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

DEC 3 0 2015

Refer to NMFS No: SWR-2013-9572

Lieutenant Colonel John C. Morrow
U.S. 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 San Francisquito Creek Flood Reduction, Ecosystem Restoration, and Recreation Project near the cities of East Palo Alto and Palo Alto in San Mateo and Santa Clara counties, California (Corps file #2013-00030S).

Dear Colonel Morrow:

Thank you for your letter of April 26, 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) (16 U.S.C. 1531 et seq.) for the U.S. Army Corps of Engineers' (Corps) proposed authorization for the San Francisquito Creek Joint Powers Authority to undertake the San Francisquito Creek Flood Reduction, Ecosystem Restoration, and Recreation Project in San Mateo and Santa Clara counties, California, under Section 404 of the Clean Water Act of 1973, as amended (33 USC Section 1344 *et seq*.).

The enclosed biological opinion is based on our review of the proposed project and describes NMFS' analysis of potential effects on threatened Central California Coast (CCC) steelhead (*Oncorhynchus mykiss*) and threatened southern distinct population segment (DPS) of North American green sturgeon (*Acipenser medirostris*) and their critical habitat 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 or southern DPS green sturgeon, nor is it likely to adversely modify their critical habitat. However, NMFS anticipates take of CCC steelhead will occur during project construction as juvenile steelhead are likely to be present during dewatering of the work site for construction. An incidental take statement which applies to this project with non-discretionary terms and conditions is included with the enclosed biological opinion.

This document also includes the results of our analysis of the action's likely effects on Essential Fish Habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA). Based on our review, NMFS concludes the proposed project would adversely affect EFH for species managed within the Pacific Coast Groundfish and Coastal Pelagic Species Fishery Management Plans. NMFS has included a conservation recommendation that can be taken by the action agency to avoid, minimize, or otherwise offset potential adverse effects on EFH. Section 305(b)(4)(B) of the MSA requires Federal agencies to provide a detailed written response to NMFS within 30 days after receiving EFH Conservation Recommendations.

Please contact Amanda Morrison, North-Central Coast Office in Santa Rosa, California at (707) 575-6083 or Amanda.Morrison@noaa.gov if you have any questions concerning this biological opinion or EFH response, or if you require additional information.

Sincerely,

William W. Stelle, Jr.
Regional Administrator

Enclosure

cc: Gregory Brown, Corps Regulatory, San Francisco
Joseph Terry, US Fish and Wildlife Service, Sacramento
Tami Schane, California Department of Fish and Wildlife, Yountville
Susan Glendening, San Francisco Regional Water Quality Control Board, Oakland
Len Materman, San Francisquito Creek Joint Powers Authority, Menlo Park
Copy to ARN File # 151422SWR2013SR00116
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Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation

San Francisquito Creek Flood Reduction, Ecosystem Restoration, and Recreation Project
San Mateo and Santa Clara Counties, California
(Corps File No. 2013-00030S)

NMFS Consultation Number: SWR-2013-9572

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 or Critical Habitat?	Is Action Likely To Jeopardize the Species?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Central California Coast steelhead (*O. mykiss*)	Threatened	Yes	No	No
North American Green Sturgeon (*Acipenser medirostris*)	Threatened	Yes	No	No

Fishery Management Plan That Describes EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Groundfish	Yes	Yes
Pacific Coast Salmon	No	No
Coastal Pelagic	Yes	Yes

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

Issued By: [signature] for

William W. Stelle, Jr.
Regional Administrator

Date: December 30, 2015

LIST OF ACRONYMS AND ABBREVIATIONS

BA	Biological Assessment
BCDC	Bay Conservation and Development Commission
BMP	Best Management Practices
BOR	Federal Bureau of Reclamation
CDFW	California Department of Fish and Wildlife
Caltrans	California Department of Transportation
CCC	Central California Coast steelhead
Corps	U.S. Army Corps of Engineers
cy	cubic yards
cfs	cubic feet per second
DWR	California Department of Water Resources
DPS	distinct population segment
EFH	essential fish habitat
FMP	Fishery Management Plan
ft/s	foot per second
GCID	Glenn-Colusa Irrigation District
HCP	Habitat Conservation Plan
ITP	Incidental Take Permit
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MHHW	mean higher high water
MLLW	mean lower low water
MTL	mean tide level
mg/l	milligrams per liter
mm	millimeter
MMP	Mitigation and Monitoring Plan
NMFS	National Marine Fisheries Service
NTU	nephelometric turbidity units
O&M	Operations and Maintenance
PG&E	Pacific Gas and Electric
Refuge	U.S. Fish and Wildlife Don Edwards San Francisco Bay National Wildlife Refuge
RBDD	Red Bluff Diversion Dam
RSP	rock-slope protection
SFRWQCB	San Francisco Regional Water Quality Control Board
SFCJPA	San Francisquito Creek Joint Powers Authority
SCVWD	Santa Clara Valley Water District
SMP	Stream Maintenance Program
S-CCC	South-Central California Coast steelhead
SWRCB	State Water Resources Control Board
SHEP	Steelhead Habitat Enhancement Program
USFWS	U.S. Fish and Wildlife Service

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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 sections 2 and 3 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 also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR 600.

