UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404-4731

OCT 05 2017

Refer to NMFS No: SWR-2013-9696

Rick M. Bottoms, Ph.D.
Regulatory Branch Chief
Department of the Army
San Francisco District, Corps of Engineers
1455 Market Street
San Francisco, California 94103-1398

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Joint Lower Alameda Creek Fish Passage Improvements Project in Fremont, California (Corps File No. 2013-00083S)

Dear Dr. Bottoms:

Thank you for your letter of July 1, 2013, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS), pursuant to section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 USC Section 1531 et seq.), for construction of the Joint Lower Alameda Creek Fish Passage Improvements Project (Project), located in Fremont, Alameda County, California. The Corps of Engineers (Corps) proposes to provide authorization pursuant to Section 404 of the Clean Water Act (CWA) of 1972, as amended (33 U.S.C. § 1344 *et seq.*), to the Alameda County Water District (ACWD) and the Alameda County Flood Control and Water Conservation District (ACFCD) for construction of the Project. The Corps also proposes to grant permission for construction of the Project under Section 408 of the Rivers and Harbors Act of 1899 (33 USC 408).

Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1855(b)) for this action. However, after reviewing the proposed action, we concluded that it would not adversely affect EFH; therefore, no EFH consultation is required.

The enclosed biological opinion is based on our review of the Project proposed by ACWD and ACFCD, and describes NMFS' analysis of the effects of the construction and operation of the Project on threatened Central California Coast (CCC) steelhead (*Oncorhynchus mykiss)* in accordance with section 7 of the ESA.

In the enclosed biological opinion, NMFS concludes the Project is not likely to jeopardize the continued existence of threatened CCC steelhead. However, NMFS anticipates take of CCC steelhead will occur as a result of future project operations. An incidental take statement with non-discretionary terms and conditions is included with the enclosed biological opinion. NMFS has also found that the proposed Project is not likely to adversely affect the threatened Southern Distinct Population Segment of North American green sturgeon (*Acipenser medirostris*) or its critical habitat.

Please contact Josh Fuller (707-575-6096) or Gary Stern (707-575-6060) of the NMFS North-Central Coast Office in Santa Rosa, California if you have any questions concerning this section 7 consultation, or if you require additional information.

Sincerely,

for

Barry A. Thom
Regional Administrator

Enclosure

cc: Keith Hess, Corps, San Francisco, CA
Leslie Perry, RWQCB, Oakland, CA
Robert Shaver, ACWD, Fremont, CA
Therese Wooding, ACWD, Fremont, CA
Hank Ackerman, ACFCD, Fremont, CA
Scott Wilson, CDFW, Yountville, CA
Ryan Olah, USFWS, Sacramento, CA
Copy to ARN File #151422SWR2013SR00191

Endangered Species Act Section 7(a)(2) Biological Opinion

Joint Lower Alameda Creek Fish Passage Improvements Project

NMFS Consultation Number: SWR-2013-9696

Action Agency: Army Corps of Engineers, San Francisco District

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Central California Coast steelhead (*Oncorhynchus mykiss*)	Threatened	Yes	No	N/A	N/A
North American Green Sturgeon (*Acipenser medirostris*)	Threatened	No	N/A	No	N/A

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

Issued By: [signature] for

Barry A. Thom
Regional Administrator

Date: OCT 0 5 2017

LIST OF ACRONYMS

ACDD	Alameda Creek Diversion Dam
ACWD	Alameda County Water District
ACRP	Alameda Creek Recapture Project
ACFCD	Alameda County Flood Control and Water Conservation District
AF	acre feet
BA	Biological Assessment
BART	Bay Area Rapid Transit
C	Celsius
CCC	Central California Coast
CDFW	California Department of Fish and Wildlife
cm	centimeters
Corps	US Army Corps of Engineers
DPS	Distinct Population Segment
DWR	California Department of Water Resources
EFH	Essential Fish Habitat
ESA	Endangered Species Act
ITS	Incidental Take Statement
mm	millimeters
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NMFS	National Marine Fisheries Service
PBF	Physical or Biological Feature
PCE	Primary Constituent Element
PIT	Passive Integrated Transponder
RD1	Rubber Dam 1
RD2	Rubber Dam 2
RD3	Rubber Dam 3
RWQCB	Regional Water Quality Control Board
SFPUC	San Francisco Public Utilities Commission
SBA	South Bay Aqueduct
SCVWD	Santa Clara Valley Water District
SWP	State Water Project
UPRR	Union Pacific Railroad
USFWS	U.S. Fish and Wildlife Service
USGS	US Geological Survey

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1. INTRODUCTION

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

1.1 Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 USC 1531 *et seq*.), and implementing regulations at 50 CFR 402.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available through NMFS' Public Consultation Tracking System (https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts). A complete record of this consultation is on file at the NMFS North-Central Coast Office in Santa Rosa, California (ARN File #151422SWR2013SR00191).

1.2 Consultation History

In early 1999, the Alameda Creek Fisheries Restoration Workgroup was formed to explore the possibility of restoring steelhead to the Alameda Creek watershed. Led by the efforts and financial support of the Alameda County Flood Control and Water Conservation District (ACFCD), the workgroup initiated regular meetings with representatives from the Alameda County Water District (ACWD), Alameda Creek Alliance (citizen's group), the California State Coastal Conservancy, California Department of Fish and Wildlife (CDFW), East Bay Regional Park District, NMFS, the U.S. Army Corps of Engineers (Corps), San Francisco Public Utilities Commission (SFPUC), and Zone 7 Water Agency.

Recognizing that ACWD's rubber dams and water supply operations in the Alameda Creek Flood Control Channel (hereafter "Flood Control Channel") increased the complexity of designing fish passage facilities for steelhead, ACWD and ACFCD initiated planning and coordination with agencies in 2006 to restore upstream fish passage for Central California Coast (CCC) steelhead (*Oncorhynchus mykiss*). From April 2007 through December 2012, NMFS participated in numerous pre-consultation meetings, teleconferences, and workshops with staff from ACWD, ACFCD, and CDFW regarding fishway designs and minimum bypass flow requirements. These discussions culminated in the development of proposed minimum bypass flows for ACWD's water diversion facilities in Lower Alameda Creek in January 2011, an administrative draft of the Project's Biological Assessment (BA) in June 2012, and a 30% Basis of Design Draft Report for Rubber Dam 1 (RD1) and Rubber Dam 3 (RD3) in September 2012.

On July 3, 2013, NMFS received a letter from the Corps requesting the initiation of formal consultation for the Joint Lower Alameda Creek Fish Passage Improvement Project (Project). The Corps' July 1, 2013 letter also transmitted an updated BA dated February 15, 2013. In the initiation letter, the Corps determined the Project is likely to adversely affect threatened CCC steelhead. Additionally, the Corps requested consultation to address potential adverse effects on essential fish habitat (EFH) designated under the Magnuson-Stevens Fishery Conservation and Management Act (MSA) for Chinook salmon (*O. tshawytscha*).

Due to the engineering challenges of constructing two fishways within the Corps-constructed Flood Control Channel and providing fish passage over a range of operational conditions at ACWD's rubber dams, additional design work and agency coordination were required to finalize Project plans. From 2013 through early 2017, representatives from ACWD, ACFCD, NMFS, CFDW, and the Corps meet frequently in-person and by phone to discuss and evaluate the various components of the proposed fish passage facilities. In February 2017, the final BA for the Project was completed and provided to the Corps and NMFS. In July 2017, revisions to the fishway design at RD1 were presented in the Final 30% Basis of Design Report for the Alameda Creek Lower Fishway. With these two final documents, NMFS had sufficient information to complete consultation and prepare a biological opinion for the Project.

The following describes in detail the work of NMFS, Corps, and the Project proponents during the period between the Corps' July 1, 2013, letter requesting consultation to the completion of consultation in mid-2017:

On July 25, 2013, NMFS participated in a meeting with ACWD and their engineering contractor, GHD, to discuss updates to the design of the fishway for passage over RD1 and the ACFCD grade control structure (RD1/Drop Structure). GHD gave a presentation of the current (near 95%) design concept for the RD1/Drop Structure fish passage project. Outcomes of the meeting included reconfiguration of the plunge pool, pursuing a sonar-based fish monitoring apparatus, evaluating the proposed fish screen design (rotating spray), and an agreed upon construction approach.

On July 30, 2013, NMFS attended a meeting with representatives from the ACWD, ACFCD, CDFW, San Francisco Bay Regional Water Quality Control Board (RWQCB), and the Corps to discuss the development of a low flow channel segment between Rubber Dam #2 (RD2) foundation and the RD1/Drop Structure. ACFCD suggested notching the RD2 foundation to a lower elevation than previously proposed to match the adjacent low flow channel thalweg.[1]

On August 1, 2013, NMFS participated in a conference call with ACWD and their engineering contractor, GHD, to discuss a design concept for the RD1/Drop Structure and low flow channel interface. Three concepts were discussed: 1) do nothing; 2) extend the RD1/Drop Structure 200 feet downstream and add one weir; and 3) extend the RD1/Drop Structure 30 feet downstream and add 3 weirs.

In September 2013, ACWD provided to NMFS an updated set of design plans (95% design) for fish passage at RD1.

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[1] A thalweg is the line of lowest elevation within a valley or watercourse.

On September 23, 2013, NMFS attended a meeting with ACWD and GHD to discuss the regulatory aspects of the proposed RD2 modifications, the transition channel from RD1 to RD2, and biological monitoring at the RD1/Drop Structure fishway.

On October 29, 2013, NMFS received from the ACWD via email a general description of the modifications that will be necessary to integrate the low flow channel with the RD1/Drop Structure, and a proposed schedule for project planning, permitting, and construction.

On November 7, 2013, NMFS provided ACWD comments on the 95% design drawings for the RD1/Drop Structure via email. The comments were related to specific design features of the fish screen cleaning apparatus, and installing access points in the ladder for cleaning and future modifications, if necessary. NMFS also offered to assist with post-construction hydraulic evaluations of the Shinn Pond fish screens.

On December 9, 2013, the Corps' Readiness Branch sent an email to ACWD, which ACWD forwarded to NMFS, describing the Rivers and Harbors Act Section 408 permitting policies and procedures. Since the fish passage project is located within the footprint of a Corps public works project (*i.e.*, Lower Alameda Creek Flood Control Channel), proposed modifications, alterations, or occupation must be reviewed and approved by the Corps' Section 408 program. The email described the Corps' Section 408 review and approval process and provided supplemental information related to the program.

On December 17, 2013, the Corps' Regulatory Branch sent an email to notify NMFS and the RWQCB that the project had just recently been submitted for review under the Section 408 program. The Regulatory Branch noted in their email that this would likely delay completion of the Section 404 permit, since approval under the 408 program must be completed prior to issuance of the 404 permit.

On January 3, 2014, NMFS received from the ACWD via email information regarding the Shinn Pond fish screen construction schedule.

On February 24, 2014, the Corps' Regulatory Branch forwarded NMFS an email from the Readiness Branch which provided an update on the Section 408 review status. The email noted that a complete 408 application package had yet to be submitted and would likely not be submitted until April 2014.

On October 31, 2014, NMFS and ACWD staff met to discuss revisions to the RD1/Drop Structure design that would be necessary to integrate the fishway with the downstream channel and RD2. Specifically, NMFS and ACWD discussed replacing the originally proposed roughened channel with a pool and weir fishway to match ACFCD's planned downstream improvements in the Flood Control Channel. As a follow-up to the meeting, ACWD provided to NMFS via email on February 24, 2015, a narrative description and conceptual sketch of the RD1/Drop Structure pool and weir structure, and a general description of how it will interface with RD2.

On February 26, 2015, ACWD provided NMFS the specifications for the RD3 fishway via email. In their email, ACWD notified NMFS that the routine replacement of the RD3 dam "bag" will be conducted at the same time as the RD3 fishway construction, and that the details of the bag replacement will be included in subsequent design plans.

On May 26, 2015, ACWD met with NMFS to provide an overview of proposed changes to the project description. These included: an updated project schedule, removal of completed project activities from the project description (*i.e.*, replacement of the RD1 bag and stream gage installation), and updates to the cumulative effects section of the BA to reflect a new housing development constructed in the action area. ACWD proposed to provide NMFS a revised BA to reflect these changes. During the meeting, NMFS and ACWD also discussed the relationship between the Corps' Clean Water Act (CWA) Section 404, and Rivers and Harbors Act Section 408 permitting processes.

On May 6, 2016, NMFS attended an interagency meeting regarding the Project and a site visit to RD1 and RD3 with representatives from the U.S. Fish and Wildlife Service (USFWS), the Corps (Regulatory Division and Readiness Branch), CDFW, RWQCB, NMFS, Hanson Environmental, ACWD, and ACFCD. The purpose of the meeting was for ACWD and ACFCD to provide an overview of the Project to the agencies and discuss the Project permitting processes and timelines. ACWD described the steps that must be taken to complete the revised BA. ACWD estimated that a final revised BA would be provided to NMFS and other agencies by fall 2016.

By letter dated February 2, 2017, ACWD transmitted to NMFS an updated BA (February 2017) that reflected the following proposed changes to the Project: (1) extension of the construction duration from three to four years; (2) inclusion of construction to replace the RD3 bag; (3) revision of RD1/Drop Structure fishway lower section from a roughened channel to a pool/weir type fishway design; and (4) additional information regarding bypass flows including flow releases upstream from facilities operated by the San Francisco Public Utilities Commission (SFPUC).

On July 19, 2017, an interagency meeting was held to provide an update on the status of the Project and discuss agency permitting. Participants included representatives from the Corps, CDFW, RWQCB, NMFS, Hanson Environmental, ACWD, and ACFCD. The agencies agreed to proceed with processing of permit applications and an effort will be made to issue permits in the fall of 2017.

1.3 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02). The Corps proposes to issue a permit under Section 404 of the CWA of 1973 (33 U.S.C. Section 1344) to the ACWD and ACFCD to construct fish ladders and fish screens in Lower Alameda Creek as part of a comprehensive program for fish passage in the Alameda Creek Flood Control Channel. The proposed Project will construct fishways over ACWD's two rubber dams (*i.e.*, RD1 and RD3) and ACFCD's grade control structure downstream of RD1. The Project will also construct fish screens at a consolidated water diversion intake site between RD1 and RD3. The Corps must also grant permission for construction of the Project under Section 408 of the Rivers and Harbors Act of 1899 (33 USC 408) because the Alameda Creek Flood Control Channel is a Corps federally authorized civil works project, and as such, the Corps must ensure that any proposed alterations not be injurious to the public interest or affect the Corps project's ability to meet its authorized purpose. Project construction is scheduled to occur over a 4-year period beginning in 2018. When construction is completed, ACWD proposes to modify streamflow bypass rates below RD1 to enhance fish passage conditions for steelhead in the Flood Control Channel.

1.3.1. Project Overview

The ACFCD provides flood protection for Alameda County residents and businesses through designing, planning, constructing, and maintaining flood control projects. ACWD is a retail water purveyor with a service area encompassing the cities of Newark, Fremont, and Union City. Within the Flood Control Channel in lower Alameda Creek, ACWD diverts water to percolation ponds for groundwater recharge and/or re-diversion using two rubber dams: RD1 in the vicinity of ACFCD's Drop Structure (also referred to as the "BART Weir") near the Bay Area Rapid Transit (BART) train bridge, and RD3 near Mission Boulevard (Figure 1). When the rubber dams are inflated, they create large ponds that allow water to flow by gravity through diversion pipelines into off-channel recharge ponds. Except during periods of high flow (about 700 cfs) or when maintenance is required, rubber dams are maintained in the "up" or "raised" position, and, thus, can be used to divert the natural flow of Alameda Creek and water released from upstream State Water Project (SWP) facilities. When inflated, RD1 and RD3 physically block steelhead migration.

As part of the original construction of the Flood Control Channel from 1969 to 1972, the Corps installed a series of concrete grade control structures including the Drop Structure under the BART train bridge maintained by ACFCD. ACFCD's Drop Structure is a low concrete dam across the channel between the Union Pacific Railroad (UPRR) Bridge and the BART Bridge footings. The grade control structures incorporated into the Flood Control Channel modify flow depth and velocity, reducing the energy of the flow and erosive forces. ACFCD's Drop Structure beneath the BART Bridge is also a complete barrier to upstream fish passage.

Over the past decade ACWD has planned and implemented a number of projects associated with restoring passage of anadromous fish through the 12-mile long Flood Control Channel. These projects include removal of RD2 and installing a fishway in the remaining RD2 foundation (2009), installation of a positive barrier fish screen at Bunting Pond (design flow rate of 28 cfs, 2009), installation of positive barrier fish screens on the Alameda Creek Pipeline (design flow rate of 150 cfs, 2008), and installation of a positive barrier fish screen on the Kaiser Pond diversion (design flow rate of 50 cfs, 2013). The proposed Joint Lower Alameda Creek Fish Passage Improvements (Project) would construct fishways at RD1/Drop Structure and RD3, as well as construct fish screens at ACWD's Shinn Pond intakes (design flow rate of 425 cfs).

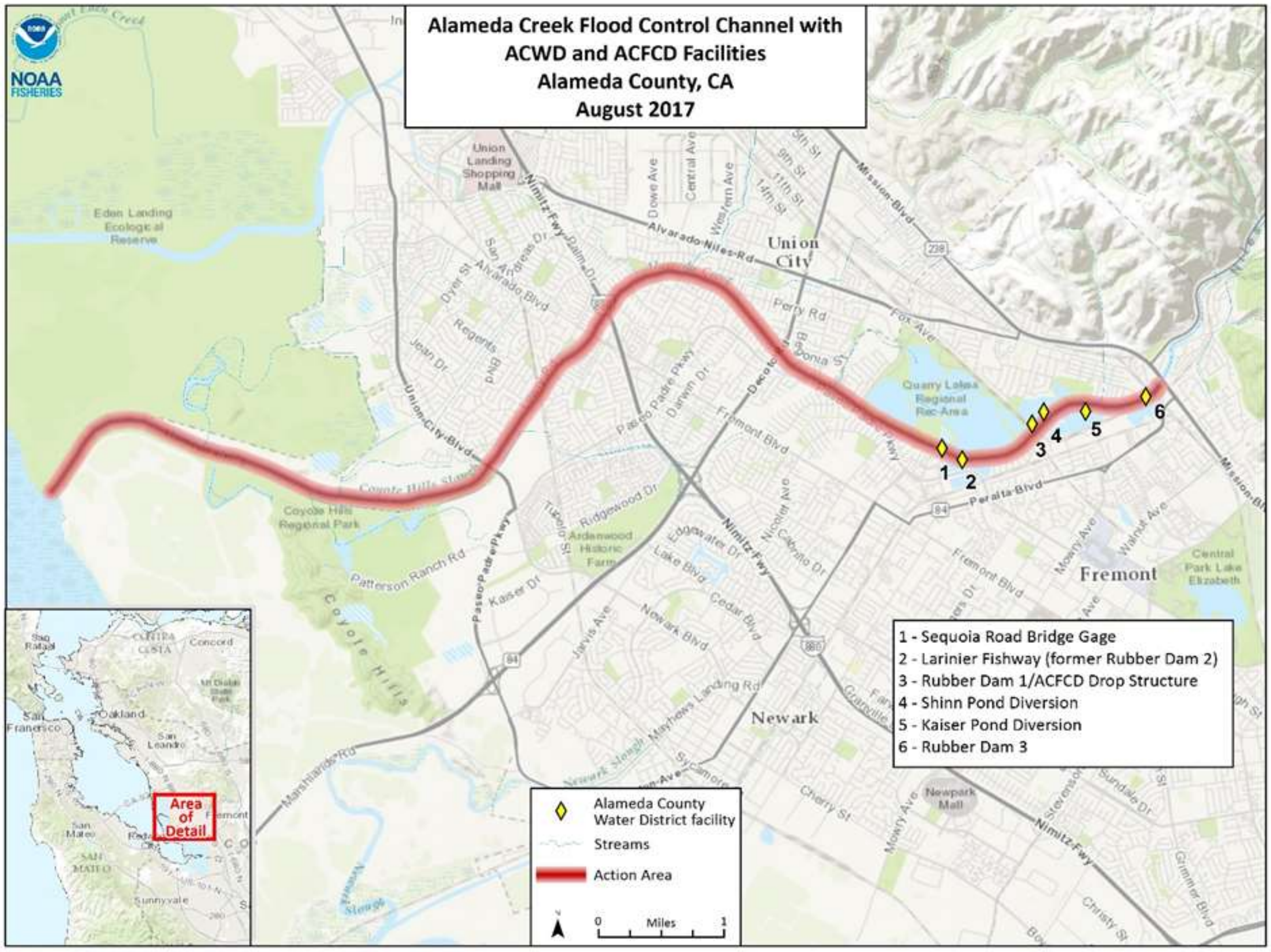

Figure 1. Action Area for Joint Lower Alameda Creek Fish Passage Improvements Project.

