed steps. All of the following tasks/work products are anticipated to require varying degrees of interaction among or between the design team, Corps and NMFS, and require written agreement from NMFS, as outlined below and/or defined in the operating framework and schedule.

    a. Design parameters – The design team will identify the fish migration operational flow range (low, high, and flood-flow design) and hydraulic design criteria (e.g., depth, velocity, and turbulence) proposed for guiding the development and evaluation of conceptual design alternatives intended to achieve the fish-passage goal, based on local climate, hydrology, and sediment regimes while optimizing established fish-passage guidelines. NMFS geomorphology, engineering and

[19] Cadre candidates may be considered from any of the following sources: Federal and state government (e.g., Corps, NMFS, U.S. Fish and Wildlife Service, U.S. Bureau of Reclamation, U.S. Forest Service, CA Department of Fish and Game, etc.), private consulting firms, and academia. Owing to the breadth of expertise and access to analytical tools of the Corps' Engineer and Development Center—Coastal and Hydraulics Laboratory, this cadre could be comprised mostly or entirely from this organization. However, NMFS requires the Corps to include NMFS participation (the NMFS representative(s) shall possess expertise in geomorphology, fish-passage engineering, and steelhead biology and ecology) with this cadre to facilitate mutual understanding of the design development for attaining the fish-passage goal.

biology staff (the specific points of contact in NMFS will be identified at a later date) must review and agree with the proposed design parameters.

b. Conceptual design alternatives – In developing conceptual design alternatives, the design team will consider and list the types of Project modifications (structural and/or spatial) that may be appropriate for attaining the fish-passage goal as defined in this reasonable and prudent alternative. NMFS and Corps geomorphology, engineering and biology staff must be consulted to consider arguments and rationale supporting all contending conceptual designs, and to allow for review of information and conceptual drawings that support each alternative.

c. Feasibility study – Once development of conceptual design alternatives is complete, the design team will undertake a feasibility study. In this study, the design team will build greater detail and develop each design concept of merit (including a preliminary cost estimate as part of the consideration of feasibility) for the purpose of enabling selection of a preferred alternative that is commensurate with the fish-passage goal defined in this reasonable and prudent alternative. NMFS and Corps geomorphology, engineering and biology staff must agree with the set of fish-passage options considered at the feasibility level of study. NMFS must review the findings of the feasibility study and provide written agreement for the preferred alternative based upon design-specific objectives developed by the design team in collaboration with NMFS and the Corps before work on a preliminary design document begins.

d. Preliminary design – Once NMFS has provided written agreement for the preferred alternative, a preliminary design for fish-passage through the Project must be developed based on a synthesis of geomorphic, hydrologic and biologic information (e.g., Preliminary Design Report). The low, high, and flood-flow design parameters shall be confirmed during the preliminary-design phase. Submittal of a Preliminary Design Report is required for NMFS' review.

e. Detailed design – Using elements of the preliminary design, the design team shall proceed to a detailed design phase and prepare the final design and specifications package suitable for implementation. NMFS anticipates that a physical model of the proposed design will be necessary to adequately assess and refine the design prior to finalization to ensure that it meets the fish-passage goal. The design team will inform the integration of a physical model in the detailed design process, and if the design team recommends, the Corps shall provide such services through an appropriate institution (e.g., agency, academic, or private firm) that is acceptable to the design team. Once the detailed design process commences, NMFS and Corps geomorphology, engineering and biology staff must have the opportunity to review and provide comments at each completed design development stage (e.g., 60%, 90%, and draft 100%). Three hard copies and three compact discs of design reports and drawings (11 x 17 inch) at each design stage shall be submitted to NMFS (501 West Ocean Blvd., Suite 4200, Long Beach, California 90802).

Written agreement from NMFS must be obtained for the final design package before proceeding with implementation of the final design.

3. Implementation – The Corps shall implement the final design developed by the design team and with written agreement from NMFS as specified under 2(e). The final design shall be fully implemented and operational no later than December 1, 2019.

4. Monitoring and maintenance – The Corps shall develop a monitoring and maintenance plan informed by the above design process and the expertise of the design team. Upon written agreement from NMFS, the Corps (or the non-federal sponsor through formal agreement with and oversight by the Corps) shall monitor and maintain the Project in a manner that ensures attainment of the fish-passage goal as defined in this reasonable and prudent alternative.

C. Consistency of the Reasonable and Prudent Alternative with Regulations Implementing Section 7 of the ESA

Regulations (50 CFR §402.02) implementing section 7 of the ESA define reasonable and prudent alternatives (RPA) as alternative actions, identified during formal consultation, that: (1) can be implemented in a manner consistent with the intended purpose of the action; (2) can be implemented consistent with the scope of the action agency's legal authority and jurisdiction; (3) are economically and technically feasible; and (4) would, as NMFS believes, avoid the likelihood of jeopardizing the continued existence of a listed species or destroying or adversely modifying critical habitat. In the sections that follow, NMFS provides a summary evaluation regarding the consistency of the RPA with the implementing regulations and, in doing so, responds to the Corps' comments of January 31, 2013, and April 5, 2013, regarding the RPA.

Consistency with the Intended Purpose of the Action.—The elements of the RPA can be implemented in a manner consistent with the intended purpose of the action. The short-term component of the RPA involves interim measures developed and implemented in the context of the existing facility design and are generally a refinement of the Corps' proposed action under the current and/or previous consultations. The long-term component involves developing and implementing an operating plan that includes structural changes to the facility. The process of designing structural modifications to the Santa Paula Creek Flood Control Project to attain the fish-passage goal defined in this RPA provides for Corps interaction and review, thus providing for Corps oversight in the context of intended purposes of the action. Furthermore, fish-passage is a component of the action, including the existing facility, and the Corps funded and engaged in a similar process (developing alternatives for redesigning the fish ladder) in late 2009 and early 2010. Lastly, NMFS has made every effort in the development of the RPA to ensure that the alternative will not preclude the Corps or County from maintaining the Project and related flood-control benefits. For instance, NMFS specifically designed the RPA to focus on and address the Project's impacts on the stream regimen, without altering the intent of the Project, which is flood control. As a result, the RPA is expected to allow the Corps and County to undertake the necessary activities to maintain the Project over time, yet in a manner that will ensure the action area meets the life history and habitat requirements of endangered steelhead to further the long-term survival and recovery of this species.

Consistent with the Scope of the Action Agency's Legal Authority and Jurisdiction.—The RPA can be implemented consistent with the scope of the action agency's legal authority and jurisdiction as demonstrated by the fact that the Corps undertook a similar effort in late 2009 and early 2010 resulting in the Santa Paula Creek Flood Control Project Phase II – Alternatives Evaluation and Conceptual Design for Fish Passage Improvement at the Santa Paula Creek Flood Control Channel Inlet (Corps 2010a). However, in their comments (letter dated January 31, 2013) on the draft biological opinion, the Corps disagreed with NMFS' conclusion that the RPA is consistent with the Corps' authority. As a result, and in an effort to utilize the Corps' expertise for refining the RPA, particularly in regard to the Corps' authority, NMFS requested during the March 19, 2013, teleconference that the Corps provide specific information that would illustrate the Corps' position regarding its authority, or lack thereof, to implement the RPA. In a letter of April 5, 2013, the Corps provided several Project documents and Corps guidance that pertained to the issue regarding authority. NMFS' review and consideration of the information that the Corps provided, including comments contained in the Corps' letters of January 31, 2013, and April 5, 2013, revealed the following findings.