1.3.2. Fish Passage Facilities at Rubber Dam 1

The RD1/Drop Structure is located in the Flood Control Channel approximately 10 miles upstream from San Francisco Bay (Figure 1). The Drop Structure was completed with construction of the Flood Control Channel in 1972 and ACWD's RD1 was constructed just upstream. Both structures are fish barriers and require ladders to pass steelhead upstream. Rather than installing two separate fish ladders, the Drop Structure and RD1 are close enough for the construction of one fishway to pass steelhead around both structures.

The channel at the RD1/Drop Structure fishway site is bordered on both sides by levees on the order of 20 to 25 feet high with steep rock rip-rap and/or concrete faces. When fully inflated, RD1 can be operated to approximately 13 feet in height. The dam sits on a reinforced concrete slab foundation which is approximately 210 feet across measured between the toes of the channel banks (fully inflated top width is longer) and 35 feet in width. The dam impounds water for ACWD's Shinn and Kaiser ponds diversion intakes and provides in-channel groundwater recharge. The existing dam is currently raised and lowered via filling it with—or draining it of—water from the adjacent Shinn Pond. A 42-inch diameter corrugated metal pipe (CMP) is used to bypass water from upstream to downstream of the inflated dam to maintain downstream flows in Alameda Creek. The bypass pipeline is located along the base of the northern levee, and was originally installed in 1971.

ACWD proposes to construct a fishway with several features at the RD1/Drop Structure to enable steelhead and Chinook salmon to move past the Drop Structure and RD1. These facilities include a vertical slot fishway, transition pool, vortex pool and chute fishway, guide wall, and a plunge pool (Figure 2). The fishway at RD1/Drop Structure will be installed along the rip-rap bank and concrete wall of the north levee. Construction of the fishway will include modifications to the Drop Structure and other hardscape in the channel. The upper segment of the fishway is a vertical slot ladder design and would include an auxiliary flow screen and associated piping. The fishway would include a sluicing pipe system to help remove sediment that may build up within the fishway's exit channel. The sluice piping would be installed adjacent to the fishway. The sluicing pipe discharge point would be near the entrance to the lower fishway segment. The screened auxiliary discharge will be into the middle fishway segment to enhance attraction flow. Trash racks on the upper segment exit channel will prevent larger debris from entering the fishway. A control cabinet installed on the upper embankment of the channel will house automation equipment for facility monitoring and control.

Modifications to the existing concrete apron at the Drop Structure will be made to construct the middle fishway segment, concrete transition pool, and lower fishway segment downstream of the transition pool. Construction of the lower fishway segment will also require modifications to the rock riprap on the embankment and within the channel. The lower fishway is a vortex pool and chute ladder design. A new guidewall will be constructed across the channel to guide fish to the entrance of the lower fishway segment. Downstream of the guidewall, an existing scour pool would be enhanced and maintained as the interface between the lower fishway segment and the downstream earthen channel.

The rubber dam's foundation and the downstream grouted rock will be modified to include a stream-wide plunge pool, about 2.5 feet deep, immediately downstream of the rubber dam. Additionally, renovation to the RD1 control building will be made to accommodate new fishway control equipment and controls used to inflate/deflate the RD1 bag. The new permanent facilities associated with the RD1/Drop Structure fishway would have a footprint of about 0.9 acre within the channel and along the rock rip-rap embankment.

1.3.2.1. Channel Spanning Concrete Sill.

Steelhead have been observed unsuccessfully attempting to swim up the concrete sloping face of the Drop Structure, which is too steep and shallow for steelhead to traverse. To prevent steelhead from attempting to swim up the apron of the structure, a 2-foot-tall by 2-foot-wide concrete sill will be constructed along the downstream edge of the apron. The sill will span the entire channel from the transition pool to the south bank. The riprap currently downstream of the concrete apron will be rebuilt to raise it up to the height of the sill. This will provide stray fish swimming up the riprap apron a means of swimming over the sill and onto the backwatered apron. Fish will then move laterally towards the transition pool and vertical slot fishway

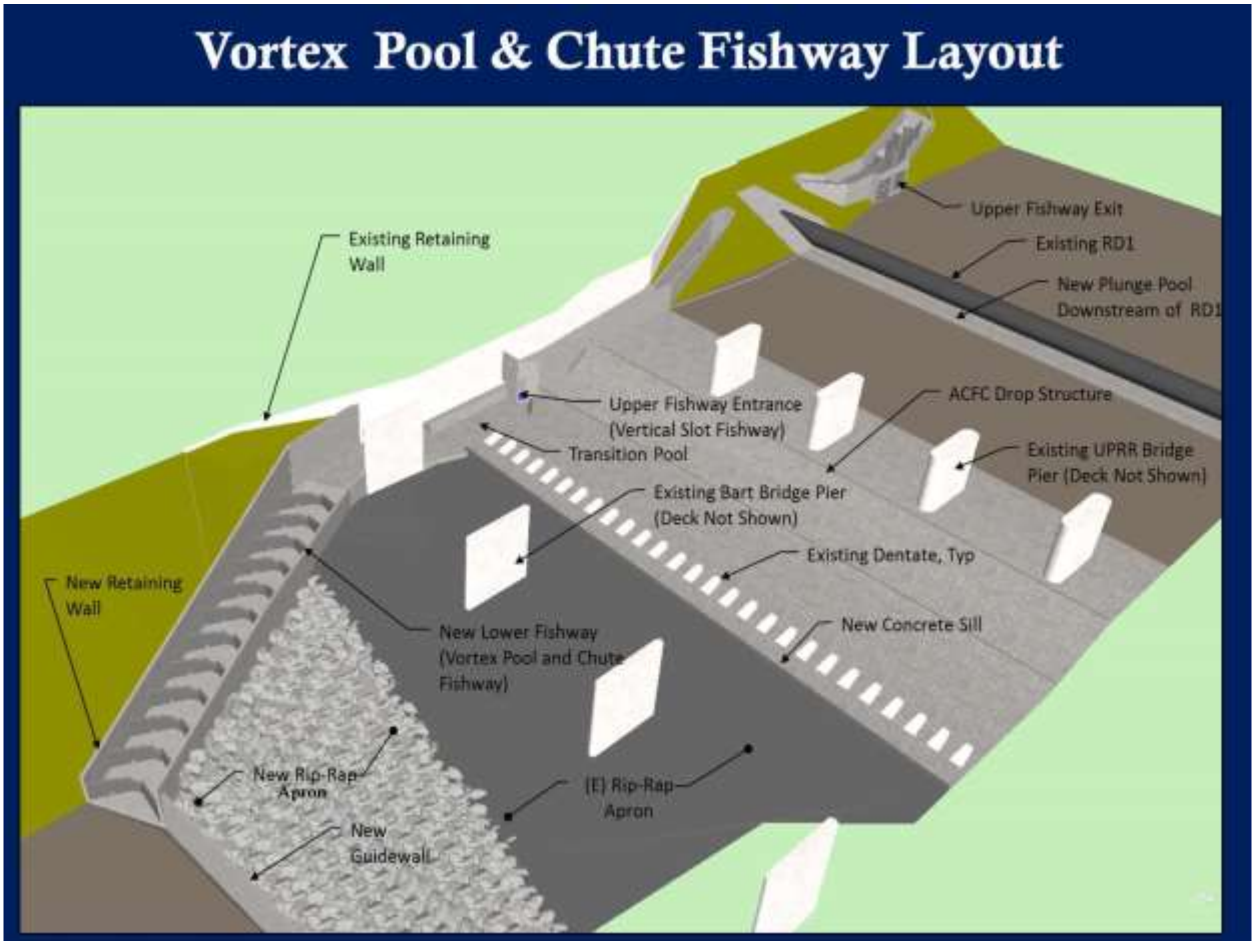

Figure 2. RD1/Drop Structure Fishway

entrance. To accommodate fish migrating along the south bank, a 0.5-foot-deep notch will be placed in the sill near the south side of the Flood Control Channel to attract and guide fish toward the upstream end of the sill and enable them to move laterally towards the vertical slot fishway entrance.

1.3.2.2. RD1/Drop Structure Fishway and Culvert.

As noted in the discussion above, a vertical slot fishway will be installed at the upstream end of the transition pool to provide up- and downstream migration of steelhead around RD1 and the Drop Structure. It will consist of a lower fishway leading upstream into a culvert that runs underneath the RD1 foundation into an upper fishway. The fishway is designed to meet NMFS and CDFW criteria when RD1 is both deflated and inflated (at all forebay levels).

The lower fishway is considered the portion of the vertical slot fishway downstream of the culvert that passes under the RD1 foundation. The lower fishway includes an entrance gate, vertical wall diffuser, fish monitoring equipment, and nine vertical slots. The fishway entrance (downstream end) will be located at the downstream end of the Drop Structure. The entrance discharges to the transition pool. An automatic wing gate will control the water surface elevation within the entrance pool (the most downstream pool within the fishway). The gate will be operated to keep the head differential between the entrance pool and the transition pool to NMFS/CDFW fish passage criteria. The differential will be determined by two water level sensors; one in the entrance pool and the other in the transition pool.

To reach the entrance pool, water will flow down the fishway or enter through a vertical wall diffuser. Water flowing down the fishway will travel through 10 pools that are created by the nine vertical slots. To pass under the dam foundation water and fish will pass through a concrete culvert. The culvert will be 4 feet wide, 12 feet tall, and 56 feet long. The culvert bottom will be horizontal. Fish monitoring equipment will be installed in the vicinity downstream of the culvert (see Section 1.3.8.2 of this opinion).

The upper fishway is considered the portion of the vertical slot fishway upstream of the culvert. The upper fishway overcomes 11.5 feet of elevation and includes 10 vertical slots, five exit gates and pools, one low-flow gate, two exit channels, the juvenile spillway, the auxiliary flow system, sluice system, trash racks, and a crane. The exit gates will be upward opening slide gates with 2-foot wide by 4-foot tall openings. Flow entering the fishway through the opening is perpendicular to the primary fishway flow path. Fish migrating upstream will exit the fishway through one of the five exit gates. Which exit gate is open is dependent on the forebay elevation. When the fish passes through a gate, it will be in one of two exit channels: the lower or upper exit channel. The lower exit channel will include two fishway exits (1 and 2), with the invert of Exit Gate 1 as much as four feet below stream grade. Because this exit channel is below the stream grade, sedimentation is expected. A sluice gate will be installed on the downstream end of the lower exit channel to help flush sediment out. Fish continuing to move upstream from the lower exit channel will exit the fishway through a trashrack. The trashrack will keep larger debris from entering the facility. A rake will clean the trashrack and deposit accumulated material onto the grating above the fishway. A crane will be located on the deck to lift the material into a truck for transport. The upper exit channel also has a trashrack. The same trash rake that cleans the lower exit channel trashrack will clean the upper trashrack. There will be three exit gates in the upper exit channel, Exit Gates 3, 4, and 5. There will also be a low flow gate adjacent to Exit Gate 5. The purpose for the low flow gate is primarily to convey flow less than 20 cfs into the fishway. This gate may be used by juveniles and kelts (post-spawn adult steelhead) during their out-migration and outside of peak adult migration periods, depending on the required bypass. The auxiliary flow system inlet (described below) is within the upper exit channel.

1.3.2.3. Juvenile Spillway.

The juvenile spillway inlet is at the downstream end of the lower exit channel of the upper fishway. Its primary function is to provide a downstream flow path for steelhead juveniles and kelts. The juvenile spillway gate is a downward opening gate. The crest elevation will be adjusted to a desired spillway flow. The flow through the juvenile spillway will range between 24 cfs to approximately 100-150 cfs. Downstream of the gate and upstream of the spillway (opening in the fishway wall) is referred to as the juvenile spillway channel. The channel is shaped to maintain velocity within the channel and maintain a uniform flow through the spillway along its length. The spillway is notched on the downstream end of the spillway to concentrate lower flows and help minimize accumulation of debris. A drain hole is placed in the low spot of the spillway channel to help avoid potential for entrapment of juvenile fish when flow to the spillway is shut-off.

1.3.2.4. Auxiliary Flow System.

Screened auxiliary flow will be incorporated into the upper exit channel of the fishway. It is intended to convey water around RD1 and Drop Structure for more precise control of in-stream flow releases into the downstream channel. It also aids in reducing the frequency and magnitude of dam overtopping by providing more precise control of the forebay level. The auxiliary flow will be discharged into the fishway entrance pool, which has the advantage of improving attraction of fish to the fishway. The combined capacity of the auxiliary flow system and the fishway is targeted to convey enough streamflow to the downstream channel to minimize the frequency of overtopping RD1. Auxiliary water will flow through a pipe downstream to a discharge point near the entrance pool in the lower fishway. It will be discharged to a diffuser chamber and then through a vertical diffuser wall into the entrance pool.

1.3.2.5. Sluice System.

As briefly described above, to help remove sediment that builds up within the lower exit channel of the upper fishway, a sluice gate and pipe will be installed. The sluice gate may be manually operated or motorized. The frequency of operation will not be known until the facility is operational. Immediately downstream of the sluice gate is a gate valve. The gate valve provides back up in the event the sluice gate cannot close completely. Sediment will flow down the sluice pipe and be discharged downstream of the facility.

1.3.2.6. RD1 Foundation Modifications.

As briefly described above, the existing RD1 foundation will be modified to create a recessed plunge pool on the downstream side of the dam. The pool is intended to improve landing conditions for juvenile salmonids and kelts that could spill over the dam crest. The pool will dissipate the energy of plunging flow during dam overtopping and create a cushion for fish falling into the pool. The pool will span the entire width of the channel, from the toe of the south levee to the toe of the north levee. It will have residual depth of approximately 2.5 feet, and have more depth during higher flows due to backwater effects of the channel. If sedimentation occurs in the plunge pool when the dam is down, the flow overtopping the dam during reinflation will scour out these sediments to maintain the pools depth.

1.3.3. Fish Passage Facilities at Rubber Dam 3

1.3.3.1. Fishway.

The RD3 fishway is designed to convey up- and downstream migrating steelhead and Chinook salmon when RD3 is inflated and the impoundment is partially full or filled to capacity. When the rubber dam is deflated, it is not a fish passage barrier and therefore the fishway is not operational under these conditions. The fishway will be located on the north bank. The fishway is a standard vertical slot fishway and the vertical slots have the same dimensions as the fishway at RD1. When RD3 is inflated, flows through the fishway will generally range between 24 cfs and 45 cfs. A control cabinet similar to the one at RD1 will be installed and the RD3 bag will be replaced as part of the Project.

The fishway entrance pool will be located immediately downstream of the RD3 bag. The entrance pool will be connected to the proposed plunge pool so fish migrating upstream through the center or southern portion of the channel can find the entrance after encountering the dam. The entrance will be an automated wing gate. The entrance gate will control the water surface elevation within the entrance pool. Water surface sensors within the entrance pool and outside of the fishway will be used to record head differential. There will be four vertical slots before the first exit gate. Because RD3 does not have to overcome as much elevation, the fishway will be much shorter than the fishway at RD1. The RD3 plunge pool will be backwatered by the impoundment caused by RD1. Unlike RD1, there is no culvert.

Like RD1, there are five exit gates at RD3. Because the exit channel is raised above the adjacent streambed, little sediment is expected to accumulate in the fishway, eliminating the need for a sediment sluicing mechanism. There will be no auxiliary water system or bypass streamflows conveyed through the fishway. A trashrack and rake system similar to the one proposed for RD1 will be installed at RD3. Debris collected by the rake from the trashrack will be deposited on the grating above the fishway. A crane mounted on the top of the fishway will then be used to lift the material into a truck and hauled away.

1.3.3.2. Juvenile Spillway.

The RD3 juvenile spillway will operate the same as RD1 (see above Section 1.3.2.3). The pool below the spillway will be sufficiently deep so that fish, even under low flow conditions, could move through the spillway.

1.3.4. Shinn Pond Fish Screens

There are currently two existing unscreened diversion points from the RD1 impoundment along the north bank of the flood channel that are sized for a combined total of 425 cfs of diverted streamflow to Shinn Pond. The most upstream existing diversion, Shinn A, is sized for 200 cfs of total diverted flow. The second existing diversion, Shinn B, is sized for 225 cfs of total diverted streamflow. The Project proposes to consolidate these two points of diversion into a single new facility to be located closer to RD1 where there are currently no existing diversion facilities. A total of 10 cylindrical screens will be installed for a combined diversion capacity of 425 cfs. The new diversion facility and fish screens will occupy an area approximately 300 feet long by 75 feet wide along the levee of the flood channel.

The proposed fish screen facility will be similar to the other existing screens installed and operated by ACWD, including a track-mounted configuration with winches that raise and lower the screens. Flow through the screens will be controlled by slide gates mounted under the screens with stems that extend to allow for gate control from the top of the bank. The screens will be cleaned by rotating against stationary internal and external brushes.

1.3.5. Construction of Fish Passage Facilities

Construction would take place in the dry season, May 1 through October 31 and would include, in general sequence, the following:

- Mobilizing;
- Temporary diversion of the active channel around the construction zone. This may involve several sequential diversions as the location of work shifts;
- Removal of aquatic species and dewatering of construction areas;
- Demolition (i.e., removal of concrete, rock, and sediment from the channel) and stockpiling materials;
- Grading and excavation;
- Pipe installation;
- Concrete formwork and pouring;
- Formwork removal;
- Installation of gates and appurtenances;
- Electrical conduit installation;
- Backfill and slope protection;
- Operations testing;
- Post-construction grading and site cleanup; and
- Re-connection of the active channel.

These activities would require construction equipment to work in the channel, on the levees, on the levee access roads, and the levee crest. Fish screen construction would be less intensive than construction of the fishways, modifications to rubber dam foundations, and grouted rock sills.

Equipment used for construction would include excavators, dump trucks, concrete trucks, pumper trucks, loaders/backhoes, compaction equipment, water trucks, dewatering equipment, and crane. Work sites would be isolated from the active/wet channel of Alameda Creek utilizing RD3 in combination with gravel bags, fiber mats and temporary cofferdams.

1.3.5.1. Dewatering and Fish Collection and Relocation

To facilitate in-channel construction, isolation of construction sites may be performed by utilizing ACWD’s existing RD3, in conjunction with gravel bags, fiber mats, and temporary cofferdams to ensure that fish will be excluded from the construction area, and that runoff from the construction area will be fully contained during construction activity. The temporary cofferdams may consist of a plastic barrier fence, k-rail barrier, an earthen levee with plastic sheeting to protect it from erosion, interlocking steel sheet-pile and piping for control of water, or another similar type of barrier. Location of these temporary facilities may be channel spanning or designed for isolation of smaller localized areas.

In preparation for and during the isolation of construction sites, fish rescue will be performed. Aquatic species within the work area will be collected and relocated to an area of active stream. The construction site would then be dewatered (drained). Fish collection and relocation will follow the standard procedures for fish rescue that have been employed in prior ACWD in-channel construction projects. Fish will be collected using seining, dip netting, or electrofishing. Captured fish will be held in cool, shaded water that will be continuously aerated. Captured fish will be relocated, as soon as possible to an instream location in the Flood Control Channel with suitable habitat conditions.

1.3.5.2. Construction Best Management Practices

Table 10 of the Project's BA presents an extensive list of avoidance and minimization measures to be employed during the Project's construction activities. The following subset of the measures are relevant to protection of the Alameda Creek channel and water quality:

(1) In-channel construction areas will be isolated from the active creek channel with sand bags, hay bales, fiber mats, cofferdams, silt screens, or other methods during construction.

(2) Equipment access to the channel will be via areas where no riparian vegetation will be affected.

(3) Runoff will be controlled from the site with sand bags, fiber mats, or other methods.

(4) Fuel and maintenance of construction equipment will occur out of the channel. If this is not feasible, containment materials will be used and construction equipment will be fitted with absorbent materials to address potential fuel, oil, and other fluid leak spots.

(5) Washout areas will be provided for vehicles outside of the channel and isolate these areas to ensure that concrete materials do not runoff into the channel or to recharge ponds.

(6) Sand bags and other materials will be stockpiled on site so that they may be immediately used around any spill.

1.3.5.3. Construction Schedule

Construction will occur over a period of four years. A three-year period is required for construction of the RD1/Drop Structure fishway and construction of the Shinn Pond fish screen facility. One year is required for construction of the RD3 fishway including foundation modifications and bag replacement. A dual-shift construction schedule may be implemented at various phases to facilitate construction progress.

The following is the anticipated schedule for construction of Project elements:

Year 1 (2018): RD3 Fishway
Year 2 (2019): RD1/Drop Structure Fishway

Year 3 (2020): RD1/Drop Structure Fishway – continued; Shinn Pond Fish Screens
Year 4 (2021): RD1/Drop Structure – continued; Shinn Pond Fish Screens – continued.

Construction activities would be conducted during the dry season between May 1 and October 31. However, some construction activities may begin earlier or extend later in the year with agency approvals.

1.3.6. ACWD Operations

ACWD has existing water rights to divert and use natural inflow from lower Alameda Creek (*i.e*., Flood Control Channel) from October 1 through May 31. ACWD also has a water rights permit to capture and store water from natural inflows into Del Valle Reservoir. Del Valle Reservoir is owned and operated by the California Department of Water Resources (DWR). In addition to these water rights, ACWD purchases water from the State Water Project (SWP) and from the SFPUC. These water supplies are used either for groundwater recharge or delivered directly to ACWD's water treatment plants.

Within the upper two miles of the Flood Control Channel, ACWD uses RD1 and RD3 inflatable dams to raise water levels so that water can flow by gravity into a system of groundwater recharge basins on both sides of the Flood Control Channel. The recharge basins were formed by gravel mining in the first half of the 20th Century. The rubber dams used for water diversion remain operational (inflated) up to daily averaged flow rates in Alameda Creek of approximately 700 cfs. When this inflow rate is exceeded, ACWD lowers the dams to let flows and debris pass downstream unimpeded. Although the rubber dams may be inflated to streamflow levels as high as 700 cfs, ACWD diversions may only operate when streamflow is less than 400 cfs. Thus, no water diversion from Alameda Creek will occur during periods when streamflows exceed 400 cfs.

SWP deliveries to ACWD may be provided in a number of ways. Water may be delivered via pipeline directly to ACWD's water treatment facilities or water may be "turned out" into a creek channel where it flows downstream to the Flood Control Channel for re-diversion at RD1 or RD3. Two turnouts from the South Bay Aqueduct (SBA) are typically used for SWP deliveries to ACWD: (1) Vallecitos Turnout and (2) Del Valle Turnout. The Vallecitos Turnout releases water into Vallecitos Creek, an ephemeral tributary to Alameda Creek immediately upstream of Niles Canyon at Sunol. The Del Valle Turnout is located directly downstream of Del Valle Reservoir on Arroyo del Valle and releases water directly into Arroyo del Valle. Arroyo del Valle is a tributary to Arroyo de la Laguna and thence Alameda Creek near Sunol. Typically, DWR utilizes the Vallecitos Turnout, rather than the Del Valle Turnout, for deliveries to ACWD in order to minimize evaporative and other losses in Arroyo del Valle. ACWD's water right in Del Valle Reservoir is released from storage into the SBA and distributed in the same manner as the SWP water deliveries described above.

1.3.6.1. Bypass Flows

Upon completion of the proposed Project, ACWD will modify operation of the water diversion facilities in the Flood Control Channel to provide bypass flows for the protection of steelhead and other native fishes downstream of RD1. ACWD diversions may be open only when the flow of Alameda Creek, as measured at the Niles Gage, is below 400 cfs. However, there are also occasions when the diversion will be closed at lower flows due to poor water quality, or operational/maintenance reasons.

The Project's proposed bypass operations were developed in coordination with NMFS and CDFW, and are based on the structural capability of RD1 and RD3, ACWD's operational objectives, and steelhead habitat and migration goals. Proposed streamflow bypass rates are presented in Table 1. The in-stream bypass flow schedule defines three seasonal periods: (1) Steelhead In-Migration period is from January 1 through March 31; (2) Steelhead Out-Migration period is April 1 through May 31; and (3) Outside of Peak Migration Periods is June 1 through December 31.

To implement bypass stream flows, the total stream flow through the Flood Control Channel would be measured as an average daily flow downstream of the RD1/Drop Structure at the Sequoia Road Bridge Gage. This stream gage will be used to document flows in the Flood Control Channel and for compliance with bypass requirements. As noted on Table 1, bypass stream flow amounts are based on the flow in Alameda Creek upstream of ACWD's facilities and measured upstream of Mission Boulevard at USGS Station 111790000 (*i.e.*, Niles Gage).

Also included in the bypass flow requirements are considerations for variable hydrologic conditions (different water year types), and the contribution to the flow at the Niles Gage from SFPUC releases to Alameda Creek from its upstream facilities. SFPUC fisheries releases are defined as the flows that are released and/or bypassed by the SFPUC at Calaveras Reservoir and Alameda Creek Diversion Dam (ACDD) (hereafter "net SFPUC releases"). The net SFPUC releases will contribute to streamflows in Alameda Creek from the southern portion[2] of the upper watershed during the steelhead migration months of January through May. Pursuant to section 7 of the ESA, NMFS completed a formal consultation with the Corps on the SFPUC's re-construction of Calaveras Dam and a biological opinion was issued on March 5, 2011. SFPUC's fisheries bypass/releases have been incorporated into the Calaveras Dam Replacement Project and included in the NMFS March 5, 2011 Biological Opinion/Incidental Take Statement for the project.

ACWD's bypass flows for the peak period of juvenile and kelt steelhead outmigration (April 1 through May 31) are determined by water year type calculated on April 1st of each year. ACWD will determine the water year type based on the cumulative precipitation measured at ACWD's Blending Facility in Fremont, California. The "normal/wet" water year classification is based on a 60% exceedance threshold (*i.e.*, 60% of the outmigration seasons [April and May] are expected

[2] The "southern watershed" is defined as the watershed of Alameda Creek and its tributaries upstream of its confluence with Arroyo de la Laguna.

to be classified as "normal/wet") and the "dry/critical" water year classification is also based on the 60% exceedance threshold (*i.e.*, 40% of the outmigration seasons are classified as "dry/critical").[3]

Table 1. Proposed ACWD Minimum Bypass Flows

Season	Dates	Flow at Niles Gage[1]	Minimum Bypass Flow at ACFCD Drop Structure	Additional Conditions of Bypass
Year Round	January 1 – December 31	>700 cfs	N/A	Dams down; no off stream diversions
		>400 cfs	N/A	Dams may be up; no off stream diversions when turbidity is high
Steelhead In-Migration	January 1 – March 31	100-400 cfs	25 cfs + Net SFPUC Releases at Niles Gage[2]	No water will be released from storage to meet bypass flow requirements
		30-100 cfs	25 cfs	If less than 25 cfs arrives at the ACFCD Drop Structure, all flow arriving at ACFCD Drop Structure shall be bypassed. No water will be released from storage to meet bypassed flow requirements.
		<30 cfs	20 cfs	If less than 20 cfs arrives at ACFCD Drop Structure, all flow arriving at ACFCD Drop Structure shall be bypassed. No water will be released from storage to meet bypassed flow requirements.
Steelhead Out-Migration	April 1 – May 31 Normal to Wet years	All flows	12 cfs + Net SFPUC Releases at Niles Gage[1,2]	Normal/wet conditions are years when water-year rainfall to date (as of April 1, at Fremont) is greater than the 60% annual exceedance value. Dry/Critical conditions are years when water-year rainfall to date (as of April 1, at Fremont) is less than the 60% annual exceedance value. In such years, if less than 12 cfs of natural flow arrives at ACFCD Drop Structure then all flow arriving at ACFCD

[3] ACWD used the 137-year period of record at this location to define normal/wet and dry water year types. Results of this analysis indicate that if cumulative rainfall calculated from October 1st to March 31st is less than 15.3 inches, conditions are considered dry, and if the cumulative rainfall is greater than 15.3 inches, conditions are classified as normal/wet.

				Drop Structure shall be bypassed. No water will be released from storage to meet bypassed flow requirements.
Steelhead Out-Migration	April 1 – May 31 Dry or critical dry years	>25 cfs	12 cfs + Net SFPUC Releases at Niles Gage[1,2]	If flows are less than 25 cfs under dry/critical conditions, ACWD will provide 12 cfs + Net SFPUC Releases at Niles Gage 7 consecutive days in April and 7 consecutive days in May (days to be specified by NMFS/CDFW). If ACWD diversions are zero and less than 12 cfs arrives at ACFCD Drop Structure, all of the flow at ACFCD Drop Structure shall be bypassed. No water will be released from storage to meet bypass flow requirements.
	April 1 – May 31 Dry or critical dry years	<25 cfs	5 cfs	If flows are less than 25 cfs under dry/critical conditions, ACWD will provide 12 cfs + Net SFPUC Releases at Niles Gage 7 consecutive days in April and 7 consecutive days in May (days to be specified by NMFS/CDFW). If ACWD diversions are zero and less than 12 cfs arrives at ACFCD Drop Structure, all of the flow at ACFCD Drop Structure shall be bypassed. No water will be released from storage to meet bypass flow requirements.
Outside Of Peak Migration	June 1 – December 31	All flows	5 cfs	If less than 5 cfs arrives at ACFCD Drop Structure, all of the flow at ACFCD Drop Structure shall be bypassed. No water will be released from storage to meet bypass flow requirements.

[1] Daily average inflows as measured at the USGS Niles Gage.

[2] Pursuant to the March 5, 2011, NMFS Biological Opinion issued to the Corps and SFPUC for the Calaveras Dam Replacement Project, water releases from Calaveras Reservoir and bypass flows at the Alameda Creek Diversion Dam may, at times, contribute to flow further downstream in Alameda Creek at Niles Gage, and, if they do, any such flows contributing to total flow at Niles Gage would be bypassed by ACWD.

1.3.6.2. Rubber Dam Operations

As part of the proposed Project, ACWD will continue to operate RD1 and RD3 in a similar manner as they have in the past. When daily average creek flows are less than 700 cfs, the rubber dams are inflated and they create ponds that allow water to flow by gravity through diversion pipelines into the recharge ponds. Except when maintenance is required, rubber dams are maintained in the "up" or "raised" position, and, thus, can be used to divert and recharge natural flow and releases from SWP facilities, whenever these sources are available.

When streamflows in Alameda Creek are predicted to exceed 700 cfs, or for maintenance purposes, ACWD will deflate RD1 and RD3 rubber dams. ACWD will typically begin the operation of dam deflation by draining the upstream pool about half way by operating the diversions, and the remaining volume of water will be released downstream over a 3-6 hour timeframe. This remaining water creates a small pulse flow as it moves down the Flood Control Channel, and can be seen from time to time on the USGS gages downstream of the ACWD diversion facilities.

When daily average streamflows in Alameda Creek drop to less than 700 cfs, ACWD may inflate either or both rubber dams. It generally takes 6-12 hours to completely fill both impoundments, but may require more time depending on streamflow levels in Alameda Creek. RD1 will be inflated first, and will allow water to overspill the rubber dam crest for a period of 2 hours before utilizing the fishway and auxiliary flow to meet instream flow requirements. After RD1 has been completely inflated, inflation of RD3 will be initiated. During this time period, streamflow rates will slowly decrease to the minimum bypass rate below the dams as water is stored in the on-channel ponds within the Flood Control Channel. As the dams complete inflation and the pond storage capacity is filled, all water will be bypassed downstream through the fishways. If the fishway flow capacities are exceeded, excess flow overtops the rubber dams. When streamflows drop to approximately 400 cfs, ACWD may initiate water diversions in accordance with the bypass flow requirements.

1.3.6.3. Delivery of SWP Supplies to ACWD.

ACWD's contract for SWP supplies provides for year-round water supply from DWR delivered via the SBA. This source constitutes about 40% of ACWD's supply. ACWD predicts releases from the SBA via the Vallecitos Turnout for ACWD groundwater recharge operations will range from approximately 5 cfs to 40 cfs. These releases typically occur in the summer months, however in dry years, releases may occur throughout the year. As part of the proposed Project, ACWD has agreed to not use the SBA Vallecitos Turnout for SBA water deliveries in April and May during wet and normal water years, but may use the Bayside Turnouts for SBA deliveries. By utilizing the Bayside Turnouts, SBA water deliveries do not pass downstream in Alameda Creek and, thus, avoid the potential effects of SBA flows warming natural streamflow originating from the upper watershed. SBA water supplies are typically warmer than the natural runoff of Alameda Creek during the late spring, summer and early fall months. In all other water years, ACWD will preferentially utilize the Bayside Turnouts for direct delivery of SBA to water treatment plants rather than utilizing the Vallecitos Turnout during the months of April, May, September, and October.

1.3.6.4. Delivery of SFPUC Supplies to ACWD.

ACWD may also receive treated water supplies year-round from the SFPUC Regional Water System. This water is delivered via SFPUC pipelines directly to ACWD's water distribution system. ACWD does not request raw water from any SFPUC sources and this aspect of ACWD's water operations has no effect on conditions in Alameda Creek or tributaries to Alameda Creek.

1.3.7. Routine Maintenance

ACWD and ACFCD propose to perform routine maintenance on their fish screens, diversions, fishways, drop structures, and associated equipment in the Flood Control Channel. Routine maintenance activities include the following:

(1) Removal and disposal of sediment, trash, and woody debris from the fishway and plunge pool, typically using hand tools, small cranes and lifts, hoses and suction pumps, and similar small equipment. Additionally, the fishways will be equipped with a trash-raking system;

(2) Inspection of moving parts and lubrication, painting, sealing, cleaning, and replacement of moveable parts;

(3) Inspection, repair and/or replacement of instrumentation and monitoring devices including sensors and flow meters;

(4) Patching damaged concrete and grouted rock (generally following periods of high flow and damage from debris); and

(5) Periodic repair and replacement of rubber dams.

Maintenance associated with these activities would be contained within the Flood Control Channel and levees from Mission Boulevard downstream to the RD1/Drop Structure fishway intake. The fishway designs include ports in the fishway metal decking for inspection, a sluice pipe system for flushing sediment, and trash rake and crane for debris removal.

The Project's biological assessment describes several measures designed to avoid and minimize impacts to steelhead associated with maintenance including scheduling maintenance activities during the period of June through October, isolation of maintenance work sites from the waters of Alameda Creek, and regular notification and coordination with agency staff. ACWD and

ACFCD will jointly develop and implement an operation and maintenance manual for the fish passage facilities in the Flood Control Channel. This plan will be provided to NMFS and CDFW for approval and is expected to be completed within one year of initial operation of the facilities.

1.3.8. Monitoring and Adaptive Management

ACWD proposes to conduct both compliance monitoring and biological monitoring. ACWD also proposes to develop an adaptive management plan.

1.3.8.1. Compliance Monitoring

Following construction, ACWD will ensure their operations are compliant with the Project's Alameda Creek streamflow bypass requirements by monitoring streamflow at the Sequoia Road Bridge Gage (downstream of RD1/Drop Structure) and USGS Niles Gage (upstream of RD3). Water quality data collected at the Niles Gage (currently water temperature, turbidity and suspended sediment) will also be monitored. Auxiliary flow in the RD1/Drop Structure fishway facility will be measured using a flow meter, and a stage-discharge curve will be developed to measure flow within the vertical slot fishway. ACWD will prepare and submit annual monitoring reports to NMFS and CDFW detailing the monitoring activities and any significant deviations from the proposed operations. Reports will include most current data available at the time of submittal.

As described in Section 1.3.6.1 of this opinion and Table 1, SFPUC's fisheries releases from Calaveras Reservoir and flow bypassed at the ACDD are expected to contribute to flow in the Flood Control Channel and these flows would be a factor in determining ACWD's minimum bypass flow requirement. Under most conditions, ACWD will allow the quantity of water originating from SFPUC's fisheries releases/bypasses to continue downstream through the Flood Control Channel as a contribution in addition to ACWD's minimum bypass requirement. However, there currently is no continuous stream gage within Sunol Valley to accurately track net SFPUC fisheries releases. ACWD has develop a method for calculating net SFPUC releases in terms of flow at the Niles Gage and examples that demonstrate this calculation method are presented in chapter 3 of the Project's biological assessment. However, future projects in the Sunol Valley are expected to influence the rate of streamflow infiltration in this reach of Alameda Creek. Therefore, ACWD proposes to develop a methodology to periodically re-evaluate the estimates of net Sunol Valley surface water losses. The method may be based on measured streamflow and operational data, hydraulic/hydrologic modeling simulation results, and/or a combination of both. This methodology will also include a schedule for re-evaluating net Sunol Valley surface water losses, especially after any physical or operational changes in Sunol Valley or upstream of Niles Canyon that may affect discharge rates arriving in the Flood Control Channel. The final methodology will be subject to the approval of NMFS. Until development of the methodology is complete, the net Sunol Valley losses will be based on the current estimate of 17 cfs.

1.3.8.2. Steelhead Monitoring

Facilities for monitoring of adult and juvenile steelhead migrating through the RD1/Drop Structure fishway will be incorporated into the fishway design. Facilities will include a passive integrated transponder (PIT) tag reader and provisions will be made to allow for the installation of a Vaki or similar infrared scanner, DIDSON high definition sonar, or similar camera sensing technology. Specific monitoring equipment will be determined during final design in consultation with, and subject to approval by NMFS and CDFW.

1.3.8.3. Adaptive Management

ACWD has committed to the development of an adaptive management plan to ensure that bypass flows and operation of ACWD facilities in the Flood Control Channel meet project objectives related to fish passage through the channel. The adaptive management program will establish management objectives and utilize the results of the monitoring program to measure the effectiveness of ACWD's operations with respect to fish passage. Ongoing monitoring and learning through this program will be used to recognize differences in the consequences of various actions, which will in turn offer the opportunity to evaluate management strategies. By comparing and contrasting different actions, ACWD will be able to refine their operations and choose the best action to meet water supply goals and passage for anadromous fish.

1.3.9. Section 408 Permission for Alteration of the Flood Control Channel

In addition to the Corps' permitting of the Project under Section 404 of the CWA, the Corps must also grant permission for construction of the Project under Section 408 of the Rivers and Harbors Act of 1899 (33 USC 408). The Alameda Creek Flood Control Channel is a Corps federally authorized civil works project, and as such, the Corps must ensure that any proposed alterations not be injurious to the public interest or affect the Corps project's ability to meet its authorized purpose. ACWD and ACFCD have prepared and submitted a Section 408 submittal package to the Corps for review. The Corps' Readiness Branch will review the proposed modifications to determine if the proposed actions would impair the usefulness of the flood channel, and based on that finding, either grant or deny permission pursuant to Section 408. Following the granting of permission pursuant to Section 408, the Corps' Regulatory Division can make a determination regarding authorization pursuant to Section 404 of the CWA.