The information that the Corps provided included the Rivers and Harbors Act of 1948; NMFS' review of this Act revealed that, in addition to authorizing the Corps to construct the Project, this Act explicitly authorizes the repair and preservation of the Project for flood control and other purposes, including to "…perform any work necessitated by the effect of flood control on stream regimen…" which NMFS understands as "The system or order characteristic of a stream, i.e., its habits with respect to velocity and volume, form and changes in channel, capacity to transport sediment, and amount of material supplied for transportation."[20] Furthermore, NMFS' review of the information that the Corps made available provides no indication that the RPA is inconsistent with the Corps' authority. The Corps' 1995 General Reevaluation Report (at Sections 5.1.6 and 5.1.13.2) and 2000 Final Supplemental Environmental Assessment acknowledged the Corps' retained authority to design and construct a fish-passage facility pursuant to the original Rivers and Harbors Act authorization for this project. Corps Engineering Regulations 1165-2-119 also provides authority for "work to correct design or construction deficiencies." A design deficiency is "a flaw in the Federal design of a project that significantly interferes with the project's authorized purposes or full usefulness," which is the situation with current fish-passage elements of the project, the design of which prevents proper functioning under the conditions which prevail in Santa Paula Creek. The Corps has acknowledged the design deficiency in its letter of August 3, 2009, to NMFS.

The Corps argues that because implementing the RPA "would likely require new study authority and would clearly require new appropriations," the RPA is not consistent with its authority. However, this argument is problematic because these conditions, as cited in the Corps' letter of April 5, 2013, do not relate to the requirements for developing a RPA under Section 7 of the ESA and endeavor to redefine the requirements of Section 7 of the ESA. In this regard, the Corps is attempting to define the issue to be whether the Corps is currently authorized to undertake the activities that are the basis of the RPA, but such is not the issue that NMFS is required to demonstrate. The real issue at hand, and certainly the issue that NMFS is required to address when developing an RPA, is whether the RPA "…can be implemented consistent with

[20] According to the online ecology dictionary, available at http://www.ecologydictionary.org/REGIMEN_OF_A_STREAM

the scope of the action agency's legal authority…" Based on this requirement of the ESA, and given the authority granted the Corps through the Rivers and Harbors Act to construct, repair and preserve the Project, NMFS concludes the RPA is consistent with the Corps' scope of authority. As a final point, while NMFS recognizes that the Corps' argument regarding funding and additional studies has potential implications for implementing the RPA, NMFS addresses the issues of technical and economic feasibility in the following subsection.

Feasibility of Implementing the Reasonable and Prudent Alternative—In this section, NMFS evaluates the technical and economic feasibility of implementing the RPA, in accordance with the implementing regulations for Section 7 of the ESA. This evaluation begins with consideration of the technical feasibility for implementing the RPA. The evaluation regarding the economic feasibility is presented subsequently.

Technical feasibility of implementing the RPA. The elements of the RPA are expected to be technically feasible for the Corps because dams and diversions are commonly made passable for fish, as a review of the scientific literature regarding fish passage indicates. Within south-central and southern California alone, NMFS is collaborating with numerous project proponents to improve passage conditions for endangered steelhead, including a few select projects that are exceedingly larger in scope than is currently required through implementation of the RPA (e.g., Matilija Dam Ecosystem Restoration Project, Santa Felicia Dam Hydroelectric Project) and several projects have been completed (e.g., Robles Diversion Dam and Fish Passage Facility, San Luis Obispo Creek Fish Passage Improvement at Stagecoach Road, Prefumo Creek Fish Passage Project at Highway 101).

Of particular note involves an ongoing project to improve passage conditions for endangered steelhead on the lower Santa Clara River. This particular project adopted a strategy to assess, diagnose and develop a fish-passage improvement project that is the same or similar to the strategy that is the basis of the RPA. In this regard, the project proponent (United Water Conservation District) convened a panel of fish-passage experts, whom subsequently undertook an evaluation of the performance of the fish passage at the Vern Freeman Diversion Dam. The panel concluded that improvements to fish passage were warranted and identified conceptual alternatives to promote volitional passage of steelhead at the diversion. Currently, the project proponent is in the process of developing design details and pursuing the necessary environmental permits and approvals for implementing the selected passage-improvement alternative. Overall, considerable information exists to indicate that the specific elements of the RPA that are intended to improve passage conditions for endangered steelhead through the action area are technically feasible. As a result, NMFS concludes that implementing the RPA is technically feasible.

Economic feasibility of implementing the RPA. In reviewing the comments NMFS received from the Corps on the draft biological opinion, NMFS found that the Corps does not explicitly question the economic feasibility of implementing the RPA. Rather the comments indicate the Corps would likely need to pursue additional funding and approvals to undertake elements of the RPA. Nonetheless, NMFS considers here the issue of economic feasibility in accordance with the requirements under the ESA section 7 implementing regulations, and the likelihood that the Corps would be successful in securing the necessary approvals to fund implementation of the RPA.

In terms of cost, the RPA is expected to be economically feasible because the studies that are often undertaken to assess and diagnose fish-passage prescriptions are not cost prohibitive. Two most recent and large scale fish-passage assessments that have either been undertaken or are scheduled for implementation in the Santa Clara River Watershed, of which Santa Paula Creek is a part, involve assessments at the Vern Freeman Diversion Dam (lower Santa Clara River) and the Santa Felicia Dam Hydroelectric Project (Piru Creek). The cost to conduct the assessment at Santa Felicia Dam is useful to consider here because this particular assessment is one, if not the, most involved assessment that has yet to be undertaken in southern California for endangered steelhead and therefore represents a reasonable upper limit to the cost for an assessment. The cost for this assessment is expected to be one-million dollars (pers. comm. C. McCalvin, United Water Conservation District, April 10, 2013), but for several reasons NMFS does not anticipate that the cost for the panel assessment that is the basis of the RPA will reach this cost. One principal reason involves the scope of the Project considered in this biological opinion which is substantially smaller in scope than the Santa Felicia Hydroelectric Project. Overall, NMFS concludes that in terms of cost, the RPA is economically feasible.

With regard to the Corps being able to secure the necessary funding, NMFS' review of available information clearly indicates that the Corps has a long and successful history of receiving appropriations for planning, construction and maintenance of the Santa Paula Creek Flood Control Project. Most recent funding allocations include American Recovery and Reinvestment Act funding of approximately $4 million in 2009, $7.5 million in 2010, and $2 million in 2012. As a result, NMFS concludes that the Corps would be successful in obtaining the necessary approvals to fund the RPA.

The Likelihood of Jeopardizing the Continued Existence of a Listed Species or Destroying or Adversely Modifying Critical Habitat.—The elements of the RPA address those aspects of the proposed action that appreciably reduce or prevent safe and successful migration of steelhead through the action area, and continue to cause a decrease in successful reproduction and abundance of this species. Chief among these aspects are the adverse effects of hydraulic and physical conditions within the existing flood control channel and fish ladder that limit or prevent upstream migrating adult steelhead from accessing suitable spawning and rearing habitats. Additionally, conditions resulting from the existing facility and proposed action expose juvenile and adult steelhead to physical injury and increased exposure to predation. The short-term elements of the RPA address the interim period (approximately 6 years) and are intended to minimize existing effects of the facility, including the proposed action, until the long-term physical modifications that are necessary to provide or approximate unimpeded migration of this species are fully implemented and operational. Given the observed capacity of the existing facility to function under the extreme conditions of the Santa Paula Creek watershed (i.e., frequent and large sediment loads and short duration of migration opportunities), the Corps' demonstrated failure to maintain the facility since construction, and the constraints on implementing maintenance described by the Corps during this consultation strongly indicates that an expanded and expedited maintenance strategy developed under the short-term elements of the RPA would only provide partially improved migratory conditions and would not be sustainable over the life of the Project. Therefore, redesign of the facility (i.e., long-term element) to provide a functional freshwater migration corridor for endangered steelhead and to reduce the reliance on frequent and timely maintenance is necessary to ensure that the Project will not jeopardize the continued existence of endangered steelhead. The timing of

implementing the long-term solution generally corresponds with the anticipated implementation of other on-going efforts to restore unimpeded migration of steelhead in the watershed (e.g., Vern Freeman Diversion Dam on the Santa Clara River and Harvey Diversion Dam on Santa Paula Creek). Overall, the RPA is expected to improve the functional value of the freshwater migration corridor (i.e., critical habitat), resulting in increased access for upstream migrating adult steelhead to suitable spawning and rearing habitats in Santa Paula Creek and increased access for downstream migrating kelts and smolts to the Santa Clara River, estuary and ocean. This in turn is expected to increase successful reproduction and overall abundance of the Santa Paula Creek steelhead subpopulation and its contribution to the Santa Clara River population unit. While take of steelhead is anticipated to occur during construction of the long-term element of the RPA, measures specified in the following incidental take statement (i.e., timing of construction, and survey and relocation of steelhead that would be exposed to harm or death from construction related activities) would be implemented to minimize the effect of such taking. Accordingly, NMFS concludes the RPA would avoid the likelihood of jeopardizing the continued existence of Southern California steelhead or destroying or adversely modifying critical habitat for this species.

XI. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA prohibits any taking of endangered species without a permit or exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or to attempt to engage in any such conduct. Harm is further defined by NMFS to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering. Incidental take is defined as take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not the purpose of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary, must be undertaken by the Corps for the exemption in section 7(o)(2) to apply, and assume the reasonable and prudent alternative will be implemented. 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 adhere to the terms and conditions of this incidental take statement through enforceable terms that are added to any contract or agreement with the non-federal sponsor (i.e., Ventura County Watershed Protection District), the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps must report the progress of the action and its impact on the species to NMFS as specified in the incidental take statement (50 CFR §402.14(i)(3)).

A. Amount and Extent of Take

The following description of the anticipated amount and extent of take is predicated on the adoption and implementation of the RPA as defined in this biological opinion. Operating and maintaining the Santa Paula Creek Flood Control Project, even with the RPA, is expected to result in incidental take of the endangered Southern California DPS of steelhead in Santa Paula

Creek as summarized in Table 8 and discussed below.

Table 8. The amount and form of incidental take anticipated from the Santa Paula Creek Flood Control Project.

Period	Activity	Form of Take	Amount of Annual Take		
			Juvenile	Adult	Mortality
2013-2019	Maintenance of existing facility, and Construction of redesigned facility	Capture / Relocation	40	2	2 Juveniles 0 Adult
2013 – 2019	Operation – continued existence of the existing fish ladder including interim element of the reasonable and prudent alternative	Harm (migration delay, reduced spawning success, injury)	Portion of population migrating during average daily flows ≥150 cfs, and the following 24-hour period until flows through the fish ladder are restored (i.e., flows are not flanking the fish ladder and weir notches are clear of boulders or debris).	Portion of population migrating during average daily flows ≥150 cfs, and the following 24-hour period until flows through the fish ladder are restored (i.e., flows are not flanking the fish ladder and weir notches are clear of boulders or debris).	Not quantifiable and not likely detectable. Any observed mortality requires evaluation and modification, as necessary, of strategies implemented under RPA element A-1.
2019 - 2052	Operation and Maintenance of redesigned facility that obtains the fish passage goal defined in the reasonable and prudent alternative	Take is not anticipated	None	None	None

Take resulting from implementation of the long-term component of the reasonable and prudent alternative is expected to be confined to the construction phase of the action because: a) implementing a facility that restores and maintains a continuous, unobstructed, and properly functioning freshwater migration corridor to provide or approximate unimpeded migration (upstream and downstream) of steelhead during winter and spring over a broad range of hydrologic events should eliminate the project-related take associated with migratory delay, stranding, and exposure to predators; and b) any necessary maintenance could be confined to the period when steelhead are not expected to be present in the vicinity of the facility (i.e., July 1 through October 31). While the period for constructing the long-term component of the reasonable and prudent alternative has not been defined, it is reasonable to expect that construction could be confined to the in-channel work period for maintenance as defined by the proposed action (i.e., June 1 through December 31), require no more than 2 years to complete (e.g., June 1, 2018 through December 1, 2019), and allow for steelhead migration in the wet season. Incidental take in regard to implementing modifications to the Santa Paula Creek Flood Control Project to attain the fish-passage goal defined in the reasonable and prudent alternative is in the form of stranding, capture, and relocating individual steelhead. Based on recent observations in lower Santa Paula Creek and the Santa Clara River at the Vern Freeman Diversion Dam (approximately 4 miles downstream of the action area) during the anticipated construction period (June 1 through December 31), NMFS does not anticipate more than 1 adult and 20 juvenile steelhead will be stranded, captured and relocated annually and expects no more than one juvenile steelhead killed and no adults killed annually during construction.

Incidental take of steelhead during the next 6 years, prior to implementing the long-term component of the reasonable and prudent alternative by December 1, 2019, is expected to occur as presented in this biological opinion. This incidental take is associated with the proposed (ongoing) operation and maintenance of the facility during the primary steelhead migration period (i.e., December 1 through May 31), and proposed maintenance activities, including timing extensions, during the period when steelhead are not expected or are less likely to be present in the action area (June 1 through December 31).

Given the limited and uncertain steelhead population size in Santa Paula Creek, the natural annual variability in habitat conditions (i.e., streamflow magnitude and duration that stimulates and provides for migration), and the variation in functional conditions of the existing facility, the actual number of individual steelhead that are likely to be taken annually (December 1 through May 31) owing to the ongoing presence and operation of the flood control channel and fish ladder during the interim period is not known. On one hand, considering all migrating steelhead in Santa Paula Creek must pass through the facility, take of the entire Santa Paula Creek steelhead population could occur. On another, the facility is expected to provide upstream and downstream passage at some level and over some duration of the annual steelhead migration season. Furthermore, the likelihood of directly observing a stranded, injured or dead steelhead is low. Therefore, NMFS relied on the surrogate measure of streamflow magnitude (i.e., 150 cfs) and expected timing (i.e., 24 hours) to restore fish-ladder performance to a level approximating a Slightly Impaired to Moderately Impaired condition, as presented in this biological opinion, to define take limits for the interim operation period (2013 through 2019). Although the level of take cannot be accurately quantified, NMFS expects the short-term component of the reasonable and prudent alternative will serve to minimize the level of take by increasing the duration and

degree the fish ladder and flood control channel provides steelhead passage on an annual basis. To account for take associated with capture and relocation of steelhead during unscheduled maintenance activities (i.e., removal of boulders and/or debris from the fish-ladder weir-notches or weir-pools) occurring within the migratory period (December 1 through May 31) that may be necessary to restore migratory function of the fish ladder, NMFS anticipates no more than 1 adult and 20 juvenile steelhead will be captured annually during unscheduled maintenance activities, and no adults and no more than 1 juvenile will be injured or killed. Measures to minimize or avoid such take will be developed and defined through element A of the reasonable and prudent alternative.

Scheduled maintenance activities during proposed work period extensions of June 1 to June 30 and November 1 to December 31 (i.e., sediment removal from the flood control channel and fish ladder), including measures to minimize adverse effects to steelhead, over the interim period are expected to result in take. Take is expected through stranding, capture and relocation of individuals. Based on recent observations in the lower Santa Paula Creek and the Santa Clara River at the Vern Freeman Diversion Dam (approximately 4 miles downstream of the action area) during the general maintenance period with proposed extensions (June 1 through December 31), NMFS does not anticipate more than 1 adult and 20 juvenile steelhead to be stranded, captured and relocated during scheduled maintenance activities for the interim period (i.e., 6 years). NMFS expects no more than one juvenile steelhead killed and no adults killed during maintenance activities for the interim period.

B. Effect of Take

In this Biological Opinion, NMFS concludes the anticipated level of take associated with the proposed action is not likely to jeopardize the continued existence of the endangered Southern California DPS of steelhead when all of the elements of the reasonable and prudent alternative are implemented.

C. Reasonable and Prudent Measures

NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize and monitor incidental take of steelhead.