1.3.10. Interrelated and Interdependent Actions

"Interrelated actions" are those that are part of a larger action and depend on the larger action for their justification. "Interdependent actions" are those that have no independent utility apart from the action under consideration (50 CFR 402.02).

1.3.10.1. Del Valle Reservoir

The ongoing operation of Del Valle Reservoir is an action that is interrelated to ACWD in that water supplies from this reservoir are released by DWR for re-diversion by ACWD at RD1 and RD3 in the Flood Control Channel. Del Valle Reservoir is fed by two sources of inflows – SWP water from the SBA, and natural inflows from the Arroyo del Valle watershed. ACWD and Zone 7 Water Agency in Livermore share a water right to capture and store natural inflows from Arroyo del Valle at Lake Del Valle. When DWR constructed Del Valle Dam in the upper Alameda Creek Watershed in 1968, those rights were recognized in an agreement between DWR, ACWD, and Zone 7. Consequently, DWR typically makes a total of 15,000 acre-feet (AF) of storage available annually in Lake Del Valle for use by ACWD and Zone 7. ACWD and Zone 7 equally share this storage capacity, thereby providing up to 7,500 AF of storage capacity annually to each agency.

Del Valle Reservoir captures local runoff from the Arroyo del Valle watershed during the winter months and during the dry season SWP water is pumped into the reservoir to maintain a supply adequate for recreational uses and water supply. During the fall, water is released from the reservoir into the SBA to provide water supply for ACWD, SCVWD, and Zone 7, and to create winter flood capacity in the reservoir. Del Valle water supplies in the SBA are distributed to ACWD as described in Section 1.3.6.3 of this opinion.

2. ENDANGERED SPECIES ACT CONSULTATION: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, Federal agencies must ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provides an opinion stating how the agency's actions would affect listed species and their critical habitat. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an incidental take statement (ITS) that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures and terms and conditions to minimize such impacts.

2.1 Analytical Approach

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

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

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

Within the action area (see Section 2.3 for description of the action area) of this project, no areas of critical habitat have been designated by NMFS. However, our analysis of the proposed action does evaluate the effects of the Project on habitat for steelhead and focuses on migratory habitat conditions with the Flood Control Channel.

2.1.1.1. Use of Best Available Scientific and Commercial Information

To conduct the assessment, NMFS examined an extensive amount of information from a variety of sources. Detailed background information on the biology and status of the listed species and their habitat requirements has been published in a number of documents including peer reviewed scientific journals, primary reference materials, and governmental and non-governmental reports. Additional information regarding the effects of the Project's actions on the listed species in question, their anticipated response to these actions, and the environmental consequences of the actions as a whole was formulated from the aforementioned resources referenced in the Consultation History (Section 1.2 of this opinion) and the Project's biological assessment dated February 2017. Information was also provided to NMFS in electronic mail messages and telephone conversations with ACWD and Corps representatives between April 2013 and August 2017. For information that has been taken directly from published, citable documents, those citations have been referenced in the text and listed at the end of this document. A complete administrative record of this consultation is on file at the NMFS North-Central Coast Office in Santa Rosa, California (Administrative Record Number 151422SWR2013SR00191).

2.2 Rangewide Status of the Species

This opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02.

2.2.1. Listed Species

This biological opinion analyzes the effect of the ACWD and ACFCD's proposed fish passage and fish screening project within the Alameda Creek Flood Control Channel on the CCC steelhead. CCC steelhead are listed as threatened under the ESA (71 FR 834, January 5, 2006). The CCC steelhead distinct population segment (DPS) includes steelhead in coastal California streams from the Russian River to Aptos Creek, and the drainages of Suisun Bay, San Pablo Bay, and San Francisco Bay. Under current conditions, Alameda Creek does not support a population of anadromous *O. mykiss* due to complete barriers to upstream passage approximately 10 miles above San Francisco Bay (*i.e*., RD1/Drop Structure), and the listing of the CCC steelhead DPS only applies to the anadromous forms of *O. mykiss*. However, resident *O. mykiss* in the Alameda Creek watershed have the potential to become anadromous, and individuals would become listed steelhead when they exhibit an anadromous life history. Alameda Creek, including the action area of the Project, is not designated as critical habitat for CCC steelhead.

2.2.1.1. CCC Steelhead General Life History

Steelhead are anadromous forms of *O. mykiss*, spending some time in both fresh- and saltwater. The older juvenile and adult life stages reside in the ocean, until the adults ascend freshwater streams to spawn. Unlike Pacific salmon, steelhead are iteroparous, or capable of spawning more than once before death (Busby *et al.* 1996). Although one-time spawners are the great majority, Shapovalov and Taft (1954) reported that repeat spawners are relatively numerous (17.2 %) in California streams. Eggs (laid in gravel nests called redds), alevins (gravel dwelling hatchlings), fry (juveniles newly emerged from stream gravels), and young juveniles all rear in freshwater until they become large enough to migrate to the ocean to finish rearing and maturing to adults.

Adult CCC steelhead are classified as winter-run steelhead because they emigrate from the ocean to their natal streams to spawn annually during the winter. Specifically, adult CCC steelhead typically enter freshwater between December and April, peaking in January and February (Fukushima and Lesh 1998). During this time, seasonal high flows create stream velocities and depth that are optimal for adults to transit to and from spawning grounds. Moving during seasonal high flows also enables steelhead to utilize intermittent streams—a common stream characteristic found in the San Francisco Bay region—for spawning (Everest 1973, Barnhart 1986). The minimum stream depth necessary for successful upstream migration is about 13 centimeters (cm) (Thompson 1972). The preferred water velocity for upstream migration is in the range of 40-90 cm/s, with a maximum velocity, beyond which upstream migration is not likely to occur, of 240 cm/s (Thompson 1972).

Steelhead may spawn more than one season before dying (iteroparity), in contrast to other species of the genus *Oncorhynchus*. Most adult steelhead in a run are first time spawners, although Shapovalov and Taft (1954) reported that repeat spawners are relatively numerous (about 17%) in California streams. Among repeat spawners, the representation of each group declines as the number of spawnings increases. There is a sharp decline in numbers from second spawners (about 15%) to third spawners (about 2%). Fish spawning four or more times are rare (less than 1%).

Upon entering their natal stream, steelhead females build redds to bury eggs for a several month-long incubation period. Redds are generally located in areas where the hydraulic conditions are such that fine sediments, for the most part, are sorted out and streamflow is constant. Reiser and

Bjornn (1979) found that gravels of 1.3-11.7 cm in diameter were preferred by steelhead. The survival of embryos is reduced when fines smaller than 6.4 millimeters (mm) comprise 20 to 25% of the substrate. This is because, during the incubation period, the intragravel environment must permit a constant flow of water to deliver dissolved oxygen and to remove metabolic wastes. Studies have shown a higher survival of embryos when intragravel velocities exceed 20 cm/hr (Coble 1961; Phillips and Campbell 1961). The number of days required for steelhead eggs to hatch is inversely proportional to water temperature and varies from about 19 days at 15.6˚ degrees (°) Celsius (C) to about 80 days at 5.6˚ C. Fry typically emerge from the gravel two to three weeks after hatching (Barnhart 1986). Other intragravel parameters such as the organic material in the substrate effect the survival of eggs to fry emergence (Chapman 1988; Everest *et al.* 1987; Shapovalov and Taft 1954).

Once emerged from the gravel, steelhead fry rear in freshwater edgewater habitats and move gradually into pools and riffles as they grow larger. Cover, water temperature, sediment, and food items are important habitat components for juvenile steelhead. Cover in the form of woody debris, rocks, overhanging banks, and other in-water structures provide velocity refuge and a means of avoiding predation (Bjornn *et al.* 1991; Shirvell 1990). Steelhead, however, tend to use riffles and other habitats not strongly associated with cover during summer rearing more than other salmonids. In winter, juvenile steelhead become less active and hide in available cover, including gravel or woody debris. Young steelhead feed on a wide variety of aquatic and terrestrial insects, and emerging fry are sometimes preyed upon by older juveniles. Water temperature can influence the metabolic rate, distribution, abundance, and swimming ability of rearing juvenile steelhead (Barnhart 1986; Bjornn and Reiser 1991; Myrick and Cech 2005). Optimal temperatures for steelhead growth range between 10 and 20° C (Hokanson *et al.* 1977; Myrick and Cech 2005; Wurtsbaugh and Davis 1977). Fluctuating diurnal water temperatures are also important for the survival and growth of salmonids (Busby *et al.* 1996).

Although variation occurs, in coastal California juvenile steelhead usually rear in freshwater for 1-2 years until they are become large enough to migrate to the ocean as smolts to finish rearing and maturing to adults. Barnhart (1986) reported that steelhead smolts in California range in size from 140 to 210-millimeter (mm) (fork length). CCC steelhead smolts emigrate episodically from natal streams during fall, winter, and spring high flows, with peak migration occurring in April and May (Fukushima and Lesh 1998).

2.2.1.2. Status of CCC Steelhead DPS

Historically, approximately 70 populations[4] of steelhead existed in the CCC steelhead DPS (Spence *et al.* 2008; Spence *et al.* 2012). Many of these populations (about 37) were independent, or potentially independent, meaning they had a high likelihood of surviving for 100

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

years absent anthropogenic impacts (Bjorkstedt *et al.* 2005). The remaining populations were dependent upon immigration from nearby CCC steelhead DPS populations to ensure their viability (Bjorkstedt *et al.* 2005; McElhany *et al.* 2000).

While historical and present data on abundance are limited, CCC steelhead numbers are substantially reduced from historical levels. A total of 94,000 adult steelhead were estimated to spawn in the rivers of this DPS in the mid-1960s, including 50,000 fish in the Russian River - the largest population within the DPS (Busby *et al.* 1996). Near the end of the 20th century the population of wild CCC steelhead in the Russian River was estimated to be between 1,700-7,000 fish (Busby *et al.* 1996; Good *et al.* 2005). Abundance estimates for smaller coastal streams in the DPS indicate low but stable levels, with recent estimates for several streams (Lagunitas, Waddell, Scott, San Vicente, Soquel, and Aptos creeks) of individual run sizes of 500 fish or less (62 FR 43937). However, as noted in Williams *et al.* (2016) data for CCC steelhead populations remains scarce outside of Scott Creek, which is the only long-term dataset and shows a significant decline. Short-term records indicate the low but stable assessment of populations is reasonably accurate; however, it should be noted that there is no population data for any populations outside of the Santa Cruz Mountain stratum, other than hatchery data from the Russian River.

NMFS cites many reasons (primarily human caused) for the decline of steelhead (Busby *et al.* 1996). The foremost reason for the decline in steelhead is the degradation and/or destruction of freshwater and estuarine habitat. Activities having the largest impacts on habitats include: logging, agricultural and mining activities, urbanization, dams, and water withdrawals, including unscreened diversions for irrigation (Busby *et al.* 1996; Good *et al.* 2005). These activities cause alteration of stream bank and channel morphology, alteration of water temperatures, loss of spawning and rearing habitat, fragmentation of habitat, loss of downstream recruitment of spawning gravels and large woody debris, degradation of water quality, removal of riparian vegetation resulting in increased stream bank erosion, loss of shade (higher water temperatures), and loss of nutrient inputs (70 FR 52488; Busby *et al.* 1996). Depletion and storage of natural river flows have drastically altered natural hydrologic cycles in many of the streams in the DPS. Alteration of flows results in migration delays, loss of suitable habitat due to dewatering and blockage, stranding of fish from rapid flow fluctuations, entrainment of juveniles into poorly screened or unscreened diversions, and increased water temperatures harmful to salmonids. Other factors, such as overfishing and artificial propagation have also contributed to status of the current population, yet are believed to play a smaller role in the widespread decline in habitat values.

Some loss of genetic diversity in the CCC steelhead DPS has been documented and attributed to previous among-basin transfers of stock and local hatchery production in interior populations in the Russian River (Bjorkstedt *et al.* 2005). Similar losses in genetic diversity in the Napa River may have resulted from out-of-basin and out-of-DPS releases of steelhead in the Napa River basin in the 1970s and 80s. These transfers included fish from the South Fork Eel River, San Lorenzo River, Mad River, Russian River, and the Sacramento River. In San Francisco Bay streams, reduced population sizes and fragmentation of habitat has likely also led to loss of genetic diversity in these populations.

NMFS periodically reviews the best available information on steelhead abundance to reassess the status of the DPS and determine if it is viable in the long term. In 2005, a status review concluded that steelhead in the CCC steelhead DPS remain "likely to become endangered in the foreseeable future" (Good *et al.* 2005). On January 5, 2006, NMFS issued a final determination that the CCC steelhead DPS is a threatened species, as previously listed (71 FR 834). As described above, since the 2006 determination, CCC steelhead have continued to experience serious declines in abundance and long-term population trends suggest a negative growth rate. However, CCC steelhead remain present in most streams throughout the DPS, roughly approximating the known historical range. Therefore, despite serious population declines throughout the DPS, CCC steelhead likely possess a resilience that is likely to slow their decline relative to other salmonid DPSs or evolutionarily significant units in worse condition. Considering this and other factors, the 2011 status update found that the status of the CCC steelhead DPS remains "likely to become endangered in the foreseeable future" (Williams *et al.* 2011). The most recent status review (Williams *et al.* 2016) reached the same conclusion. On May 26, 2016, NMFS affirmed no change to the determination that the CCC steelhead DPS is a threatened species (81 FR 33468), as previously listed (76 FR 76386). For more detailed information on trends in CCC steelhead abundance, see: (Busby *et al.* 1996; Good *et al.* 2005; Spence *et al.* 2008; Williams *et al.* 2011, Williams *et al.* 2016).

2.2.2. Global Climate Change

One factor affecting the range-wide status of the CCC steelhead DPS, and aquatic habitat at large is climate change. Impacts from global climate change are already occurring in California. For example, average annual air temperatures, heat extremes, and sea level have all increased in California over the last century (Kadir *et al.* 2013). Snow melt from the Sierra Nevada has declined (Kadir *et al.* 2013). However, total annual precipitation amounts have shown no discernable change (Kadir *et al.* 2013). CCC steelhead may have already experienced some detrimental impacts from climate change. NMFS believes the impacts on listed salmonids to date are likely fairly minor because natural, and local climate factors likely still drive most of the climatic conditions steelhead experience, and many of these factors have much less influence on steelhead abundance and distribution than human disturbance across the landscape. In addition, CCC steelhead are not dependent on snowmelt driven streams and, thus not affected by declining snow packs.

The threat to CCC steelhead from global climate change will increase in the future. Modeling of climate change impacts in California suggests that average summer air temperatures are expected to continue to increase (Lindley *et al.* 2007; Moser *et al.* 2012). Heat waves are expected to occur more often, and heat wave temperatures are likely to be higher (Hayhoe *et al.* 2004, Moser *et al.* 2012; Kadir *et al.* 2013). Total precipitation in California may decline and critically dry years may increase (Lindley *et al.* 2007; Schneider 2007; Moser *et al.* 2012). Wildfires are expected to increase in frequency and magnitude (Westerling *et al.* 2011, Moser *et al.* 2012).

In the San Francisco Bay region, warm temperatures generally occur in July and August, but as climate change takes hold, the occurrences of these events will likely begin in June and could continue to occur in September (Cayan *et al.* 2012). Climate simulation models project that the San Francisco region will maintain its Mediterranean climate regime, but experience a higher degree of variability of annual precipitation during the next 50 years and years that are drier than the historical annual average during the middle and end of the twenty-first century. The greatest reduction in precipitation is projected to occur in March and April, with the core winter months remaining relatively unchanged (Cayan *et al.* 2012).

Estuaries may also experience changes detrimental to steelhead. Estuarine productivity is likely to change based on changes in freshwater flows, nutrient cycling, and sediment amounts (Scavia *et al.* 2002, Ruggiero *et al.* 2010). In marine environments, ecosystems and habitats important to juvenile and adult salmonids are likely to experience changes in temperatures, circulation, water chemistry, and food supplies (Brewer and Barry 2008, Feely 2004, Osgood 2008, Turley 2008, Abdul-Aziz *et al*. 2011, Doney *et al*. 2012). The projections described above are for the mid to late 21st Century. In shorter time frames, climate conditions not caused by the human addition of carbon dioxide to the atmosphere are more likely to predominate (Cox and Stephenson 2007, Santer *et al.* 2011).

2.2.3. Coastal Multispecies Recovery Plan

Spence *et al.* (2012) identified the CCC steelhead population that historically occupied the Alameda Creek watershed as "functionally independent". With a historical population status of "independent", the restoration of fish passage for CCC steelhead to access the Alameda Creek watershed is identified as a high priority in the NMFS Coastal Multispecies Recovery Plan (NMFS 2016).

The current status of CCC steelhead populations in tributaries to South San Francisco Bay is poor. Very small returns of adult steelhead have been observed in recent years in Coyote Creek, Guadalupe River, and Stevens Creek. In San Francisquito Creek and San Mateo Creek, conditions are more favorable, but population levels remain low and habitat conditions are severely constrained by urbanization. Alameda Creek offers a unique and important restoration opportunity for CCC steelhead. Based on an assessment of habitat suitability and other factors in the watershed, the NMFS Steelhead Recovery Team selected Alameda Creek as an "essential" population for the recovery of the CCC steelhead DPS. Virtually all of the historic intrinsic potential habitat in the watershed is now inaccessible to steelhead and the proposed Project is designed to restore access to a significant portion of this lost habitat.

2.3 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area for this project consists of the Alameda Creek Flood Control Channel from the upstream end of the RD3 impoundment near Mission Boulevard to the mouth of the creek at San Francisco Bay. This area contains all of ACWD and ACFCD's facilities within the Flood Control Channel, including the Project's new fishways and fish screens. The action area also includes the reach of Alameda Creek where streamflows are affected by ACWD's water diversions. The action area for this Project is presented in Figure 1.

2.4 Environmental Baseline

The "environmental baseline" includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

Alameda Creek is located in a Mediterranean climatic region, with over 90% of annual precipitation occurring between November and April. Cool, moist coastal fog generally alternates with clear, warm weather during the months of May through September, and significant rainfall during that time is rare.

Alameda Creek in the action area was re-aligned and channelized by the Corps between 1969 and 1972 to construct the Flood Control Channel. The present-day course of Alameda Creek in the action area generally follows the historical route until just upstream of Interstate 880. At this point, construction of the flood channel re-routed the streamflow of Alameda Creek more directly towards San Francisco Bay to a location approximately 2 miles south of the historical mouth of Alameda Creek. The old bed of Alameda Creek, which continues northwest to San Francisco Bay, is now referred to as "Old Alameda Creek". Due to a restricted hydrologic connection at Old Alameda Creek, all the flow of Alameda Creek at this location follows the Flood Control Channel (Stanford *et al.* 2013). Throughout this opinion, "Alameda Creek" refers to the current route of the Flood Control Channel.

2.4.1. Status of CCC Steelhead in the Action Area

The loss of upstream fish passage at the BART Weir has prevented steelhead access to all suitable spawning and rearing habitat in the Alameda Creek watershed since the early 1970s. This complete passage barrier has depleted the Alameda Creek steelhead population. Observations below the BART Weir indicate adult steelhead sporadically return to the watershed in attempt to complete their life history; however, these adults are unable to pass upstream at the RD1/Drop Structure and conditions in the Flood Control Channel do not support successful spawning, incubation, and juvenile rearing.