1. Ensure that scheduled maintenance activities (i.e., those proposed to occur during the dry season with extensions – June 1 through December 31) are conducted in a manner that minimizes or avoids the likelihood of encountering juvenile or adult steelhead.

2. Ensure that the construction activities associated with repairing the facility or implementing the long-term design solutions to attain the fish-passage goal are conducted during a period and in a manner that minimizes the likelihood of injuring or killing steelhead.

3. Report to NMFS the activities associated with minimizing and monitoring the effects of operation and maintenance.

D. Terms and Conditions

To be exempt from the take prohibitions of the ESA, the Corps must comply with the following

terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary and are as follows:

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

    (a) Confine scheduled in-channel maintenance work (e.g., annual sediment removal from the fish ladder, and maintenance of the flood control channel) to July 1 through November 30.

    (b) Implement measures to minimize or avoid impacts to steelhead that were incorporated into the proposed action (Corps 2012a) and summarized in this biological opinion, including surveying for steelhead presence and any necessary capture and relocation of steelhead found during maintenance activities.

        i. Containers used for relocating captured steelhead shall be equipped with aeration devices.

2. The following term and condition implements reasonable and prudent measure 2.

    (a) Confine the in-channel construction period to June 1 through December 31.

    (b) Implement proposed measures to minimize or avoid impacts to steelhead that were incorporated into the proposed action (Corps 2012a) and summarized in this biological opinion, including surveying for steelhead presence and any necessary capture and relocation of steelhead found during construction activities.

        i. Containers used for relocating captured steelhead shall be equipped with aeration devices.

3. The following terms and conditions implement reasonable and prudent measure 3.

    (a) The Corps shall document evidence demonstrating compliance with the above terms and conditions, and elements of the subsequently developed interim operation and maintenance strategies under reasonable and prudent alternative element A. Documentation shall be submitted to NMFS at 501 W. Ocean Blvd., Suite 4200, Long Beach, California 90802 for review no later than December 31 of each year for the life of the proposed action.

    (b) The Corps shall contact NMFS at 562-980-4045 or 562-980-4020 immediately if one or more steelhead are found dead or injured, or if the number of steelhead captured and relocated during maintenance activities is exceeded or anticipated to be exceeded. Dead steelhead shall be collected and individually placed in an appropriately sized whirl-pack or zip-lock bag, labeled with the date and time of collection, fork length, location of capture, condition of the individual, suspected cause of injury or death, and then frozen as soon as possible. The purposes of the contact shall be to review the activities

resulting in lethal take, to determine if additional protective measures are required, and to discuss handling procedures for injured or dead steelhead.

XII. REINITIATION NOTICE

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 in this opinion, (3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, formal consultation shall be reinitiated immediately.

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Appendices—Final Biological Opinion for Operation and Maintenance of the U.S. Army Corps of Engineers Santa Paula Creek Flood Control Project

Appendix A – Fish-passage performance categories to assess the U.S. Army Corps of Engineers – Santa Paula Creek Flood Control Project fish ladder.

BACKGROUND:

The Corps designed the Santa Paula Creek Flood Control Project fish ladder (fish ladder), in coordination with NMFS and the CA Department of Fish and Wildlife (CDFW; formerly known as CA Department of Fish and Game (CDFG)), based on the below criteria (Corps 2000) to facilitate upstream migration of adult steelhead and downstream migration of juvenile (smolts) and post-spawn adults (kelts).

- Low fish passage design flow: 10 cfs. [50% exceedence for January through April (1928-1992) is 15 cfs]
- High fish passage design flow: 150 cfs. [10% exceedence for January through April (1928-1992) is 150 cfs]
- Maximum drop between resting pools: 12 inches
- Average velocity through weir notch: between 4.0 and 8.0 ft/s
- Average velocity through resting pools: less than or equal to 1.0 ft/s
- Minimum flow depth: 1.0 foot
- Minimum depth in resting pool: 2.0 feet
- Energy dissipation: less than or equal to 4 ft-lbs/s-ft^3

The fish ladder design, constructed in 2002, was considered experimental given the unknowns of potential impacts from sediment transport over and through the fish ladder and its effects on fish ladder performance (Corps 2010a). Although modeling predictions indicated that not all of the criteria would be met (Table 1), the fish ladder was designed to meet or approach the above criteria during flows between 10 cfs and 150 cfs. Given the hydrologic variability of Santa Paula Creek, it was thought that the amount of time in which fish passage effectiveness is reduced would be minimal and as flows receded the effectiveness would increase again and allow fish to pass (Corps 2010a). Subsequent to designing the fish ladder, NMFS published guidelines (NMFS 2001) specifying the low and high fish passage design flows as 50 percent and 1 percent annual exceedence values, respectively, which were calculated as 4.9 cfs and 340 cfs for the period of flow record through 2009 (Corps 2010a). However, CDFG (2009) recognizes that rainfall events in southern California are often more intense but less frequent than further north resulting in more limited opportunities for adult steelhead to migrate upstream to spawning habitat, and a more appropriate upper fish passage design flow in this region may be closer to the 2-year recurrence flow. The 2-year recurrence flow for Santa Paula Creek is 1,700 cfs (Corps 2012a).

Table 1. Santa Paula Creek Flood Control Project fish ladder hydraulic calculations for "clean" condition – no accumulated sediment (Corps 2000 – Table 6, Weir Configuration 5).

Discharge (cfs)	Pool Depth (ft)	Pool Velocity Avg. (ft/s)	EDF* (ft-lbs/s-ft^3)	Notch Depth (ft)	Notch Velocity Avg. (ft/s)
5	1.5	0.3	1.6	1.1	4.2
10	2.0	0.5	2.3	1.4	4.8
50	4.3	0.7	3.0	2.8	8.1
150	5.2	1.4	6.5	4.3	6.6
300	5.7	1.1	4.9	5.2	6.1
400	5.9	1.3	6.0	5.2	7.0
500	6.1	1.5	7.0	5.3	7.7
600	6.3	1.7	7.9	5.4	8.3

* EDF – Energy Dissipation Factor: The rate of energy dissipation within a volume of water, used as a measure of turbulence in hydraulic design approach for roughened channels and fishways (CDFG 2009).

The existing ladder is a pool-and-chute design comprised of 17 notched weirs over a distance of approximately 215 feet at a 7.5 percent slope. The Corps (2012a) proposes to implement minor modifications to the existing ladder to repair damages incurred during the January 2005 storm event (peak flow of 27,500 cfs). The modifications consist of rounding the weir tops and encapsulating with steel plating, and restoring the original weir notch configuration, also to be encapsulated with steel plating. The proposed modification would improve durability of the fish ladder while having negligible effects on hydraulics (Corps 2012a). While the Corps (2010a) acknowledged that quantitative monitoring (i.e. surveying sedimentation quantities, performing velocity and depth profiles and measuring bedload transport rates over a range of flows and sediment conditions) would inform performance of the existing fish ladder, the Corps has not implemented a quantitative monitoring program for the Santa Paula Creek Flood Control Project fish ladder. In particular, sediment has been observed to accumulate in the fish ladder at increasing amounts and sizes relative to storm-flow magnitude.

Therefore, the following fish-ladder performance categories are based on the existing design modeled hydraulics, sediment transport predictions, and qualitative observations (i.e. photo and site inspections) to qualitatively estimate the degree that steelhead will be able to ascend the fish ladder associated with various storm magnitudes.

FISH-LADDER PERFORMANCE CATEGORIES:

Using the Corps' hydraulic modeling output, sediment transport modeling output, and qualitative monitoring (photos and inspection reports), NMFS delineated fish ladder performance into four qualitative categories – Slightly Impaired Passage, Moderately Impaired Passage, Significantly Impaired Passage, and Severely Impaired / No Passage (Table 2). Given that the existing fish ladder does not meet published design criteria (surrogate for unimpaired passage) for the range of design flows (10 cfs to 150 cfs) and that the range of design flows does not encompass the full range of flows when steelhead may be migrating in Santa Paula Creek, or revised high design flow (i.e. 340 cfs) (Table 1), the highest level of anticipated fish passage performance is qualified

as slightly impaired. While Table 2 provides relative occurrence of annual peak storms over the period flow records, it should be recognized that multiple storms of one or more of the following categories is likely to occur in a single year as demonstrated during the past ten years since the fish ladder was constructed.

Table 2. Anticipated fish passage performance for the Santa Paula Creek Flood Control Project fish ladder following storms having various peak discharge values.

Fish Passage Performance	**Peak Flow (cfs)**	**Annual Peak Flow Occurrence 1933-2012**		**Mobilized Sediment Size (feet)** Modeled and/or Observed	**Visually Observed Ladder Condition**
		#	**%**		
Slightly Impaired Passage	<500	20	25%	sand and gravel (<0.1)	Accumulation of silt, sand and gravel at weir pool margins (see Figure 1).
Moderately Impaired Passage	500 – 1,500	24	30%	coarse gravel (0.1) to large cobble (1.0)	Accumulation of gravel and large cobble in weir pools up to/within weir notch (see Figures 3, 4 and 5).
Significantly Impaired Passage	1,500 – 5,000	20	25%	medium boulders (2.0)	Boulder occlusion of 1 to 3 weir notches and accumulation of cobbles and boulders in weir pool(s) (see Figures 6, 8, 9, and 11). Hydraulic flanking of ladder caused by aggradation at upstream end of ladder (see Figure 10).
Severely Impaired/No Passage	>5,000	15	19%	boulders (>2.0)	Ladder partially (3 or more weir pools) or fully covered with boulders (see Figures 12 and 13). Hydraulic flanking of ladder caused by aggradation at upstream end of ladder.

Slightly Impaired Passage (<500 cfs storm peak)

Sediment transport modeling demonstrated that coarse gravel (0.1 feet diameter) is mobilized at flows of approximately 500 cfs (Corps 2010a, Corps 2012a). Figure 1 depicts the fish ladder condition following the initial period after construction (i.e. clean condition) and when average daily flows had not exceeded 65 cfs. Although instantaneous flow data are not available, we presume that peak flows were greater than 65 cfs but less than 500 cfs as suggested by comparing daily average (224 cfs) and peak (782 cfs) flow data of the March 15, 2003, storm event. The Corps (2010a) assumes that the gravel filling the sides of the fish ladder pools demonstrated in Figure 1 does not significantly impair fish passage at low flows, and that the sediment remobilizes and does not significantly impair pool volume or energy dissipation at higher flows when the whole weir crest is wetted and effective. NMFS is not aware of any monitoring data that quantifies sediment accumulation (size, depth, amount and distribution) and associated hydraulic parameters (depth, velocity and EDF) in the fish ladder following a peak

flow event of 500 cfs or less. For purposes of this assessment, we assume that the above description is accurate and that the fish ladder will generally perform as predicted in Table 1 during and following peak flow events of 500 cfs or less. Figure 2 provides a comparison of the fish ladder pools without sediment.

Figure 1. Santa Paula Creek Flood Control Project fish ladder, March 3, 2003 (8.9 cfs average daily discharge).

Figure 2. Santa Paula Creek Flood Control Project fish ladder, August 26, 2011 (5 cfs), approximately two months following maintenance (sediment removal) and prior to any storm flows.

Moderately Impaired Passage (500 cfs – 1,500 cfs)

Sediment transport modeling predicted mobilization of large cobble (0.5 feet diameter) at flows of approximately 1,000 cfs; however, field monitoring photos (e.g. Figure 3) indicate that instantaneous flows of up to 782 cfs move sediment on the order of 0.5 to 1.0 feet in diameter into the fish ladder (Corps 2010a, Corps 2012a). The Corps (2010a and 2012a) qualified this condition as not completely limiting the functionality of the fish ladder. As observed (e.g. Figures 3-5), this condition reduces resting areas for adult steelhead ascending the ladder beyond the level observed for storm events of less than 500 cfs, and facilitates further departure from the design criteria and predicted conditions (Table 1). Storm events of this magnitude and resulting conditions were observed during water year 2012, described below.

Figure 3. Santa Paula Creek Flood Control Project fish ladder on October 7, 2003 (2.8 cfs, daily average discharge) approximately one year following construction.

Water Year 2012 - Example

Storm events within the Moderately Impaired Fish Passage category occurred on March 17 and April 13 of 2012 with peak flows of 677 cfs and 793 cfs (USGS provisional data), respectively. Figures 4 and 5, along with corresponding depth measurements (Tables 4 and 5) taken along the edge of the weirs demonstrates accumulation of sediment that resulted in reduced pool depth (i.e. less than designed and modeled minimum 2.0 feet) and volume, with the majority of the remaining pool volume centered around the notch area (Corps 2012b and 2012c). See Figure 2 for fish ladder condition comparison. Constriction of flow in the weir pools likely further increases average pool velocity and turbulence (i.e. EDF) beyond the design criteria. The loss of pool volume away from the notch reduces potential resting zones and concentrates energy dissipation in the remaining pool volume.

Figure 4. Santa Paula Creek Flood Control Project fish ladder on March 20, 2012 (~8 cfs) following the first stormflow event (677 cfs) of water-year 2012 on March 17, 2012.

Figure 5. Santa Paula Creek Flood Control Project fish ladder on April 16, 2012 (~23 cfs) following storm flow events on March 17 (677 cfs), March 25 (190 cfs), and April 13 (793 cfs).

Table 4. Depth measurements taken in selected fish ladder pools on March 20, 2012, during approximately 8 cfs average daily discharge (USGS provisional data). Measurements were taken laterally along the edge of the weirs forming the pool: "Top" being the weir at the upstream end of the pool, and "Bottom" being the downstream weir.

Pool No. (starting at top of the ladder)	**Pool Depth (feet)**							
	Notch		**3 feet from Notch**		**6 feet from Notch**		**10 feet from Notch**	
	Top	**Bottom**	**Top**	**Bottom**	**Top**	**Bottom**	**Top**	**Bottom**
1	1.5	1.7	1.3	0.1	0.5	0.0	0.0	0.0
8	1.5	1.3	1.4	0.1	1.0	0.0	0.0	0.0
16	1.3	1.5	1.4	0.7	1.5	0.1	0.2	0.0

Table 5. Depth measurements taken in selected fish ladder pools on April 16, 2012, during average daily discharge of 23 cfs (USGS provisional data). Measurements were taken laterally along the edge of the weirs forming the pool: "Top" being the weir at the upstream end of the pool, and "Bottom" being the downstream weir.

Pool No. (starting at top of the ladder)	**Pool Depth (feet)**							
	Notch		**3 feet from Notch**		**6 feet from Notch**		**10 feet from Notch**	
	Top	**Bottom**	**Top**	**Bottom**	**Top**	**Bottom**	**Top**	**Bottom**
1	2.0	2.5	1.5	1.0	1.5	0.0	0.5	0.0
8	2.1	1.5	2.0	1.0	1.75	0.0	0.5	0.0
16	2.5	1.5	2.0	0.25	2.5	0.0	1.5	0.0

Significantly Impaired Passage (1,500 cfs – 5,000 cfs)

Sediment transport modeling predicted mobilization of large cobble (0.5 feet diameter) at flows of approximately 1,000 cfs, and medium boulders (2.0 feet diameter) at flows of approximately 5,000 cfs (Corps 2010, Corps 2012). However, field monitoring photos (Figure 3) indicate accumulation of large cobbles (0.5 to 1.0 feet diameter) in the fish ladder at flows of up to 782 cfs, and medium boulders at flows up to 2,410 cfs (Figure 6) which completely blocked the weir notches and limited the functionality of the fish ladder relative to design thresholds (Corps 2010a, Corps 2012a). The Corps (2010a) further states that if a 2-foot boulder becomes lodged in a notch combined with other sediment or debris, the notches can become occluded to the point that fish passage is severely impaired at lower flows (i.e. less than 50 cfs), but when flow overtops the rest of the weir crest at higher flows fish passage criteria may be met depending on the downstream notch condition. Table 6 summarizes modeling predictions (Corps 2000) for the fish ladder with sediment accumulated in the weir pools up to the top of the weir notch, approximately 3 feet of accumulation. These predicted hydraulic conditions indicate that the

minimum pool depth criteria of 2.0 feet is not met at flows less than 50 cfs and the EDF is not met for any of the modeled flows, particularly at flows equal to or greater than 50 cfs. Weir notches blocked by boulders or debris necessitate fish being able to leap over the weir, requiring adequate pool depth below the weir. Large amounts of turbulence (commonly measured as EDF) can disorient and exhaust fish, resulting in a passage barrier (CDFG 2009).