The origin of the adult steelhead returning to Alameda Creek is currently unknown. A few adult steelhead returns are adipose fin-clipped indicating that they originated from a hatchery and have strayed into Alameda Creek. However, the majority of adult steelhead returns observed below the BART Weir are not adipose fin-clipped and it is likely that the current resident *O. mykiss* population in the upper Alameda Creek watershed is the source of these returning adults.[5] Spillover events at upstream reservoirs (Calaveras Reservoir, San Antonio Reservoir, and Del Valle Reservoir) and other high flows events during the late winter/spring can provide suitable conditions for the outmigration of juvenile *O. mykiss* through lower Alameda Creek to San Francisco Bay and thence the ocean. Population genetic studies are underway to improve our understanding of the current population structure of *O. mykiss* that reside within the watershed

[5] Resident rainbow trout can produce anadromous offspring (71 FR 834).

and determine the origin of returning anadromous adults. The information below is a summary of what is currently known about *O. mykiss* in the Alameda Creek watershed.

As noted above, the historical steelhead population within the Alameda Creek watershed has been identified as a functionally independent population within the CCC steelhead DPS (Spence *et al*. 2008; Bjorkstedt *et al.* 2005). This determination was primarily based on the size of the watershed, its potential production capacity (*i.e*., number of adults), and geographic location. Empirical information regarding the historical population of steelhead in Alameda Creek is very limited. However, there are accounts which indicate the presence of steelhead at the time of construction of Calaveras Dam, completed in 1925. More recently, there are accounts of steelhead in Alameda Creek prior to completion of the Flood Control Channel in 1972. Photographic records appear to document the historical runs; however, no reliable scientific records exist of the size of steelhead spawning populations or the distribution of spawning and rearing areas that once occurred within the watershed.

Resident *O. mykiss* have been documented above Calaveras Reservoir on several occasions since 1905, based on collections from Arroyo Hondo, Isabel, and Smith Creeks. To better understand the resident and adfluvial *O. mykiss* populations in these reservoirs, the SFPUC initiated a fish trapping program in 2001. Upstream and downstream migrant traps were operated on two streams during 2002 (San Antonio Creek and Arroyo Hondo) and three streams during 2003 and 2004 (San Antonio Creek, Indian Creek, and Arroyo Hondo). The results of this trapping program have provided information regarding abundance and adfluvial behavior of *O. mykiss* populations in the upper Alameda Creek watershed. Pre-spawning adult *O. mykiss* were captured in upstream migrant traps between February and early April, fish were tagged, and post-spawning tagged adults were recaptured in downstream migrant traps. Operation of downstream migrant traps also documented the presence of fry, young-of-year, age 1+ and age 2+ juveniles. Over 80% of the juvenile (parr, partial smolts, and smolts) *O. mykiss* captured in the downstream migrant traps displayed morphological characteristics of smoltification (*i.e.* classified as partial smolt or smolt) (SFPUC 2009b).

The genetic characteristics of these resident/adfluvial populations have been assessed. Nielson (2003) analyzed genetic diversity of four sub-populations of *O. mykiss* on Alameda Creek in 2002. Three sample locations – Arroyo Hondo, upper Alameda Creek, and San Antonio Reservoir – were more closely related to each other than to any reference collection used in the analyses. The closest out-of-basin genetic relationship for these three Alameda Creek sub-populations of *O. mykiss* (excluding Arroyo Mocho) was with steelhead collected from Lagunitas Creek in Marin County. Microsatellite analyses showed the fourth sub-population of *O. mykiss* from Arroyo Mocho in northern sub-basin of upper Alameda Creek to be more closely related to hatchery fish from the Mount Whitney hatchery strain (Nielsen 2003). These results strongly suggest the three subpopulations of *O. mykiss* in Arroyo Hondo (*i.e.* Calaveras Reservoir), upper Alameda Creek, and San Antonio Reservoir (*i.e*. Indian Creek and San Antonio Creek) represent significant genetic components of the native, wild *O. mykiss* resource found in central and southern California (Nielsen 2003).

Although there may have been some stocking of exotic trout in the watershed in the past, to what extent is currently unknown. Based on Nielsen's work (2003) and the observed adfluvial life history traits, the present self-sustaining populations are most likely derived from CCC steelhead that were isolated in the upper part of the drainage by natural processes or by construction of Calaveras Dam between 1916 and 1925. Self-sustaining *O. mykiss* populations also exist in streams of the San Antonio watershed above the SFPUC's Turner Dam (San Antonio Reservoir). Currently, *O. mykiss* isolated above both the Turner and Calaveras Dams express an adfluvial life history strategy, spending most of their lives in the reservoirs and migrating upstream into tributary streams to spawn.

Recent work by the NMFS Southwest Fisheries Science Center and others have identified a specific genomic region on chromosome Omy5 in *O. mykiss* that is strongly associated with life history populations of steelhead and rainbow trout (referred to as the Omy5 Migration Associated Region) (Hecht *et al.* 2012, Miller *et al.* 2012, Pearse *et al*. 2014, Leitwein *et al*. 2016). Pearse *et al*. (2014) reports *O. mykiss* known to display adfluvial migration behavior from upper Alameda Creek had the highest observed frequencies of Omy5 MAR migratory alleles of six different sample locations from tributaries to San Francisco Bay. These results indicate the adfluvial population of *O. mykiss* in upper Alameda Creek retain a portion of the genetic variants and migratory behavior associated with anadromy.

During the past 10+ years, several observations of adult steelhead have been made downstream of the impassable barrier at RD1/Drop Structure. In 1998 and in subsequent years (*i.e.*, 1999, 2006, 2008, and 2017), individual adult steelhead were captured below RD1/Drop Structure by local government agencies and citizen groups, and released at various locations throughout Niles Canyon and lower Alameda Creek. In 1998, steelhead were observed spawning in very poor substrate conditions within the Flood Control Channel downstream of RD1/Drop Structure. Due to poor habitat conditions within the Flood Control Channel, the fertilized eggs from this spawning event were collected and moved to an offsite incubation facility to ensure survival. The eggs hatched successfully and the resulting fry were released into Alameda Creek near Sunol Park (Gunther *et al*. 2000). In 1999, three adult steelhead were captured and released upstream of RD1/Drop Structure. In 2006, six adult steelhead were collected and released upstream. In February 2008, two adult steelhead were captured below RD1/Drop Structure and released in the Niles Canyon reach of Alameda Creek. These two fish exhibited spawning behavior on March 2 and 3, 2008, in Stonybrook Creek (J. Miller, personal communication). No adult steelhead were observed at the BART Weir from 2009 through 2016. In 2017, nine adult steelhead were collected from the area immediately downstream of RD1/Drop Structure. One fish was adipose fin-clipped, indicating that it was of hatchery-origin, and this fish was released downstream. For the remaining eight adult steelhead collected in 2017, five were tagged with radio transmitters and all eight were released in the Niles Canyon reach of Alameda Creek upstream of RD3 (J. Sullivan, personal communication).

2.4.2. Factors Affecting Species Environment within the Action Area

The Flood Control Channel where the action area is located was constructed in response to floods that inundated the surrounding urbanized area in the 1950's. The earthen channel is approximately 200 feet wide with rock rip-rapped levee slopes and is designed to convey a 500-year flood event. Several sills or grade control structures including the one at ACFCD's Drop Structure were installed across the channel bottom to prevent head-cutting and to secure transportation bridge footings. No provisions were made to provide for the upstream passage of anadromous fish when the flood channel was constructed. As noted above, the grade control structure at the ACFCD Drop Structure (*i.e*, BART Weir), approximately 10 miles upstream of San Francisco Bay, is a complete barrier to upstream fish passage under all streamflow conditions.

The historical floodplain adjacent to lower Alameda Creek has been largely converted to residential, commercial, and industrial urban uses. The cities of Fremont and Union City now occupy the floodplain and development extends right up to the levees of the Flood Control Channel. The loss of this floodplain habitat has greatly reduced available high value winter rearing habitat for juvenile steelhead and degraded habitat conditions for migrating steelhead.

Water supply development has also profoundly affected habitat conditions for steelhead in the action area. Large abandoned gravel extraction pits adjacent to the Flood Control Channel were developed to serve as groundwater recharge basins. ACWD constructed a series of three inflatable dams to raise water levels so that water can flow by gravity through diversion pipes into the adjacent recharge basins. One of the three rubber dams in the Flood Control Channel (*i.e*., RD2) was decommissioned in 2009. The two remaining rubber dams (RD1 and RD3) currently create bank-to-bank ponded conditions in the channel when inflated for a distance of over one mile.

ACWD's existing water diversions in the Flood Control Channel have been operated since the 1980's without minimum bypass flows to protect fish downstream of RD1. A 150 cfs-capacity diversion is operated with four fish screens immediately upstream of RD3 on the north levee to serve the Alameda Creek Pipeline. A 28 cfs-capacity diversion with one fish screen is operated immediately upstream of RD3 on the south levee to fill the Bunting Pond. A 50 cfs-capacity diversion with a fish screen is operated on the south levee in between RD1 and RD3 to fill the Kaiser Pond. The Shinn Pond recharge facility is filled by two points of diversion; one is 200 cfs and the other 225 cfs. These two points of diversion for the Shinn Pond are currently unscreened, and the Project proposes to consolidate these two diversion sites to one location and install fish screens. With the two Shinn Pond diversions consolidated into one location by the proposed Project, there will be four points of diversion post-project. ACWD uses these diversions year-round to exercise their water rights from Alameda Creek and to take delivery of water from the SWP.

From Mission Boulevard to RD1, the channel of Alameda Creek is typically inundated with large ponds due to operation of ACWD's rubber dams. These large ponds of slow moving water provide very poor habitat conditions for steelhead due to low water velocities, lack of riffle habitat, thermal warming, high summer temperatures, and substrate with a large silt component. However, the ponds do provide habitat for a variety of native and non-native fish. Sampling by the East Bay Regional Park District in 2008 identified the following fish species in ponded areas near RD3:

> Pacific lamprey (*Entosphenus tridentatus*),
> Sacramento Hitch (*Lavinia exilicauda*),
> Prickly sculpin (*Cottus asper*),

Sacramento sucker (*Catostomus occidentalis*),
Sacramento pikeminnow (*Ptychocheilus grandis*),
Common carp (non- native) (*Cyprinus carpio*),
Largemouth bass (non-native) (*Micropterus salmoides*),
White catfish (non-native) (*Ameiurus catus*),
Bluegill (non-native) (*Lepomis macrochirus*),
Green sunfish (non-native) (*Lepomis cyanellus*),
Goldfish (non-native) (*Carassius auratus*),
Bigscale logperch (non-native) (*Percina macrolepida*).

Downstream of RD1, there is no artificial ponding of flow and some sections of the channel may become dry during the summer and fall months (Hanson Environmental Inc. 2002). The Flood Control Channel in this reach is a wide, flat, shallow floodplain with segments of narrow channel below grade control structures alternating with segments of wide shallow channel meandering through disturbed freshwater marsh, dominated by California bulrush. From Decoto Road to the tidal marshes of San Francisco Bay, the channel slope decreases which results in substantial sediment accumulation. ACFCD periodically removes sediment and vegetation from these reaches of the Flood Control Channel to maintain the design capacity; however, a large scale maintenance event has not occurred since 2000.

The grade control structure under the UPRR Bridge near Alvarado Boulevard, approximately 4.5 miles above the Bay, generally marks the Flood Control Channel's transition from freshwater marsh to tidal saline estuarine marsh. In this reach, floodplain habitat is dominated by alkali bulrush. Along the San Francisco Bay shoreline including the tidal reach of lower Alameda Creek, commercial salt production was carried out in an extensive system of evaporation ponds. Solar salt production in South San Francisco Bay began in the mid-1850s and resulted in the conversion of large wetland areas to salt evaporation ponds (Siegel and Bachand 2002) which significantly reduced the quality and extent of tidal rearing habitat for steelhead. With the development of ponds for salt production and the re-routing of Alameda Creek into the Flood Control Channel, the historical Alameda Creek estuary no longer exists (Stanford *et al*. 2013). The Flood Control Channel receives little tidal influence, and most tidal channels have been obliterated or have silted up through lack of tidal action (Collins and Grossinger 2004).

The flood control and water development actions described above have resulted in low value habitat for steelhead due to the creation of passage barriers, altered streamflows, excessive amounts of fine substrate, poorly developed native riparian vegetation, and uniform elongated pool features with limited riffle habitat. Lower Alameda Creek now offers poor seasonal rearing habitat and limited growth opportunities for juvenile steelhead. Currently and historically, lower Alameda Creek offers poor conditions for steelhead spawning and egg incubation.

The long-term effects of climate change have been presented under the Rangewide Status of the Species and Critical Habitat section of this biological opinion (Section 2.2.2). These include changes in streamflow regimes, water temperatures, and rainfall patterns. Climate change poses a threat to CCC steelhead within the action area. The current climate in the action area is generally warm, and modeled regional average air temperatures show an increase in summer (Lindley *et al*. 2007) and greater heat waves (Hayhoe *et al.* 2004). The likely change in amount of rainfall in Northern and Central Coastal streams under various warming scenarios is less certain; total rainfall across the state is expected to decline. For the California North Coast, some models show large increases (75 to 200%) in precipitation while other models show decreases of 15 to 30% (Hayhoe *et al*. 2004).

Steelhead rearing and migratory habitat are most at risk to climate change. Increasing water temperatures, and changes in the amount and timing of precipitation will impact water quality, streamflow levels, and steelhead migration. Low and warm summer flow conditions will negatively affect juvenile steelhead growth and survival. The upstream migration of adult steelhead will be impeded by low stream conditions during winter months, as well as, excessively high streamflows during large winter precipitation events. Smolt outmigration may be constrained by fewer and/or lower spring high flow events.

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

Few consultations have occurred in the action area of this Project because Alameda Creek has not supported a run of anadromous fish since CCC steelhead were listed in October 1997 and the stream is not designated as critical habitat. Pursuant to section 7 of the ESA, NMFS has conducted four interagency consultation within the action area of the Project. All four consultations were conducted with the Corps.

- The Decoto Road Bridge Seismic Retrofit (PCTS #SWR-2010-5173) involved modifications to the bridge crossing of the Flood Control Channel for seismic safety by Union City. By letter dated March 22, 2011, NMFS concurred with the Corps that the proposed action was not likely to adversely affected listed steelhead.

- The Old Alameda Creek Sediment Removal Project (PCTS #SWR-2009-3313) involved the removal of 44,000 cubic yards of accumulated sediment by the ACFCD to restore the channel to its original design flood capacity. By letter dated April 21, 2010, NMFS concurred with the Corps that the proposed action was not likely to adversely affected listed steelhead nor green sturgeon.

- The Alameda Creek North Levee Remedial Project (PCTS #SWR-2011-00327) involved the placement of 10,000 cubic yards of rock riprap by the ACFCD along 2,600 linear feet of the Flood Control Channel in the reach between Alvarado Boulevard and the UPRR Bridge. By letter dated February 18, 2011, NMFS concurred with the Corps that the proposed action was not likely to adversely affected listed steelhead.

- The Calaveras Dam Replacement Project (PCTS #SWR-2005-7436) involved the rebuilding of SFPUC's Calaveras Dam on Calaveras Creek in the upper Alameda Creek watershed. The consultation addressed the construction of the dam and the future operation of the 96,850 acre-foot reservoir. The impoundment of local runoff from the upper Alameda Creek watershed in Calaveras Reservoir and the dam's future bypass flow releases for fish downstream will affect streamflow conditions within the action area of the Joint Lower Alameda Creek Fish Passage Improvements Project. The March 5, 2011 biological opinion issued by NMFS concluded that the construction and future operation of the Calaveras Dam Replacement Project are not likely to jeopardize the continued existence of threatened CCC steelhead.

In addition to the above consultations, NMFS has provided technical assistance to the Corps and ACWD regarding the Larinier fishway design constructed at the site of former RD2 in 2009, and the fish screen designs for the Alameda Creek Pipeline intake (constructed in 2008), the Bunting Pond intake (constructed in 2009), and the Kaiser Pond intake (constructed in 2013). NMFS also provided technical assistance to the Corps and the Union Sanitation District in October 2006 regarding the emergency repair of a sanitary sewer pipeline crossing in lower Alameda Creek.

Several research and enhancement projects resulting from NMFS' Section 10(a)(1)(A) research and enhancement permits and section 4(d) limits or exceptions could occur in the action area. East Bay Regional Park District has approval through the section 4(d) state research program to conduct a steelhead migration study in Alameda Creek. This study is designed to evaluate the collection and relocation of migrating steelhead around RD1/Drop Structure in lower Alameda Creek. Adult steelhead are captured during the winter months from below the Drop Structure and most of the collected individuals are equipped with external radio transmitters prior to being released upstream in the Niles Canyon reach of Alameda Creek. Migration movements are tracked to provide information to Alameda Creek Fisheries Restoration Workgroup. The results of this program since 1998 are presented in Section 2.4.1 of this opinion. As of September 2017, no other research or enhancement activities requiring Section 10(a)(1)(A) research and enhancement permits or section 4(d) limits have occurred in the action area.

2.5 Effects of the Action

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

2.5.1. Effects of Project Construction

Proposed work within Alameda Creek will extend over a 4-year period and includes excavation, grading and construction for completion of two fishways and fish screens in the Flood Control Channel. Large equipment including excavators, dump trucks, concrete trucks, pumper trucks, loaders/backhoes, compaction equipment, water trucks, dewatering equipment, and cranes will be used to construct Project facilities. Work sites will be isolated from the active/wet channel of Alameda Creek with sand bags, fiber mats and temporary cofferdams during construction activities.

All life stages of CCC steelhead are unlikely to be present in the action area during construction due to the presence of the impassable barrier at the RD1/Drop Structure and the proposed in-channel construction work window. The barrier at RD1/Drop Structure will continue to prevent upstream access to Alameda Creek until the fishway is completed and fully operational. Furthermore, construction activities within the Flood Control Channel will be restricted to the period between May 1 and October 31 which is outside the adult migration season of CCC steelhead (January 1 to March 31). Likewise, out-migrating juveniles (*i.e*. smolts) and post-spawn steelhead (*i.e*., kelts) steelhead are unlikely to be present during construction activities as their outmigration season is largely outside the construction window. Additionally, until the RD1/Drop Structure is remedied, no recruitment of juvenile CCC steelhead into the project area is expected and the currently accessible habitat area in the Flood Control Channel cannot support spawning or summer juvenile rearing. Thus, it is very unlikely that CCC steelhead will be present and exposed to the effects of Project construction activities. Isolation of work sites from the flowing waters of Alameda Creek is expected to prevent the degradation of water quality. Best management practices are expected to effectively prevent the discharge of sediments and contaminants into the waters of Alameda Creek. There currently is little riparian vegetation within the Flood Control Channel, particularly at the Project's construction work sites. Equipment access and construction activities will avoid areas with riparian vegetation; thus no impacts to riparian vegetation are anticipated during construction.

When each of the four construction seasons are concluded, the Project will remove cofferdams and other equipment used to dewater work sites. These activities will likely result in minor disturbance of the creek bed and banks. Disturbed soils may become mobilized when fall and winter storms increase stream flow levels post-construction. NMFS anticipates these activities would affect water quality in the action area in the form of small, short-term increases in turbidity during re-watering and subsequent higher flow events during the first winter storms following each season of construction. Instream and near-stream construction activities have been shown to result in temporary increases in turbidity (reviewed in Furniss *et al.* 1991, Reeves *et al.* 1991, Spence *et al.* 1996).

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

Although chronic elevated sediment and turbidity levels may affect steelhead as described above, sedimentation and turbidity levels associated with this Project's cofferdam construction and removal, and the subsequent rewetting of the construction sites within the action area and during subsequent rainfall events are not expected to rise to the levels discussed in the previous paragraph because the Project proposes several measures to prevent the mobilization of sediment. Due to the Project's proposed use of sand bags, hay bales, fiber mats, silt screens, and/or other methods throughout the construction phases, NMFS anticipates any resulting elevated turbidity levels would be small and only occur for a short time, well below levels and durations shown in the scientific literature as causing injury or harm to salmonids (see for example Sigler *et al.* 1984 or Newcombe and Jensen 1996) or to salmonid prey species. NMFS expects any sediment or turbidity generated by Project construction would not extend more than 100 feet downstream of the work sites based on the site conditions (low flows) and methods used to control sediment and turbidity. Additionally, steelhead do not have access to the Project's construction sites under current conditions due to the impassable barrier at RD1/Drop Structure. Thus, in-between construction work windows of this multi-year construction project, steelhead are not likely to be present in the action area. Based on the above, effects of Project construction and degraded water quality on CCC steelhead are improbable.