Photo 13. March 12, 2004 – Looking east at fish ladder weir notch obstructed with large boulders.

Figure 6. Santa Paula Creek Flood Control Project fish ladder on March 12, 2004, following a peak flow event of 2,410 cfs on February 26, 2004.

Table 6. Santa Paula Creek Flood Control Project fish ladder hydraulic calculations with sediment accumulated in pools to top of weir notch – approximately 3 feet of sediment (Corps 2000 – Table 3 (Alternative 3B w/SED)).

Discharge	Pool Depth (ft)	Pool Velocity Avg. (ft/s)	EDF (ft-lbs/s-ft^3)	Notch Velocity (ft/s)
10	0.8	1.0	4.6	3.8
50	1.6	1.9	8.7	5.8
150	2.4	2.7	12.4	7.4

Although storms within this category (1,500 to 5,000 cfs) occurred twice in both water years 2006 and 2008, there is no evidence of monitoring or maintenance for this period (see Figure 7). The Corps did, however, conduct qualitative inspections of the fish ladder following storms within this category for water years 2010 and 2011 discussed below.

Figure 7. Santa Paula Creek Flood Control Project fish ladder, October 2009. Note fish ladder filled with sediment and growing vegetation (willows and alder).

Water Year 2010 - Example

A storm series beginning on January 18, 2010, generated an initial peak flow of 3,020 cfs. This storm occurred within a few weeks following removal of sediment from the fish ladder. The ladder was inspected on January 25, 2010 (Corps 2010b). This qualitative assessment noted that the fish ladder had "*sequestered a noticeable amount of sediment since it was cleaned out*", but did not indicate whether or not the weir notches were occluded, as suggested in Figures 8 and 9 taken after the assessment. Following this storm series and prior to any maintenance of the fish ladder (i.e. sediment removal), three storm events occurred ranging in peak flows from 325 cfs to 951 cfs. Another qualitative assessment of the ladder was conducted on April 14, 2010 (Corps 2010c), following these storms, particularly the 951 cfs peak of April 11, 2010. This assessment again noted the accumulation of sediment in the ladder without mention of the weir notches being occluded.

Although inspections of the fish ladder following selected peak flow events for water year 2010 did not apparently detect occlusion of the weir notches, a subsequent assessment was conducted on September 8, 2010 (Corps 2010d), during low flow conditions (3.8 cfs daily average flow). This report concluded that "*Sediment accumulation within the resting pools and the presence of large rocks/boulders within the weir notches of the Fish Ladder likely limit and/or prohibit movement* [of steelhead] *through the ladder*", suggesting that flow conditions during the post-storm inspection (60 cfs and 18 cfs daily average flow, respectively) may not have facilitated an accurate assessment of the fish ladder.

Figure 8. Santa Paula Creek Flood Control Project fish ladder, February 18, 2010 (~28 cfs).

Figure 9. Santa Paula Creek Flood Control Project fish ladder, February 18, 2010 (~28 cfs).

Water Year 2011 - Example

Storm events occurring on December 19 and 22, 2010, generated peak flows of 2,170 cfs and 904 cfs, respectively. A qualitative assessment of the fish ladder was conducted on December 23, 2010 (Corps 2010e), noting that a) the weir notch between pools four and five was occluded with numerous small boulders resulting in an approximate 3-foot drop between the pools, and b) the majority of flows were flowing over the concrete apron rather than the fish ladder (Figure 10). Daily average flows on the day of this post storm inspection were 173 cfs. Figure 11 depicts the conditions of the weir between pools four and five on March 10, 2011, following a

subsequent storm event of 1,500 cfs on February 25, 2011. The Corps (2011a) noted the drop between pools four and five was about 3 to 4-feet on March 10, 2011, at 25 cfs. The amount of flow in the ladder is not known, as the majority of flows were flowing over the concrete apron adjacent to the fish ladder.

Figure 10. Santa Paula Creek Flood Control Project fish ladder, December 23, 2010 (150-175 cfs).

Figure 11. Santa Paula Creek Flood Control Project fish ladder on March 10, 2011.

Severely Impaired / No Passage (>5,000 cfs)

Sediment transport modeling predicted mobilization of medium-sized boulders (2.0 feet diameter) at flows of approximately 5,000 cfs. As previously discussed under the Significantly Impaired Passage category, medium-sized have been observed to accumulate in the fish ladder at peak flows of less than 2,500 cfs, 50 percent of the predicted mobilizing flow. This category represents a condition where the fish ladder is partially or completely inundated with sediment (boulders) (Figures 12 and 13) to a level that steelhead would not likely be capable of migrating upstream through the fish ladder. Table 7 summarizes predicted hydraulic conditions for a design that is similar to the existing fish ladder, Alternative A described in Corps 2010a, indicating that the resulting shallow and turbulent flow would greatly reduce or preclude upstream migration of adult steelhead.

The Severely Impaired/No Passage category, and to a large degree the Significantly Impaired Passage category, is best summarized by the Corps (2010a) statement: "*With a limited window of migration flows each year and with most migration occurring in the receding flows of a storm event, a fish passage facility needs to have the ability to pass the sediment load during peak flows and be ready to pass fish immediately by meeting fish passage hydraulic criteria. Wedged boulders and resting pools completely filled with sediment severely impact migration potential and it is likely that the required sediment clean out effort to alleviate these threats would come too late and too infrequent*."

Figure 12. Santa Paula Creek Flood Control Project fish ladder, January 11, 2005 (2,010 cfs daily average flow) following a peak flow of 27,500 cfs on January 10, 2005.

Figure 13. Santa Paula Creek Flood Control Project fish ladder, March 28, 2011 (244 cfs daily average flow) following a peak flow of 12,500 cfs on March 20, 2011.

Table 7. Santa Paula Creek Flood Control Project fish ladder hydraulic calculations for Alternative A fish ladder design (Corps 2010a) with ladder completely full of sediment (3-feet or more of accumulation including boulders). Figures are based in visual interpretation of graphs from Mann 2010.

Discharge (cfs)	Pool Depth Avg. (ft)	Pool Velocity (ft/s)	EDF (ft-lbs/s-ft^3)
10	0.25	0.75	4.0
50	0.5	1.5	7.25
150	0.75	2.5	12.0
300	1.25	3.75	17.0
500	1.5	4.75	>20.0

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U.S. Army Corps of Engineers (Corps), Los Angeles District. 2012b. 2012 Post Storm Monitoring Report No. 1 for the Santa Paula Creek Sediment Removal Project. April 2012.

U.S. Army Corps of Engineers (Corps), Los Angeles District. 2012c. 2012 Post Storm Monitoring Report No. 2 for the Santa Paula Creek Sediment Removal Project. April 2012.

Appendix B – NMFS summary and consideration of Corps January 31, 2013, letter regarding comments to the draft biological opinion of September 24, 2012.

Description of the Proposed Action

Corps Comment: Corps recommended the following correction to the draft biological opinion as follows—The Corps will retain federal ~~ownership and~~ discretion over the Project and ensure the ~~County~~ *non-federal sponsor* implements the operation and maintenance activities consistent with the Operation and Maintenance manual.

NMFS Response/Discussion: NMFS appreciates the Corps' clarification regarding ownership of the facility and confirmation that the Corps will retain federal discretion over the Project. The term "ownership" has been deleted and Ventura County Watershed Protection District (County) is identified as the *non-federal sponsor*.

Scope of Consultation

Corps Comment: Corps expressed concern that the following statement contained in the draft biological opinion is based on guidelines published subsequent to completion of the designs for the existing fish ladder.

> *Given that the existing fish ladder does not meet published design criteria (surrogate for unimpaired passage) for the range of design flows (10 cfs to 150 cfs) and that the range of design flows does not encompass the full range of flows when steelhead are likely to be migrating in Santa Paula Creek, the highest level of anticipated fish passage performance is qualified as slightly impaired*.

NMFS Response/Discussion:

The above statement that the existing fish ladder does not meet published design criteria (i.e., water depth, velocity and turbulence) is based on the criteria and analyses presented in the Corps' March 2000 Memorandum for Record: Santa Paula Creek Plan and Specifications – Revised Design of the Fish Ladder for Santa Paula Creek Flood Control Project. These criteria and analyses (i.e., Corps 2000) are summarized in Appendix A of the draft and final biological opinion. Furthermore, the draft biological opinion (see *Assumptions*, pages 24-25) recognized the design criteria applied to the existing fish ladder (Corps 2000) as generally representing agency accepted fish-passage guidelines (e.g., NMFS 2001 and CDFG 2009) and hydraulic conditions necessary to provided upstream migration for steelhead in Santa Paula Creek.

Reference to recommended design-flow guidelines published subsequent to the completion of the design for the existing fish ladder serve to inform the consultation process and analysis to assist the Corps in ensuring its Project is not likely to jeopardize the continued existence of endangered Southern California steelhead DPS or result in the destruction or adverse modification of designated critical habitat for this species.

Corps comment: Corps reinitiated ESA consultation on a minor repair to fish ladder weir caps to make them more durable in the future and to finalize an O&M Manual for the existing Project – the consultation was not a re-examination of the efficacy of the existing facility, which has not been consistently maintained. The Corps holds that the existing facility is capable of performing per the original design criteria if adequately maintained.

NMFS Response/Discussion:

NMFS informed the Corps (NMFS letters of February 23, 2010, and February 25, 2011) that the Santa Paula Flood Control Project is affecting endangered steelhead and designated critical habitat in a manner or to an extent not previously considered (i.e., 2000 BO), and recommended the Corps reinitiate consultation on the Project as required by 50 CFR 402.16. As a result, NMFS considered in this biological opinion the effects of the Project in its entirety on endangered steelhead and designated critical habitat for this species.

The basis of the analysis in the draft biological opinion is in regard to the Corps' proposed action of implementing minor repairs to the existing fish ladder and the O&M Manual for the flood control project as a whole (inclusive of the existing fish ladder and flood control channel). As supported by the record for the Project and the analysis presented in the biological opinion, the Project has not performed/functioned as designed and implementation of the proposed O&M Manual will not ensure maintenance of a functional freshwater migration corridor through the action area necessary to meet the life history and habitat requirements of endangered steelhead.

<u>Frequency and Duration of Impact from Sediment Accumulation in the Fish Ladder</u>

Corps Comment: Corps notes that "volitional passage", as referenced in the draft biological opinion, was not a factor considered during the design process for the existing fish-ladder.

NMFS Response/Discussion: The term volitional passage may not have been explicitly stated in regard to the original design development (e.g., Corps 2000); however, volitional passage (of their own volition) was a basic guiding principle as opposed to capture and transport as a means of providing steelhead access through the flood control channel and over the inlet structure. Volitional passage, during the previous consultation (i.e., September 2000 biological opinion), was presumed by maintaining (or approaching) hydraulic design criteria for the identified design flow of 10 cfs to 150 cfs, and up to 300 cfs. Furthermore, the Corps' 2010 report (Alternatives Evaluation and Conceptual Design for Fish Passage Improvement at the Santa Paula Creek Flood Control Channel Inlet) references the term "volitional passage".

Corps Comment: Corps states that the requirement for a high frequency of maintenance (i.e., sediment removal from the fish ladder) was fully understood and acknowledged during design development and analysis of the existing fish ladder.

NMFS Response/Discussion:

The anticipated frequency of maintenance was not adequately addressed or fully understood in regard to the existing fish ladder, and the presumption was that the selected design (existing fish ladder) would not require the degree (frequency and magnitude) of maintenance that has been undertaken (or should have been undertaken) since the fish ladder was constructed. This

presumption is supported by the Corps' Draft Supplemental Environmental Assessment of April 2000 that was the basis for the September 2000 biological opinion.

a. "*The primary concerns that NMFS had with the original design* [previous to existing fish-ladder design] *was that they preferred a design that required less maintenance to ensure that flow connectivity at the upper and lower ends of the ladder were maintained, and preferred a design that functioned over a wider range of discharges*."
b. "*In the FEIS/FEIR it was estimated that several times a year, VCFCD might need to restore flow through the fish ladder* [previous to the existing fish-ladder design]. *If this diligent maintenance is not performed, the fish ladder would not be functional and upstream migration would be blocked for as long as the flows by pass the ladder.*"
c. "*The proposed redesign chosen* [existing fish ladder] *was felt to provide the best likelihood of functioning hydraulically and yet be maintained with a reasonable amount of effort and expense.*"
d. "*The in-chute design* [existing fish ladder] *also* ***lessens the need for reliance on the diligent maintenance*** (emphasis added) *that would be necessary to maintain flow connectivity at the upper and lower ends under the original design. The in-chute ladder should need less maintenance to maintain flows through the ladder at the upper and lower ends*."

Furthermore, the Corps' 2010 report (Alternatives Evaluation and Conceptual Design for Fish Passage Improvement at the Santa Paula Creek Flood Control Channel Inlet) acknowledges the uncertainty of the existing fish-ladder design regarding sediment accumulation and performance—"*The best available information on passage design was used, however,* ***the fish ladder was still considered experimental*** *given its location at the head of a flood control and sediment basin and the* ***unknowns of the potential impacts from sediment transport over and through the fish ladder*** (emphasis added).

<u>Simplification of Habitat in the Flood Risk Management Channel Due to Prescribed Maintenance</u>

Corps Comment: Corps believes that the analysis in the draft biological opinion regarding sediment removal from the flood control channel (3-4 year frequency) and associated habitat simplification represents a material change in NMFS' position from previous biological opinions (i.e., September 2000 and September 2009).

NMFS Response/Discussion: NMFS' previous biological opinions identified this concern, as follows:

a. September 2000 biological opinion states:
    i. "… artificially armored banks and frequent disturbance of the stream channel and riparian area resulting from the proposed construction, maintenance and operation is anticipated to preclude natural channel evolutionary processes that could improve habitat conditions for steelhead."

ii. "Operations and maintenance of the Project is anticipated to maintain the lower 2 miles of Santa Paula Creek riparian in an immature condition through the periodic removal of sediment and associated riparian vegetation that may establish."

b. September 2009 biological opinion states: "… frequent (every 3 to 5 years) removal of riparian vegetation, boulders and woody debris associated with excavation within the flood control channel is a concern. … The Project further incorporates measures to reclaim these features, monitor persistence and performance of reclaimed features, and maintain these features as needed based on monitoring and coordination with NMFS."

Furthermore, the Corps' proposed action considered in the draft, and now final, biological opinion differs from the proposed actions considered in the referenced previous biological opinions in the following ways:

a. Corps eliminated placement of boulders in the designed low-flow channel. Boulder placement, as previously proposed by Corps, was expected to reduce impacts of channel simplification by providing resting and hiding cover for migrating steelhead.
b. Corps does not intend to maintain the low-flow channel to design specifications between sediment removal events (3-5 years) as required by the terms and conditions of the September 2000 biological opinion, which the Corps has not complied with since construction was completed in 2002.