2.5.2. Effects of Future Operations

2.5.2.1. Operation of Fish Ladders

The current construction schedule will allow for completion and full operation of two new fishways in Alameda Creek prior to the 2021-2022 winter upstream migration of adult CCC steelhead. In-migrating adult steelhead will first encounter the downstream fishway at RD1/Drop Structure and, then subsequently encounter the RD3 fishway approximately one mile upstream. Due to their location in lowermost reaches of the creek, these two new fishways re-open the watershed for the return of anadromous fish to the Alameda Creek. It will be the first time in approximately 50 years that CCC steelhead will have volitional access to the watershed upstream of the Flood Control Channel. The anticipated benefits of this Project's upstream fish passage facilities are very important as access will be restored to high quality steelhead spawning and rearing habitat in the largest tributary to San Francisco Bay (watershed area of approximately 700 square miles).

Based on a draft steelhead restoration action plan developed by the Alameda Creek Fisheries Restoration Workgroup in 2003 (CEMAR 2003), the following stream reaches in the Alameda Creek watershed are anticipated to support steelhead spawning and juvenile rearing:

- Stonybrook Creek,
- Sinbad Creek,
- Welch Creek,
- Arroyo Mocho,
- Calaveras Creek from the confluence with Alameda Creek to Calaveras Dam,
- Alameda Creek - Niles Canyon Reach,
- Alameda Creek from the Sunol Valley to the confluence with Calaveras Creek,
- Alameda Creek upstream of the confluence with Calaveras Creek.

Passage at RD1/Drop Structure. The RD1/Drop Structure fish passage facility consists of two parts; an upper vertical slot fish ladder to provide passage around the existing RD1 structure, and a lower vortex pool-and-chute fish ladder providing passage around the ACFCD Drop Structure. This combined fishway design allows for the facility to operate continuously and meet target fish passage criteria up to a streamflow of approximately 1,100 cfs. Above 1,100 cfs, fish passage opportunities will exist although some criteria may be exceeded. When RD1 is inflated, flows through the fishway will generally range from 24 cfs to 45 cfs during the adult upstream migration season (*i.e.*, January 1 and March 31). Operation of the fishway exit gates will be controlled by a programmable logic controller system, which will receive signals from water level sensors in the fishway exit channel and each exit pool as well as forebay elevation and dam height data. As the water surface elevation in the forebay rises, one exit gate will close while the gate for the next upstream exit simultaneously opens. These systems will be coordinated to maintain appropriate fishway flow and head differentials based on fishway hydraulic criteria. The reverse process happens for lowering the forebay at RD1.

Additional flow can enter the fishway via the juvenile fish spillway system and/or the auxiliary water system. The auxiliary water system is used to supplement flow to the upper fish ladder entrance pool to improve fish attraction to the fish ladder and augment bypass flows without spilling water over the dam. If the required bypass flow is more than the fishway flow at RD1, the screened auxiliary flow system will be used to convey the additional flow around the dam. For example, if the required bypass flow is 55 cfs and the forebay level results in a maximum fishway flow of 36 cfs, the auxiliary slide gate would be adjusted such that a minimum of 19 cfs flows through the auxiliary water system. The juvenile fish spillway system will be used during the outmigration season to lessen the amount of water, and therefore fish, spilling over the dam.

As part of the design for RD1, the dam's foundation and downstream grouted rock will be modified to include a stream-wide plunge pool, approximately 2.5 feet deep, located immediately downstream of the rubber dam. The plunge pool will retain water to cushion the drop of juvenile steelhead and kelts that may pass over RD1, greatly reducing the risk of injury and damage as the fish continue their downstream migration. The depth of the plunge pool was selected based on a pool depth-to-fall ratio utilized in fish passage facility designs by NMFS fish passage engineers and biologists. This channel spanning plunge pool is expected to effectively avoid injury or mortality of out-migrating juvenile steelhead and kelts if they pass over the top of the dam.

As described above, RD1/Drop Structure fishway is a relatively complex facility using state-of-the-art methods and equipment to pass fish upstream and downstream over a large drop structure (*i.e.*, BART Weir) and associated rubber dam in an inflated or deflated condition. This fishway will remain operational and within passage criteria at all streamflows up to approximately 1,100 cfs, which complies with current fish passage hydrologic standards of approximately 1% annual exceedance flow. The 1% annual exceedance flow for this Project is derived from the USGS gaging station in Niles Canyon. During flow events exceeding 1,100 cfs, passage criteria within RD1 fishway will be violated; however, the fishway will be opened for fish passage until approximately 2,000 cfs at which time the passage facility will likely close due to concerns with heavy debris. During flow events between 1,100 and 2,000 cfs, some adult steelhead may successfully navigate the fishway while others will be delayed until the high flow event subsides. When streamflows exceed 2,000 cfs in Alameda Creek, it is unlikely that adult steelhead are actively migrating. Water velocities are anticipated to be excessive during these peak flow events and swimming upstream would require a large expenditure of energy. During the highest stages of flow, adult steelhead typically find an area with cover to hold until streamflows begin to recede. On the descending limb of the hydrograph, adults are likely to resume their upstream migration and the RD1/Drop Structure fishway is designed to accommodate this migratory behavior.

In contrast to rising streamflow levels, there will be periods ranging from 4 to 24 hours when streamflows are dropping and RD1 is being inflated. RD1 will typically be inflated when streamflows drop to less than 700 cfs. During these infrequent dam inflation periods, there may be slight disruptions to fish passage opportunities and potential for fish stranding due to changing stage elevations as the forebay fills to capacity. Based on the configuration of the Flood Control Channel, the inflation of RD1 and the subsequent filling of the impoundment will result in streamflow reductions downstream of RD1 at rates generally ranging 0.01 feet/hour to 0.75 feet/hour. Approximately 85% of the time, the rate of water surface elevation drop will be less than 0.5 feet/hour during the filling of the RD1 impoundment. If the water surface elevation drops too quickly in the channel downstream, steelhead smolts may become stranded on gravel bars, in isolated side channels or pools, or within the recessed plunge pool on the downstream side of RD1. Although there is some risk of stranding, the amount of steelhead likely to be harmed or killed through stranding during the filling of the RD1 impoundment is expected to be low because the smallest life stage of steelhead expected to be the action area is smolts ranging in size from 140 to 210 mm. At this size, smolts are relatively strong swimmers which minimize their susceptibility to stranding and they are anticipated to be actively outmigrating downstream in the vicinity of the channel thalweg. In addition, the hydrology of Alameda Creek is very flashy and the anticipated drop of water levels in the Flood Control Channel under proposed Project operations is within the range of flow variability experienced by steelhead in many Central California streams.

Migration disruptions in the RD1/Drop Structure fishway during inflation periods (*i.e.*, descending hydrograph) may occur, but the duration of these events will likely be minutes rather than hours. Migration delays of returning spawners have the potential to adversely affect adult steelhead because they depend on timely flow triggers to navigate over critical riffles and through shallow areas in the channel to ascend to the upper watershed. Due to the flashy nature of Alameda Creek hydrology, short-term high to moderate flow triggers often provide critical migration windows for adult upstream fish passage. Similarly, downstream migrating smolts and kelts utilize these flow triggers to assist in their downstream migration. For this Project, passage disruptions through the RD1/Drop Structure fishway are expected to be very short-term and are unlikely to appreciably affect adult steelhead from successfully reaching suitable spawning habitat in the upper Alameda Creek watershed or prevent steelhead smolts and kelts from reaching San Francisco Bay. When RD1 is in a steady state (*i.e.*, fully inflated), the fishway will resume full operation and steelhead are expected to continue their volitional upstream or downstream migrations.

<u>Passage at RD3</u>. The RD3 fishway will operate when the rubber dam is inflated and flow through the fishway will generally range from 24 cfs to about 45 cfs, meeting NMFS fish passage flow criteria. Similar to RD1, the exit gate operations will be controlled by a signal from water level sensors in the fishway exit channel and each exit pool. As the water surface elevation in the forebay changes, one exit gate will close while the next gate simultaneously

opens. The exit gates will be coordinated to maintain appropriate fishway flow and head differentials based on fishway hydraulic criteria. There will be a complete change of exits in every two to four feet of forebay change. As described above for RD1, there will be periods when the inflatable dam is being raised and flow through the fish ladder will be reduced. During the initial moments of inflating the dam and the final moments of deflating RD3, there will be a small water level differential through the fishway and flow through the fishway will be less than 24 cfs. Adult steelhead migrating upstream, and downstream migrating smolts and kelts could be adversely affected if these flow reductions in the fishway caused delays in migration that extended for several hours or days. However, for RD3, the duration of these conditions is likely minutes, not hours; thus steelhead passage will not be impaired in a meaningful way and fish are anticipated to successfully complete their volitional upstream/downstream migrations.

When the rubber dam is deflated at RD3, all of the flow is conveyed downstream through the Flood Control Channel and the fishway will be closed. The apron at RD3 is not a fish passage impediment and fish will be able to swim directly through the site.

Benefits of Fish Ladder Operations. As described above in Section 2.2.3 of this opinion, restoration of fish passage through the Flood Control Channel is identified as a high priority action for CCC steelhead in the Coastal Multispecies Recovery Plan (NMFS 2016). Based on habitat surveys conducted throughout the Alameda Creek watershed, many miles of high quality historically-accessible habitat in both the northern and southern portions of the basin will once again become available to CCC steelhead. NMFS anticipates that, post-construction, adult steelhead returning to the watershed in the winter and spring months will successful navigate the fishways to access this habitat. Suitable substrate, cool perennial streamflow, abundant instream cover, and the relatively undisturbed condition of instream habitat within several reaches of the upper watershed are expected to provide good to excellent conditions for spawning, egg/larval incubation, and juvenile rearing. This expanded area of high quality rearing and spawning habitat will increase the viability of the CCC steelhead population in San Francisco Bay region by improving spatial structure, the expression of life history diversity critical for population resiliency, and increased abundance. The fishways are also expected to timely and effectively pass downstream migrating steelhead smolts and kelts to San Francisco Bay. By expanding the amount of habitat accessible to CCC steelhead, the Project will provide long-term benefits by contributing to actions that increase population resilience and persistence over time.

2.5.2.2. Operation of Fish Screens

The installation and operation of fish screens on ACWD's Shinn Pond water intakes are proposed by the Project. The existing two points of diversion will be consolidated into a single facility and be relocated closer to RD1. The existing Shinn Pond intakes are 200 cfs and 225 cfs; thus, the new consolidate point of diversion will be 425 cfs. A total of 10 cylindrical screens will be installed at this site.

The new Shinn Pond fish screen facility is designed to meet NMFS standards for the protection of anadromous salmonids. The screens will prevent the entrainment and impingement of steelhead as water from Alameda Creek is diverted through pipelines in the levee to off-channel recharge basins. The fish screens are designed to provide a maximum approach velocity of 0.33

cfs which will allow the smallest life stages of steelhead to freely swim away from the face of the screen (*i.e.*, avoid impingement). The screen mesh will have openings no larger than 1.75 mm which will prevent the entrainment of all life stages of steelhead into the diversion system.

The proposed screen facility is designed to operate effectively in an environment with minimal-to-no sweeping flow and in an environment that is affected by intermittent periods of high flow events with heavy debris loads. The proposed cylindrical style screens will include self-cleaning brush systems, and can easily be removed from the channel for inspection or repair without special equipment. For these reasons, no adverse effects are expected by the operation of the Project's fish screens as all life stages of steelhead will be protected from entrainment and impingement.

2.5.2.3. Minimum Bypass Flows

Upon completion of project construction, ACWD proposes to operate their water diversion facilities in the Flood Control Channel to obtain the following minimum bypass flows downstream of the RD1/Drop Structure (see Table 1 in Section 1.3.6.1 of this opinion):

- June 1 through December 31: 5 cfs bypass;
- January 1 through March 31 for flows ranging between 100-400 cfs at Niles Gage: 25 cfs plus net SFPUC releases;
- January 1 through March 31 for flows ranging between 30-100 cfs at Niles Gage: 25 cfs;
- January 1 through March 31 for flows less than 30 cfs at Niles Gage: 20 cfs;
- April 1 through May 31 for normal to wet years at all flows: 12 cfs plus net SFPUC releases;
- April 1 through May 31 for dry to critical dry years and flows exceed 25 cfs at Niles Gage: 12 cfs plus net SFPUC releases;
- April 1 through May 31 for dry to critical dry years and flows less than 25 cfs at Niles Gage: 5 cfs with seven consecutive days of 12 cfs plus net SFPUC releases during April and an additional seven consecutive days of 12 cfs plus net SFPUC releases during May.

These bypass flow requirements will apply to all of ACWD's water intakes in the Flood Control Channel. The intakes consist of the 150 cfs-capacity diversion for the Alameda Creek Pipeline, the 28 cfs-capacity diversion for the Bunting Pond, the 50 cfs-capacity diversion for the Kaiser Pond, and the new consolidated point of diversion for the Shinn Pond which will have a capacity of 425 cfs.

As described in Section 1.3.6 (Project Description) and Section 2.4.2 (Environmental Baseline) of this opinion, ACWD's exercise of their water right in lower Alameda Creek relies on winter and spring rainfall events for water supply, which coincides with the adult immigration, spawning, and smolt emigration seasons of CCC steelhead in Alameda Creek. Fish migrating upstream must have streamflows that provide suitable water depths for successful upstream passage (Bjornn and Reiser 1991). In addition, it is important to preserve streamflows that provide adequate depths and velocities supporting suitable and preferred habitats for temporary holding and resting. Spawning was unlikely historically in the action area and is not expected in the future due to poor substrate conditions and tidal influence from San Francisco Bay.

In the Alameda Creek watershed, over 90% of annual precipitation occurs between November and April. The USGS stream gage on Alameda Creek in Niles Canyon (*i.e.*, Niles Gage) provides the best long-term record of streamflow in the watershed with flow records extending back as far as 1891. Warm, dry summers typically generate little runoff in Alameda Creek, while the mild, wet winters result in flows ranging from moderate levels to very high flow events with several thousand cfs. Based on a hydrologic investigation completed for this Project, the peak discharge for a one-year return period is 1,197 cfs while the 2-year return period was calculated to be 5,004 cfs (Love & Associates 2017).

ACWD's minimum bypass flow requirements for the Flood Control Channel are designed to work within the confines of ACWD's water rights and ensure the withdrawal of water from Alameda Creek does not substantially impair downstream flow conditions for steelhead migration when the diversions are operating. ACWD's water rights on lower Alameda Creek allow for diversions between October 1 and June 1, and ACWD's diversion of SWP water supplies and storage releases from Del Valle Reservoir may occur year-round. Under ACWD's proposed operations plan for diversion of the water from the Flood Control Channel, water may only be diverted when the minimum bypass requirements downstream of RD1/Drop Structure are met. The streamflow may naturally fall below the minimum bypass flow requirement, but during these periods water diversions must cease. In this manner, the minimum bypass flow requirements prevent water diversions during periods when streamflows are at or below the flows needed for steelhead passage.

To establish minimum bypass flows for this Project, ACWD in collaboration with Dr. Bill Trush conducted the Alameda Creek Flood Control Channel Anadromous Fish Passage Assessment (Buckland 2010). In the spring and summer of 2009, three surveys of the Flood Control Channel were conducted to assess stage discharge relationships at observed critical riffles, and to identify discharges required to provide sufficient water depth for steelhead passage. Results from these surveys were analyzed and a series of empirical relationships were developed describing riffle crest thalweg depths given a known stream discharge. Based on the work of Reiser and Bjornn (1979), a passage depth of 0.6 feet was recommend as the minimum water depth required for adult steelhead upstream migration at critical riffles. For the downstream passage of steelhead smolts, a minimum depth of 0.3 feet was selected based on a recommendation from Dr. Trush. Using these criteria under 2009 channel conditions, a discharge of 21 cfs or greater was determined to be sufficient to attain the requisite 0.6 foot water depth for adult steelhead and 9 cfs to provide the minimum 0.3 foot depth for smolts. Information provided in the Alameda Creek Flood Control Channel Anadromous Fish Passage Assessment (Buckland 2010) was used to evaluate ACWD's proposed operations and minimum bypass flows for steelhead passage in Alameda Creek downstream of RD1/Drop Structure.

<u>Adult Steelhead In-Migration Period (January 1 to March 31)</u>. ACWD's proposed minimum bypass flows consist of a three stage minimum bypass plan during the period between January 1 and March 31. This time period is expected to encompass the majority of steelhead adult upstream migration season. The first stage bypass flow occurs when streamflows at Niles Gage exceed 100 cfs. Under these conditions, ACWD must bypass 25 cfs at RD1 plus ACWD must allow the amount of flow bypassed by the SFPUC's upper Alameda Creek facilities (*i.e.*,

Calaveras Reservoir and ACDD) to continue downstream of RD1. This additional water released by the SFPUC will supplement ACWD's bypass flows and further enhance passage conditions downstream of RD1/Drop Structure. This additional bypass will also enhance flow triggers for the timely upstream migration of adults to access high quality habitat in the upper Alameda Creek watershed. The SFPUC is currently reconstructing Calaveras Dam and will initiate minimum fisheries bypass flows when construction is completed and the reservoir resumes operation, anticipated to be in 2018-2019 (T. Ramirez, personal communication 9/1/2017).

The method for calculating the amount of net SFPUC releases to arrive at the Niles Gage is presented in Section 3.2 of the Project's February 2017 biological assessment. It is estimated that SFPUC releases take approximately 17 hours to reach the Flood Control Channel. Thus, the net SFPUC releases on any given day would be based, in part, on the previous day's average fisheries release from Calaveras Reservoir and ACDD. The actual proportion of net SFPUC releases arriving at the Niles Gage has yet to be determined, because SFPUC has never operated their facilities in this manner and Calaveras Dam is currently under re-construction. Based on past observations, it is estimated that under normal winter and spring conditions flows in the Flood Control Channel could increase with SFPUC releases from a few cfs to as much as 30 cfs.

The second stage bypass flow occurs when the flow of Alameda Creek at the Niles Gage ranges between 30 and 100 cfs. Under this range of flows, ACWD is required to release 25 cfs, but is not obligated to release the net SFPUC releases arriving in the Flood Control Channel. The third stage occurs during low streamflow conditions, when flows at the Niles Gage are less than 30 cfs. Under these flow conditions, ACWD is required to bypass 20 cfs at RD1/Drop Structure.

This three stage minimum bypass flow plan is expected to be protective of all freshwater life stages of CCC steelhead in the Flood Control Channel between January 1 and March 31. The minimum bypass flow of 20 cfs will be provided during periods of low winter/spring base flows to protect adult and juvenile steelhead temporarily holding in pools downstream from RD1. However, some adult passage is likely to occur at 20 cfs since most the channel's most critical riffles will near 0.6 feet of water depth. Mosley (1982) examined depth-velocity relations in over 30 riffles in New Zealand for purposes of evaluating critical depths for passage of adult salmonids and he concluded that anadromous salmonids can move upstream in very shallow water for distances of some meters; however, he notes that these fish may suffer abrasion and loss of condition as a result.

When natural inflow moderately increases to levels between 30 and 100 cfs as measured at the Niles Gage, a minimum bypass flow of 25 cfs is expected to create riffle depths sufficient for adult upstream passage. As streamflow levels increase above 100 cfs at the Niles Gage, bypass flows will be 25 cfs plus the net SFPUC release which is anticipated to further enhance passage flow conditions and provide important flow triggers for adult steelhead as they ascend or descend (*i.e.*, kelts) through the Flood Control Channel.