Corps Comment: The Corps recognizes the possible need to facilitate restoration of habitat following disturbances to habitat due to maintenance and welcomes the opportunity to engage NMFS staff to determine feasible methods of restoration that may be more durable and longer lasting than past efforts.

NMFS Response/Discussion: The short-term element of the reasonable and prudent alternative (A-3) provides for such engagement, as well as basic direction intended to facilitate the Corps' development of an interim strategy necessary to provide and maintain resting and hiding cover for migrating steelhead.

Reasonable and Prudent Alternatives (RPA)

Corps Comment: Corps is concerned that the short deadline to receive approval on the O&M Manual revisions are infeasible given that some of the deadlines have past.

NMFS Response/Discussion: The completion date for interim maintenance and monitoring strategies under the short-term component of the RPA has been revised. NMFS believes the revised dates are reasonable and attainable given: a) the Corps' extensive coordination with County maintenance crews (i.e., non-federal sponsor), as stated in the Corps' letter of January 31, 2013, and b) the Corps has been developing/revising the draft O&M Manual for more than 13 years.

Corps Comment: Corps states that response times for maintenance actions identified in the short-term element of the RPA are unsafe for work crews.

NMFS Response/Discussion: The short-term element of the RPA is predicated on the Corps' development of strategies that provide for personnel safety, and specifies consideration of any and all mechanisms to safely perform maintenance tasks, including type and size of mechanized equipment.

Corps Comment: Corps considers the requirements of the long-term component of the RPA as inappropriate because NMFS' analysis and the long-term component of the RPA is focused on the existence of the Project rather than the Corps' ministerial operation and maintenance activities related to the fish-ladder weir repairs and the O&M Manual.

NMFS Response/Discussion: The Corps designed, built, and retained authority over the maintenance and operation of the Santa Paula Creek Flood Control Project. Given the Corps' authority over the Project, it is required under the Federal ESA to ensure that the proposed action is not likely to jeopardize the continued existence of endangered steelhead or result in the destruction or adverse modification of designated critical habitat for this species. The basis of the analysis in the draft and now final biological opinion is in regard to the Corps' proposed action of implementing minor repairs to the existing fish ladder and the O&M Manual for the existing flood control project as a whole (inclusive of the existing fish ladder and flood control channel). As supported by the record for the Project and the analysis presented in this biological opinion, the existing Project has neither performed as designed nor will implementation of the proposed action (minor repairs to the existing fish ladder and implementation of the O&M Manual) ensure maintenance of a functional freshwater migration corridor necessary to meet the life history and habitat requirements of endangered steelhead. Therefore, the draft and now final biological opinion concludes the Corps' proposed action is likely to jeopardize the continued existence of endangered steelhead and result in the destruction or adverse modification of designated critical habitat. As a result of NMFS' determination (i.e., a "jeopardy" biological opinion), the ESA implementing regulations require the biological opinion to include reasonable and prudent alternatives, if any (50 CFR §402.14 (h)(3)).

Furthermore, the record supports the intent and purpose of the long-term element of the RPA including the Corps' letter of August 3, 2009, that states: *The Corps will prepare required documents, in coordination with the concerned resource agencies, for restoration of fish passage and other design deficiencies at the project inlet during this second step* [i.e., repair/replace the existing fish ladder and ensure the project is capable of providing up to the 100-year level of flood protection], and that *The Corps will seek to use the best available information to plan, design, and construct a practical and effective fish passage structure for the federally listed southern steelhead*.

Appendix C – NMFS summary and consideration of Corps April 5, 2013, letter regarding comments to the draft biological opinion of September 24, 2012, and NMFS-Corps teleconference of March 19, 2013.

Corps Comment: In reference to the long-term element of the RPA (Corps convening a facilitated panel of experts), the Corps states that it would be unprecedented to engage third parties to study fish passage and to potentially select and construct a different mitigation alternative than the fish ladder that was approved by NMFS in the 2000 biological opinion and already constructed.

NMFS Response/Discussion: The intent and purpose of the facilitated expert panel is to provide for development of a design alternative or alternatives to achieve the Corps' flood control objective while ensuring its action is not likely to jeopardize the continued existence of endangered steelhead (fish-passage goal). It is conceivable that this expert panel be comprised mostly, if not entirely, by Corps personnel such as the Corps' Engineer and Development Center—Coastal & Hydraulics Laboratory. Furthermore, the Corps regularly coordinates with other Federal and State agencies when developing its actions, and contracts with private entities to conduct various studies and assessments, including the Santa Paula Creek Flood Control Project as indicated in the Corps' letter of December 28, 2009: *We have contracted assistance from HDR/CDM to prepare conceptual planning to repair/replace the damaged fish passage facility*.

Corps Comment: Corps requests that NMFS remove the draft long-term RPA in the final biological opinion and replace it with specific recommendations for repairs to the existing fish ladder.

NMFS Response/Discussion: As supported by the administrative record for the Project and the analysis in this biological opinion, simply repairing the existing fish ladder and maintaining the Project as described in the operation and maintenance manual (i.e., proposed action) does not ensure that the Corps' proposed action would avoid jeopardizing the continued existence of endangered steelhead. As a result of NMFS' determination (i.e., a "jeopardy" biological opinion), the ESA implementing regulations require the biological opinion to include reasonable and prudent alternatives, if any (50 CFR §402.14 (h)(3)).

In recognition of the considerations for designing a facility in this landscape setting (e.g., alluvial fan at the base of a high sediment yielding watershed) that meets flood control and fish-passage objectives, the long-term element of the RPA outlines a planning process for the Corps to undertake in developing design alternatives. In an effort to utilize the Corps' expertise for the purpose of refining the RPA, NMFS requested during the teleconference of March 19, 2013, that the Corps provide recommendations and/or edits to the RPA. However, the Corps elected to not provide specific recommendations or edits to the long-term component of the RPA beyond that stated above. Therefore, NMFS retained the long-term element of the RPA with revisions, as appropriate, based on further internal review and the Corps' comments received in the letters of January 31, 2013, and April 5, 2013.

Corps Comment: Corps requests the following modifications to the short-term element of the RPA:

a. Corps requests flexibility in the RPA to negotiate concurrence with the non-federal sponsor, Ventura County Watershed Protection District (County), on response times for implementation of maintenance activities to ensure a balance between timely response and safety for workers.

b. Corps requests the non-federal sponsor (County) be identified in the RPA and biological opinion as the responsible party for all future operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) obligations for the Project.

c. Corps requests NMFS to indicate in the RPA that it will accept the OMRR&R manual, subject to conditions that NMFS deems necessary for fish passage.

NMFS Response/Discussion:

a. As supported by the administrative record for the Project, the Corps has coordinated with and is expected to continue coordination with the County, including fulfillment of the short-term element of the RPA. The short-term element of the RPA has been revised to reflect the Corps' coordination with the County.

b. The draft biological opinion (see Description of the Federal Action and Incidental Take Statement) identified the County as the non-federal sponsor and that the Corps proposes to transfer operation and maintenance responsibilities to the County while retaining its federal discretion over the Project and ensuring the County implements the operation and maintenance activities consistent with the O&M manual. Therefore, the Corps, not the County, is responsible for ensuring legal obligations (e.g., ESA) associated with the Project are met. For example, the incidental take statement in this biological opinion specifies the following: *If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to adhere to the terms and conditions of this incidental take statement through enforceable terms that are added to any contract or agreement with the County, the protective coverage of section 7(o)(2) may lapse*.

c. The Corps' interim maintenance strategy to be developed under the short-term element of the RPA, and any subsequent revisions, requires NMFS' written acceptance. Therefore, until NMFS receives and reviews the Corps' proposed interim maintenance strategy, it cannot accept the O&M manual.