For steelhead smolts during the period between January 1 and March 31, water depths will exceed 0.3 feet at 20 cfs; thus flow conditions for smolt outmigration throughout the Flood Control Channel are expected to be adequate during this early portion of the outmigration season. At the 25 cfs bypass stage and at the 25 cfs plus net SFPUC releases stage, minimum bypass flows will improve water depths and velocities in the channel and further improve outmigration conditions for steelhead smolts.

Steelhead Out-Migration Period (April 1 to May 31). During the period between April 1 and May 31, minimum bypass flows are expected to provide adequate conditions for downstream migrating steelhead smolts except in the driest of water years. In normal and wet years (based on a 60% annual exceedance threshold, where it is assumed that 60% of the outmigration seasons are classified as normal/wet), bypass flows below RD1 will be 12 cfs plus the net SFPUC releases at the Niles Gage. The fish passage assessment completed by ACWD in 2009 concluded critical riffles within the flood channel are at least 0.3 feet in water depth at 9 cfs (Buckland 2010). Thus, 12 cfs is expected to provide sufficient depths over critical riffles throughout the Flood Control Channel.

In dry and critical dry water years (based on a 60% annual exceedance threshold, where it is assumed that 40% of the outmigration seasons are classified as dry/critical), minimum bypass flows will be 12 cfs plus net SFPUC releases unless flows at the Niles Gage drop below 25 cfs. When flows arriving at the Flood Control Channel are less than 25 cfs as measured at the Niles Gage, ACWD will provide 5 cfs of bypass that is punctuated by a 7-day event of 12 cfs bypass plus the net SFPUC release during the month of April and an additional 7-day event during the month of May. These two 7-day pulse releases in dry/critical water years will be specified and at the discretion of NMFS and CDFW. Timing of these 7-day pulse releases will likely occur with spring freshets or strategically timed with SFPUC releases.

As described above, the minimum bypass flow of 12 cfs plus the net SFPUC releases is expected to provide adequate water depths and velocities for outmigrating steelhead smolts. However, during periods when inflow to the Flood Control Channel drops below 25 cfs in dry/critical dry water years, steelhead smolt passage may be poor at 5 cfs and delays may occur until the 7-day pulse release events and/or a precipitation event improves streamflow conditions. Smolts that partially pass downstream through the Flood Control Channel could become stranded in isolated pools and unable to complete their downstream migration. These smolts may become stressed, injured or killed when stranded under these critically low flow conditions (*i.e*. 5 cfs bypass) through predation, thermal stress, or desiccation.

Some adult CCC steelhead may return to Alameda Creek as late as the month of March and downstream migrating kelts may be traveling downstream through the Flood Control Channel in April. The 12 cfs minimum bypass flow is not designed to provide suitable migration conditions for kelts in April, but passage will be afforded when flows exceed 20 cfs. Net SFPUC releases will be added to the 12 cfs minimum bypass flow and these combined flows rates are likely to exceed 20 cfs for several days during April in most years. Periodic precipitation events during April are also likely to result in short-term increases in creek flow that will result in higher flow volumes in the Flood Control Channel. These events will provide opportunities for kelts to move downstream during April in most water years. The 7-day pulse releases in dry and critically dry years will also assist the outmigration of steelhead kelts similarly to smolts.

Outside of Migration Period (June 1 to December 31). During the period between June 1 and December 31, ACWD will operate water diversions from the Flood Control Channel to maintain a bypass flow 5 cfs downstream of RD1. If flows at RD1/Drop Structure are less than 5 cfs, the full amount of streamflow arriving at RD1 will be allowed to pass downstream. During the summer and fall months is it very unlikely that either adult or juvenile steelhead will be present in the action area. The large ponded reaches of Alameda Creek upstream of the inflatable dams are not suitable rearing habitat for juvenile steelhead due to warm water temperatures, low water velocities, lack of riffles, lack of coarse substrate, and large number of non-native predatory fish. Downstream of RD1 warm stream temperatures and lack of instream cover create poor conditions for juvenile steelhead rearing. Adult steelhead are unlikely to be present in Alameda Creek until late December. With the freshwater life stages of steelhead absent from the Flood Control Channel during this period, effects of ACWD operations and proposed bypass flows during the period between June 1 and December 31 on steelhead are not expected. If precipitation during the late fall/early winter period results in increases in streamflow that attract adult steelhead into Alameda Creek, the fishways will be in operation and individuals may pass upstream during these periods of higher flow. Without precipitation events that increase streamflow levels, adult steelhead are unlikely to enter Alameda Creek prior to late December.

Other Considerations Regarding Minimum Bypass Flows. Although ACWD's minimum bypass requirements provide adequate conditions for steelhead passage, additional streamflow above the minimum bypass rates benefits steelhead. Higher streamflow levels increase water depths over critical riffles, improve cover through greater pool depths and surface turbulence, and create higher water velocities through stream gravels. Steelhead and their habitat benefit from these higher flow conditions in a variety of ways including easier upstream and downstream migration, additional areas of instream cover for predator avoidance, and improved holding areas for resting. Reductions in streamflow by ACWD's diversion operations will decrease water depths over riffles and diminish the size of holding pools in the channel downstream of RD1. Shallow riffles (*i.e.*, critical riffles) can be particularly sensitive to changes in streamflow through diminished water depth (Woodard 2013). Reduced water depths make adult and smolt steelhead migration over these riffles incrementally more challenging and may increase migration time. In the above manner, this diminishment of Alameda Creek streamflow by ACWD's operations reduces the quantity and quality of migration and staging habitat in the Flood Control Channel.

Climate change is likely to increase the range and degree of variability in ambient temperature and precipitation in the action area and these predictions further highlight the importance of providing suitable streamflow conditions for fish passage in the streams of the CCC steelhead DPS. As described above, ACWD's proposed bypass flows have a dry/critical water year provision that allows for a reduction in bypass rates between April 1 and May 31 if streamflow at the Niles Gage is less than 25 cfs. The determination of water year type is based cumulative rainfall from October 1 to March 31 and a dry/critical water occurs when cumulative rainfall is less than 15.3 inches (60% exceedance threshold). Based on the existing 137-year period of record, a dry/critical water year type is assumed to occur approximately 40% of waters; however the provision for a reduction in the minimum bypass requirement only applies if the streamflow at the Niles Gage is also less than 25 cfs. Climate change may increase or decrease the percent of water years that this provision is triggered. If the greatest reduction in precipitation occurs in March and April, as predicted by Cayan *et al.* (2012), there may be very little change in the frequency of the application of the dry/critical water year provision. If the frequency of dry/critical water year types increases concurrent with flows less than 25 cfs increases at the Niles Gage between April 1 and May 31, there would be greater reliance on the use of the 7-day pulse release events, one pulse event in April and a second event in May, to provide sufficient conditions for the downstream migration of smolts. ACWD's water diversions would cease under these low streamflow conditions. Alternatively, there are some climate change models that show increases in precipitation on the California North Coast (Hayhoe *et al*. 2004), which could decrease the frequency of dry/critical water year determinations by this Project to less than 40%.

Evaluation of ACWD's water diversions in the Flood Control Channel in accordance with the Project's minimum bypass requirements, including the dry/critical water year provision, suggests the effects of water withdrawal on steelhead will not be exacerbated by the effects of climate change. If lower streamflow conditions prevail in the future due to climate change, ACWD's minimum bypass requirements remain in place and prevent water diversions from the creek during periods when streamflows are at or below the flows needed for steelhead passage in the Flood Control Channel. The available use of two 7-day pulse flow events during dry/critical water years is expected to provide two weeks of sufficient flow conditions for smolt outmigration within the eight-week period prior to May 31. During the summer and early fall dry season when the effects of climate change are most likely to increase the frequency and magnitude of low streamflows and warm water temperature conditions, steelhead are not expected to be in the action area. An increase in high flow/flood events due to climate change may result in increased maintenance at the Project's fishways and fish screens; however, maintenance activities are not anticipated to result in adverse effects to steelhead as described in Section 2.5.2.5 of this opinion.

2.5.2.4. Maximum Rate of Diversion and Channel Morphology

Salmonid habitat quality is influenced by high stream flow events that move water, sediment, and wood through stream channels (Montgomery 2004). Steelhead and salmon rely on streams to provide clean gravels, instream cover, sheltered pools, and channel/habitat diversity. In general, these important habitat attributes are maintained by fluvial processes including high stream flow events. A high rate of water withdrawal can cause a reduction in peak flows and diminish the fluvial processes that maintain a natural stream channel. Peak flow events (sometimes called "flushing flows") scour and revitalize gravel beds, import wood and organic matter from the floodplain, and support a healthy, vibrant riparian community.

Rosgen and Silvey (1996) describe bankfull flows as those discharge events which channel maintenance occurs. Channel maintenance (*e.g*. removing fine sediment, forming and reforming bars, and meandering) includes flow events that sustain natural geomorphic processes. Prior to the Corps' construction of the Flood Control Channel, bankfull flows in lower Alameda Creek provided the necessary discharge rate for periodic channel maintenance functions. The estimated peak discharge for a 2-year return period in lower Alameda Creek is approximately 5,004 cfs (Love & Associates 2017).

Although ACWD has the capacity to withdraw large volumes of water from Alameda Creek, these water withdrawals have little influence on the current channel morphology and physical habitat features in the action area. It was the Corps' re-alignment and channelization of lower Alameda Creek to construct the Flood Control Channel in the 1970's that continues to dictate current conditions. Construction of the flood project significantly altered natural geomorphic processes in the action area by creating a wide, flat and shallow channel with a designed capacity to convey the 500-year flood event. High flow events continue to create scour and alter the channel configuration, but to a much lower magnitude than historical conditions. In general, the Flood Control Channel accumulates sediment, because the transport capability of the channel has been diminished by flow alterations (*i.e.*, upstream water storage in reservoirs) and the Corps' channel re-configuration. Periodic sediment and vegetation removal by the ACFCD is performed to maintain flood conveyance capacity, and these maintenance events also result in substantial re-configuration of the streambed in the action area.

2.5.2.5. Maintenance Activities

ACWD and ACFCD propose to conduct routine maintenance of fish screens, diversions, fishways, drop structures, and associated equipment in the flood channel including:

- Removal and disposal of sediment, trash, and woody debris from the fishway and plunge pool, typically using hand tools, small cranes and lifts, hoses and suction pumps, and similar small equipment. Additionally, the fishways will be equipped with a trash-raking system;
- Inspection of moving parts and lubrication, painting, sealing, cleaning, and replacement of moveable parts;
- Inspection, repair and/or replacement of instrumentation and monitoring devices including sensors and flow meters;
- Patching damaged concrete and grouted rock (generally following periods of high flow and damage from debris); and
- Periodic repair or replacement of rubber dams.

The Project's February 2017 biological assessment describes several measures that will be employed to avoid and minimize the potential effects of maintenance activities on steelhead and water quality. These measures include actions to isolate work sites from the flowing waters of Alameda Creek, scheduling activities to avoid periods when steelhead may be present at work sites, and notification/coordination with the agencies for unplanned/emergency maintenance. The proposed development of an operations and maintenance manual for the Project's new facilities will also assist with ensuring maintenance activities avoid impacts to the extent practicable.

Based on the use of best management practices and the development of a manual to guide future maintenance work, the Project's future maintenance activities are unlikely to result in adverse effects to CCC steelhead. Most work will be scheduled for the period of June through October when steelhead are not present in the action area. Maintenance will avoid taking fishways out of service unless debris or trash removal is required to re-establish fishway passage. Debris or trash removal activities in the fishways that occur during the steelhead migration season are expected to have de minimis effects on aquatic habitat and water quality, and are not expected to require fish relocation.

2.5.2.6. Monitoring Program

The Project proposes to install equipment such as cameras, scanners, sonar, and/or PIT readers in the fishway at the RD1/Drop Structure for the purpose of detecting steelhead and other anadromous fish passing through the facility. This survey approach will passively monitor fish moving upstream or downstream through the fishway. Information such as the date, time and direction of an individual fish may be recorded. Some technology has the ability to measure the approximate size of a fish.

The specific monitoring equipment used by this monitoring effort will be determined in consultation with NMFS and CDFW during the final stages of Project construction to allow for selection of the most current state-of-the-art technology and monitoring equipment. Selection of monitoring equipment will also be based on fish survey and tagging programs implemented by the SFPUC and other researchers in the upper Alameda Creek watershed. It is anticipated that tagging of juvenile *O. mykiss* in upper Alameda Creek will be an element of a future program designed to monitor the return of anadromous fish in the watershed. Since tagging of juvenile *O. mykiss* will occur in the upper watershed, ACWD and ACFCD's monitoring program in the Flood Control Channel will not require the capture or handling of steelhead. Monitoring equipment will record information through remote scanning and store the data on a computer or similar device. By passively scanning fish traveling through the facility, no adverse effects to steelhead or their habitat are anticipated during the implementation of the Project's monitoring program.

2.5.3. <u>Effects of Interrelated Operation of Del Valle Reservoir and Vallecitos Turnout</u>

SWP deliveries of water imported from the Sacramento-San Joaquin Delta to ACWD are generally conveyed through the Vallecitos Turnout which is located on the Vallecitos Channel, a manmade trapezoidal channel that is used to convey water from the SBA approximately 2.7 miles to Vallecitos Creek. The conveyed waters ultimately enter the Alameda Creek system in the upper reach of Niles Canyon. In recent years, imported SBA flows from DWR have typically ranged between 0 and 35 cfs; however, there are times, when the Vallecitos Channel has experienced higher pulse flows (up to 120 cfs) for short durations (*e.g.*, 1-4 hours) resulting from emergency releases from the SBA. Further upstream in the watershed, DWR infrequently releases water to ACWD via the Del Valle Turnout which conveys water from Del Valle Reservoir to the Arroyo Valle stream channel. ACWD re-captures these water releases at the intakes in the Flood Control Channel.

The releases of imported water supplies from the SBA and water conveyed via the Del Valle Turnout are typically warmer during the summer and fall months than the natural runoff of Alameda Creek. During some periods, releases from the Vallecitos Turnout may be greater in volume than natural inflow. Discharges of SBA water are expected to affect steelhead by warming the waters of Alameda Creek in the action area. Releases also have the potential to affect imprinting of steelhead juveniles and adult migration/attraction.

Steelhead smolts will be particular vulnerable to the effects of warming by SBA discharges to Alameda Creek. Examination of water temperature data from the Vallecitos Turnout between 2002 and 2016 shows SBA discharges during the month of April commonly increase from 14° Celsius (°C) at the beginning of the month to 18° C in late April. During the month of May, discharge water temperature may reach 20° C or higher. Summer and early fall months discharges of SBA water supply at the Vallecitos turnout typically range from 20° to 24° C. (California Data Exchange Center at https://cdec.water.ca.gov/index.html).

Steelhead smolts passing downstream through the Flood Control Channel during the months of April and May could be harmed by thermal warming associated with SBA water deliveries to ACWD. Water temperatures in excess of 15° C are generally thought to harm steelhead smoltification (Adams *et al*. 1975; Hoar 1988; Richter and Kolmes 2005; Zaugg and Wagner 1973). Direct mortality of smolts could occur if water temperatures rise to levels in excess of 25° C. In the action area, water temperatures are not likely not reach levels that result in direct mortality during the spring months, but thermal stress can result in physiological impairment that decreases fitness and reduces survival rates during a juvenile steelhead's initial year of ocean entry. Behavioral changes may also occur as temperature levels rise causing smolts to cease outmigration and reversal of the smoltification process (McCullough 1999). With the termination of migration, individuals could elect to over-summer in freshwater and water temperature conditions within the Flood Control Channel are typically unsuitable for juvenile steelhead during the summer period.

The discharge of imported water supplies from the Sacramento-San Joaquin Delta may also adversely affect steelhead by compromising the ability of smolts to imprint on Alameda Creek. Anadromous salmonids are recognized for their amazing ability to precisely navigate thousands of miles through the ocean to return to their natal streams for reproduction. However, there are still many unanswered questions as to how the olfactory systems of salmonids discriminate and retrieve odors to identify natal streams (Ueda 2016). The discharge of large volumes of SBA water into Alameda Creek may contribute to the memory formation of odors for water originating from the Sacramento-San Joaquin Delta rather than Alameda Creek. Following 1-3 years of ocean residence, adult Alameda Creek steelhead returning to San Francisco Bay through the Golden Gate may cue on water originating from California's Central Valley rather than homing towards Alameda Creek in South San Francisco Bay. Adult steelhead straying into the Sacramento-San Joaquin Delta are unlikely to find their way back to Alameda Creek and will not contribute to future steelhead production in the Alameda Creek watershed. By this means, SBA discharges could contribute to higher rates of adult straying and reduce the number of steelhead spawning in Alameda Creek in future years.

To minimize the potential adverse effects of SBA imported water comingling with natural Alameda Creek streamflow, ACWD has agreed to not use the Vallecitos Turnout for SBA deliveries in April and May during wet/normal water years. In all other water years, ACWD proposes to preferentially utilize the Bayside Turnouts for delivery of SBA supplies during the months of April, May, September and October. The Bayside Turnout facilities provide for the direct delivery of SBA water supplies to ACWD water treatment plants and imported water does not have to be discharged into the channel of Alameda Creek. By not comingling imported water with natural Alameda Creek streamflow during April and May, thermal warming and potential adverse effects on smolt imprinting would be avoided. Since the Flood Control Channel does not support juvenile steelhead rearing during the summer and fall period, SBA discharges are not expected to affect juvenile steelhead.

2.6 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

The Alameda Creek Recapture Project (ACRP) is a potential future action by the SFPUC that may affect Alameda Creek streamflow volumes in the action area. The SFPUC recently completed the final environmental impact report (EIR) for the ACRP (Planning Department Case No. 2015-004827ENV; State Clearinghouse No. 2015062072; June 7, 2017). The ACRP would recaptured water released from Calaveras Reservoir and water bypassed at ACDD via collection in a quarry pit, Pit F2, in the Sunol Valley. Quarry Pit F2 is located approximately 6 miles downstream of Calaveras Reservoir and 0.5-mile south of the Interstate 680/State Route 84 interchange.

The ACRP proposes to recapture an amount of water equivalent to that which is released and/or bypassed by SFPUC facilities in the upper Alameda Creek watershed (*i.e.*, up to 9,820 AF/year). The proposed components of the ACRP include the following: pumps mounted on barges in Pit F2; pipelines extending from the pumps to shore; a new pipeline connecting to the existing Sunol Pump Station Pipeline; and ancillary facilities such as throttle valves, a flow meter, and electrical facilities. No work would occur in the bed, bank, or channel of Alameda Creek to construct the ACRP. However, the future operation of the ACRP may result in changes to the quantity of SFPUC water released and/or bypassed that reaches the Niles Gage and lower Alameda Creek. The potential impacts to steelhead migration presented in the ACRP's EIR are based on an analysis of the "long-term" operation of the ACRP which doesn't fully take into account short-term impacts (*i.e.*, dry water years and daily fluctuations in flow) and, as a result, the analysis presented in the EIR could underestimate potential impacts to steelhead and migratory habitat in the action area. Based on comments provided by NMFS and others, San Francisco Planning Department proposes to further assess the ACRP's potential project-induced effects on streamflow in Alameda Creek in coordination with NMFS and CDFW. SFPUC's goal is to avoid all impacts to steelhead migration associated with the future operation of the ACRP (T. Ramirez, personal communication); thus, this re-assessment of potential impacts may determine no effect or result in the development of operational measures for the ACRP to avoid effects to steelhead.

In addition to the ACRP, some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the environmental baseline section of this opinion (Section 2.4).

2.7 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminishes the value of designated or proposed critical habitat for the conservation of the species.

CCC steelhead are listed as threatened. Based on the extensive loss of historic habitat due to dams, forestry practices, and urban and agricultural land development, and the degraded condition of remaining spawning and rearing habitats, CCC steelhead have experienced severe declines. CCC steelhead in tributaries to South San Francisco Bay are currently limited to five streams (Coyote Creek, Guadalupe River, Stevens Creek, San Francisquito Creek, and San Mateo Creek) and the populations in these watershed have experienced serious declines in abundance in recent decades.

Alameda Creek in the action area was re-aligned and channelized by the Corps between 1969 and 1972 to construct the Alameda Creek Flood Control Channel. This 12-mile long earthen channel is approximately 200 feet wide with rock riprapped levee slopes and it is designed to convey a 500-year flood event. Several sills or grade control structures were installed across the channel bottom to prevent head-cutting and to secure transportation bridge footings. No provisions were made to provide for the upstream passage of anadromous fish when the Flood Control Channel was constructed. The grade control structure at the ACFCD Drop Structure (*i.e*, BART Weir), approximately 10 miles upstream of San Francisco Bay, is a complete barrier to upstream fish passage under all streamflow conditions.

Water supply development in the 1980's by ACWD utilizes large abandoned gravel extraction pits adjacent to the Flood Control Channel for groundwater recharge and two inflatable dams are operated to pass streamflow by gravity into the adjacent recharge basins. The proposed Project will construct fishways over the ACFCD Drop Structure and the two rubber dams as well as complete the installation of fish screens at ACWD's water intake facilities. These actions in the Flood Control Channel will restore access for adult CCC steelhead to the upper watershed and protect downstream migrating smolts from entrainment at water diversions. Once completed, ACWD proposes to provide minimum bypass flows for the upstream and downstream passage of steelhead through the Flood Control Channel.

Construction of the Project will occur over a 4-year period and full completion of the Project is anticipated in 2021. Since steelhead cannot currently access areas in Alameda Creek upstream of the lowermost rubber dam (*i.e.*, RD1) and construction will be conducted during the summer/early fall (*i.e*., outside the steelhead migration season), threatened CCC steelhead are not expected to be present in the action area during construction activities. As described in Section 2.5.1 of the opinion, impacts associated with construction will be temporary and fully dissipate when construction activities are complete. Therefore, construction-related effects to CCC steelhead are not anticipated.

The Project's proposed fishways at RD1/Drop Structure and RD3 are designed with state-of-the-art methods and equipment to pass fish upstream and downstream over the rubber dams in an inflated or deflated condition. The RD1/Drop Structure fish passage facility consists of an upper vertical slot fish ladder to provide passage around RD1, and a lower vortex pool-and-chute fish ladder providing passage around the ACFCD Drop Structure. When RD1 is inflated, flows through the fishway will generally range from 24 cfs to 45 cfs during the period between January 1 and March 31. This fishway is designed to operate continuously up to a streamflow of approximately 1,100 cfs in the channel. The RD3 fishway will be operated when the rubber dam is inflated and fishway flows will also range from 24 cfs to 45 cfs. When streamflow in Alameda Creek exceeds 700 cfs, RD3 is deflated. The apron at RD3 is not a fish passage impediment and fish will be able to swim directly through the site.

The installation and operation of fish screens on ACWD's Shinn Pond water intakes will also be beneficial for CCC steelhead. The existing two points of diversion will be consolidated into a single facility and be relocated closer to RD1. The proposed screen facility is designed to operate effectively in an environment with minimal-to-no sweeping flow and in an environment that is affected by intermittent periods of high flow events with heavy debris loads. When this Project is completed, the Shinn Pond water intake and all other ACWD intakes in the Flood Control Channel will be screened to prevent the entrainment of steelhead into the ACWD water diversion system.

ACWD's existing water diversions in the Flood Control Channel have been operated since the 1980's without minimum bypass flows to protect fish downstream of RD1. As part of the proposed Project, ACWD proposes to operate to the minimum bypass flows specified in Table 1. ACWD's minimum bypass flow requirements are designed to work within the confines of ACWD's water rights and ensure the withdrawal of water from the creek does not substantially impair downstream flow conditions for steelhead migration when the diversions are operating. Under ACWD's proposed operations plan, water may only be diverted when the minimum bypass requirements downstream of RD1/Drop Structure are met. The streamflow may naturally fall below the minimum bypass flow requirement, but during these periods water diversions must cease. In this manner, the minimum bypass flow requirements prevent water diversions during periods when streamflows are at or below the flows needed for steelhead passage.

Although ACWD's minimum bypass requirements provide adequate conditions for steelhead passage, additional streamflow above the minimum bypass rates benefits steelhead. Higher streamflow levels increase water depths over critical riffles, improve cover through greater pool depths and surface turbulence, and create higher water velocities through stream gravels. Steelhead and their habitat benefit from these higher flow conditions in a variety of ways including easier upstream and downstream migration, additional areas of instream cover for predator avoidance, and improved holding areas for resting. In this manner, the diminishment of Alameda Creek streamflow by ACWD's water supply operations reduces the quantity and quality of migration and staging habitat in the Flood Control Channel.

Climate change is likely to increase the range and degree of variability in ambient temperature and precipitation in the action area and these predictions further highlight the importance of providing suitable streamflow conditions for fish passage in the streams of the CCC steelhead DPS. Evaluation of ACWD's water diversions in the Flood Control Channel in accordance with the Project's minimum bypass requirements suggests the effects of water withdrawal on steelhead will not be exacerbated by the effects of climate change. If lower streamflow conditions prevail in the future due to climate change, ACWD's minimum bypass requirements remain in place and prevent water diversions during periods when streamflows are at or below the flows needed for steelhead passage. Additionally, steelhead are unlikely to be present in the action area during the summer and early fall dry season when the effects of climate change are most likely to increase the frequency and magnitude of low streamflows and warm water temperature conditions.

An interrelated and interdependent activity associated with the Project is DWR's release of SWP water supplies to ACWD via the Vallecitos and Del Valle turnouts. SWP deliveries of water imported from the Sacramento-San Joaquin Delta to ACWD are generally conveyed through the Vallecitos Turnout which ultimately enter the Alameda Creek system in the upper reach of Niles Canyon. ACWD re-captures these water releases at the intakes in the Flood Control Channel. SBA discharges to Alameda Creek during the spring (April and May) may adversely affect steelhead by warming the waters of Alameda Creek. These releases also have the potential to affect imprinting of steelhead smolts and compromise the ability of returning adults to detect migratory cues for Alameda Creek. To minimize the potential adverse effects of SBA imported water comingling with natural Alameda Creek streamflow, ACWD has agreed to not use the Vallecitos Turnout for SBA water deliveries in April and May during wet and normal water years. In all other water years, ACWD will preferentially utilize the Bayside Turnouts for delivery of SBA supplies during the months of April, May, September and October. By reducing the time period when imported waters supplies comingle with natural Alameda Creek streamflow during April and May, thermal warming would generally be avoided and potential adverse effects on smolt imprinting significantly reduced. Since the Flood Control Channel does not support juvenile steelhead rearing during the summer period, SBA discharges are not expected to affect juvenile steelhead.

A future project by the SFPUC has the potential to cause a cumulative effect on CCC steelhead in the action area. The ACRP proposes to recapture water released and/or bypassed by SFPUC facilities in upper Alameda Creek (Calaveras Reservoir and ACDD) via collection in an abandoned quarry pit, Pit F2, in the Sunol Valley. No work would occur in the bed, bank, or channel of Alameda Creek to construct the ACRP. However, the future operation of the ACRP may result in changes to the quantity of SFPUC water released and/or bypassed that reaches the action area of this Project in lower Alameda Creek. Based on comments provided by NMFS and others, San Francisco Planning Department proposes to further assess the ACRP's potential project-induced effects on streamflow in Alameda Creek. SFPUC's goal is to avoid all impacts to steelhead migration associated with the future operation of the ACRP; thus, this re-assessment of potential impacts may determine no effect or result in the development of operational measures for the ACRP to avoid effects to steelhead.

Restoration of fish passage through the Alameda Creek Flood Control Channel is identified as a high priority action for CCC steelhead in the Coastal Multispecies Recovery Plan (NMFS 2016). Alameda Creek has the largest watershed area (approximately 700 square miles) of all local streams tributary to San Francisco Bay. The combination of the size of the drainage, the protected status of large portions of the upper basin areas, and the presence of native fishes presents a unique restoration opportunity in the San Francisco Bay Area and makes the watershed a high priority for restoration. Based on surveys conducted in the upper Alameda Creek watershed, the Project will restore access to several miles of high quality historically-accessible habitat. It is anticipated that, post-construction, adult steelhead returning to the watershed in the winter and early spring months will successful navigate the fishways to ascend to this habitat. This expanded area of rearing and spawning habitat will increase the viability of the CCC steelhead population in San Francisco Bay region by improving spatial structure and abundance. The fishways are also expected to effectively pass downstream migrating steelhead smolts to San Francisco Bay. ACWD's future water diversion activities are expected to adversely affect CCC steelhead by diminishing the quality and quantity of migration habitat for steelhead in the Flood Control Channel, and the comingling of imported water supplies from the SBA will likely result in adverse effects by warming the waters of Alameda Creek and may affect the imprinting of smolts. However, the significant benefits of restoring steelhead access to many miles of historical spawning and rearing habitat in upper Alameda Creek clearly outweigh the adverse effects of the proposed Project. By expanding the amount of habitat accessible to CCC steelhead, the Project will provide long-term benefits by contributing to actions that increase population resilience and persistence over time.

2.8 Conclusion

After reviewing and analyzing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent activities, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of CCC steelhead.

2.9 Incidental Take Statement

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

2.9.1. Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take is reasonably certain to occur in association with the future operation of ACWD's facilities in the Alameda Creek Flood Control Channel. ACWD's operation of two inflatable rubber dams and the associated water intakes will divert the streamflow of Alameda Creek and adversely affect a small number of steelhead adults, kelts, and smolts migrating through the Flood Control Channel. Reductions in streamflow by ACWD's diversion operations will decrease water depths over riffles and diminish the size of holding pools in the channel downstream of RD1/Drop Structure. Reduced water depths during some time periods are anticipated to make the migration of adult, smolt, and kelt steelhead over these riffles incrementally more challenging and increase migration time through the Flood Control Channel. Inflation of the rubber dams and the associated filling of the impoundments, may strand a small number of migrating steelhead on gravel bars, in isolated side channels/pools in the Flood Control Channel, or within the recessed plunge pool on the downstream side of RD1.

For ACWD's future operation of facilities in the Flood Control Channel, NMFS was not able to estimate the specific number of adult, kelt, or smolt CCC steelhead that could be harmed due to the reduction of streamflow levels in Alameda Creek. However, as described above in the biological opinion, only a small number of steelhead would be affected. Monitoring or measuring the number of steelhead actually harmed by ACWD's operation of RD1, RD3, and the associated water diversions is not feasible. The impact associated with these water diversion operations is generally undetectable; therefore the number of affected steelhead is difficult to quantify. Due to the difficulty in quantifying the number of steelhead that could be harmed by reduction in streamflows during water diversions and flow alterations during the inflating/deflating of rubber dams, a surrogate measure is necessary to estimate the extent of incidental take. For this action, compliance with the Project's minimum bypass requirements is the best surrogate measure for incidental take associated with operation of ACWD's water diversion facilities in the Flood Control Channel. Therefore, NMFS will consider the extent of take exceeded if operations do not comply with the requirements of the Project's minimum bypass requirements (also presented in Table 1 of the opinion):

- June 1 through December 31: 5 cfs bypass;
- January 1 through March 31 for flows ranging between 100-400 cfs at Niles Gage: 25 cfs plus net SFPUC releases;
- January 1 through March 31 for flows ranging between 30-100 cfs at Niles Gage: 25 cfs;
- January 1 through March 31 for flows less than 30 cfs at Niles Gage: 20 cfs;
- April 1 through May 31 for normal to wet years at all flows: 12 cfs plus net SFPUC releases;
- April 1 through May 31 for dry to critical dry years and flows exceed 25 cfs at Niles Gage: 12 cfs plus net SFPUC releases;

- April 1 through May 31 for dry to critical dry years and flows less than 25 cfs at Niles Gage: 5 cfs with seven consecutive days of 12 cfs plus net SFPUC releases during April and an additional seven consecutive days of 12 cfs plus net SFPUC releases during May.

2.9.2. Effect of the Take

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

2.9.3. Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

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

1. Monitor operation of Project facilities in the Alameda Creek Flood Control Channel to ensure the fish screens and fishways are functioning properly.

2. Monitor operation of Project facilities in the Alameda Creek Flood Control Channel to ensure bypass flow requirements are fully achieved.

3. Prepare and submit annual reports to NMFS regarding operation of Project facilities, fish bypass flows, biological monitoring, and adaptive management actions.

2.9.4. Terms and Conditions

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

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

a. ACWD and/or ACFCD shall, at minimum, annually inspect fishways and fish screens to determine the condition and required maintenance at RD1, RD3, and all water intakes operated within the Flood Control Channel.

b. The following components, where applicable, of each facility shall be inspected: (1) upstream access and channels; (2) downstream access and channels; (3) culverts; (4) baffles/pools; (5) pool/chute structures; (6) entry and terminal pools; (7) weirs; (8) bypass channels; (9) gates; (10) debris racks; (11) control systems;

(12) screen faces; and (13) screen cleaning systems. Inspections must determine if sediment, debris, or algal growth are impairing the functionality of the facilities. Inspections must also determine if any components of the facility are loose, broken, missing, or present sharp edges. For fish screens, inspections must determine if screens are firmly attached and no gaps, tears, rips, or holes are present.

c. The results of inspections at each facility shall be presented annually to NMFS. Inspection results must include a narrative description of the condition of the facility, photographs, water depth and velocity measurements (where applicable), and maintenance needs. The inspection reports must also present any other condition that is or could be in the future compromising the functionality of the fishway or screen.

d. ACWD and/or ACFCD shall develop and maintain an inspection and maintenance log book for each fishway and fish screen facility. Maintenance logs shall be made available to NMFS upon request.

e. ACWD and/or ACFCD shall prepare and submit a draft manual for operation and maintenance of the Project's fish passage facilities in the Flood Control Channel for NMFS review and approval by January 15, 2023.

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

a. ACWD and/or ACFCD shall monitor Alameda Creek streamflows at the Niles Gage and at the Sequoia Road Bridge Gage to ensure the Project's bypass flow requirements are met downstream of RD1/Drop Structure.

b. ACWD and/or ACFCD shall establish an operations working group that includes representatives from NMFS and CDFW for the purpose of developing and implementing the 7-day pulse release events during dry and critical dry water years. A framework for this workgroup's coordination and reporting procedures shall be developed for NMFS review and approval by November 1, 2021.

d. ACWD and/or ACFCD shall prepare and submit a draft plan for biological monitoring and adaptive management of the Project to NMFS for review and approval by November 1, 2021. Implementation of the monitoring and adaptive management plan shall be initiated no later than November 1, 2022.

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

a. By November 1 of each year, ACWD and/or ACFCD shall provide an annual written report to NMFS regarding the following items from the previous season (season indicated in parenthesis below):
   (1) Fishway and fish screen monitoring and inspections (October 1 through September 30);
   (2) Streamflow monitoring and bypass flows (October 1 through September 30);
   (3) Results of biological monitoring and adaptive management actions (July 1 through June 30).

b. Annual reports shall be submitted to NMFS North-Central Coast Office, Attention: San Francisco Bay Branch Supervisor, 777 Sonoma Avenue, Room 325, Santa Rosa, California, 95404-6528.

2.10 Conservation Recommendations

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

(1) ACWD and/or ACFCD should work with the SFPUC, USGS and others to develop additional stream gaging stations in the watershed to improve our understanding of Alameda Creek's hydrology and measure net SFPUC releases passing downstream from the Sunol Valley to Niles Canyon.

2.11 Reinitiation of Consultation

This concludes formal consultation for Joint Lower Alameda Creek Fish Passage Improvement Project.

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

2.12 "Not Likely to Adversely Affect" Determinations

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the listed species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action (50 CFR 402.02). The applicable standard to find that a proposed action is not likely to adversely affect listed species or critical habitat is that all of the effects of the action are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species or critical habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur.

NMFS evaluated the proposed project for potential adverse effects to the threatened Southern DPS of North American green sturgeon (*Acipenser medirostris*) and their critical habitat. NMFS considered the life history of green sturgeon (Adams *et al.* 2002), the project's biological assessment prepared by Hanson Environmental (February 2017), and current habitat conditions.

The life history of threatened green sturgeon in California is summarized in Adams *et al.* (2002) and NMFS (2005). Southern DPS green sturgeon are anadromous, making migrations to the Sacramento River in the spring, with peaks in April-June (Moyle *et al*. 1995). They hold in deep pools or holes in the mainstem Sacramento River to stage for spawning. Spawning occurs within the upper reaches of the Sacramento River, and eggs are broadcast spawned over large cobble substrate, where they settle into the spaces between the cobbles. The juveniles spend one to four years in freshwater, before migrating to the ocean. As juvenile green sturgeon age, they migrate downstream and live in the lower delta and bays, spending from three to four years there before entering the ocean. Adult Southern DPS green sturgeon enter San Francisco Bay in late winter through early spring (NMFS 2015). Juvenile and adult Southern DPS green sturgeon may be present South San Francisco Bay and in the tidally-influenced reach of lower Alameda Creek year-round.

The designation of critical habitat for Southern DPS green sturgeon (74 FR 52300) uses the term primary constituent element (PCE) or essential features. The new critical habitat regulations (81 FR 7414) replace this term with physical or biological features (PBFs). This shift in terminology does not change the approach used in conducting our analysis, whether the original designation identified primary constituent elements, physical or biological features, or essential features. In this opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat. For the Southern DPS of green sturgeon, the PBFs of designated critical habitat in estuarine areas include food resources, water flow, water quality, migratory corridor, water depth, and sediment quality. The current condition of green sturgeon critical habitat in the action area is degraded over its historical conditions.

The action area of the Project is accessible to green sturgeon from South San Francisco Bay to approximately the UPRR Bridge. The grade control structure at the UPRR Bridge and the transition from estuarine to freshwater conditions make it unlikely that green sturgeon would pass further upstream in the Flood Control Channel. Thus, green sturgeon are not likely to be present in the reach of Alameda Creek subject to construction activities. With construction sites located over 5 miles upstream of the UPRR Bridge, and the proposed measures to reduce soil disturbance, green sturgeon are extremely unlikely to be exposed to changes in flows from dewatering activities or degraded water quality conditions during construction. Therefore, the effects of construction activities by this project on green sturgeon are expected to be discountable.

As presented in Section 2.5.2.3 of this opinion, ACWD's future water diversions in the Alameda Creek Flood Control Channel will alter downstream flow regimes in the creek. However, the potential occurrence of green sturgeon will be limited to the estuarine reach of the action area and ACWD's operations are not expected to alter Alameda Creek flow regimes in a manner that would adversely affect green sturgeon in this downstream reach. Bypass flows will have a relatively small effect on water quality and conditions in the tidally-influenced portion of the action area. For these reasons, the effects of ACWD's future operation of water diversion facilities in lower Alameda Creek on threatened green sturgeon are not expected to degrade existing habitat values in the action area or result in adverse impacts to designated critical habitat for green sturgeon.

3. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

3.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are the Corps, ACWD, and ACFCD. Other interested users could include the USFWS, CDFW, RWQCB, and East Bay Regional Park District. Individual copies of this opinion were provided to the Corps, ACWD, and ACFCD. This opinion will be posted on the Public Consultation Tracking System web site (https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts). The format and naming adheres to conventional standards for style.

3.2 Integrity

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

3.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

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4.2 Personal Communications

Jeff Miller, Alameda Creek Alliance, March 2008.

Joe Sullivan, East Bay Regional Park District, August 2017.

Tim Ramirez, San Francisco Public Utilities Commission, August 2017.