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.

1.2 Consultation History

November 8, 2011: NMFS attended a site visit along with staff from San Francisquito Creek Joint Powers Authority (SFCJPA), Santa Clara Valley Water District (SCVWD), and the U.S. Army Corps of Engineers (Corps).

April 26, 2013: NMFS received from the Corps the project's Biological Assessment (BA) (ICF International 2012) and the request for consultation on the San Francisquito Creek Flood Reduction, Ecosystem Restoration, and Recreation Project (Project). In the initiation letter, the Corps determined the project may affect, but is not likely to adversely affect, threatened Central California Coast (CCC) steelhead (*Oncorhynchus mykiss*) and threatened southern distinct population segment (DPS) of North American green sturgeon (*Acipenser medirostris*) and their critical habitat. Additionally, the Corps determined that the project would not have substantial adverse effects on EFH for various federally managed fish species within the Pacific Coast Groundfish, Pacific Coast Salmon, and Coastal Pelagic Species Fishery Management Plans (FMP).

May 13, 2013: NMFS sent an electronic message to the Corps commenting on the BA and requesting additional information on the proposed project. The message mentioned that the description of the project contained in the

	BA did not contain sufficient detail for NMFS to assess the potential impacts of the project, and requested additional clarification on the project description (*i.e*., dewatering activities and using heavy equipment in the channel).
February – July 2014:	NMFS attended multiple interagency meetings regarding the project with staff from the U.S. Fish and Wildlife Service's (USFWS) Don Edwards San Francisco Bay National Wildlife Refuge (Refuge), the Corps, SCVWD, SFCJPA, California Department of Fish and Wildlife (CDFW), San Francisco Regional Water Quality Control Board (SFRWQCB), NMFS, and the Bay Conservation and Development Commission (BCDC) to discuss the various alternative configurations for the proposed project including filling in low spots in the Main Faber Marsh levee, degrading the Bay levee adjacent to Outer Faber Marsh near the mouth of San Francisquito Creek, and further setting back the levee into the Palo Alto Municipal Golf Course.
August 28, 2014:	NMFS received from the Corps and SFCJPA the amended BA for the Project.
October 15, 2014:	NMFS attended a site visit along with staff from SFCJPA, SCVWD, CDFW, and Corps. During the site visit NMFS was informed several additional documents regarding the project were available. These documents consisted of the Draft Mitigation and Monitoring Plan (MMP) (SFCJPA 2015c), Draft Operations and Maintenance (O&M) Plan (SFCJPA 2015a), and Temporary Water Diversion Plan (SFCJPA 2015b). NMFS received these documents from the SFCJPA on October 17, 2014.
November 3, 2014:	NMFS sent a letter to the Corps and SFCJPA commenting on the August 2014 amended BA, the Draft MMP, and the Draft O&M Plan and requested additional information on channel capacity, sedimentation, and flooding, and fish passage and habitat. In this letter, NMFS also informed the Corps and SFCJPA that this information was necessary to complete the NMFS assessment of potential project impacts and conclude consultation.
April 24, 2015:	NMFS attended a meeting with the Corps, SFRWQCB, SCVWD, and SFCJPA to discuss NMFS's comments and questions raised in the November 3, 2014, letter. The SFCJPA agreed to investigate the feasibility of, and provide to NMFS a conceptual proposal for incorporation of several project features (*i.e*., velocity refuges and passive tidal marsh revegetation) to improve conditions for fish. The SFCJPA further agreed to provide: 1) updated planting plans and landscape sheets; 2) a table of wetlands impacts and mitigation calculations; 3) an updated MMP; 4) written responses to the points

	raised in the NMFS letter of November 3, 2014; and 5) HEC-RAS model results for existing conditions and proposed conditions. In addition, NMFS informed the Corps that the project may adversely affect ESA-listed species, critical habitat, and EFH and that a formal consultation will likely be necessary.
May – July 2015:	NMFS received via electronic mail from SFCJPA the responses to NMFS's comments and questions raised in the November 3, 2014, letter and the additional information the SFCJPA agreed to provide at the April 24, 2015, meeting.
July - October 2015:	NMFS participated in biweekly conference calls with SFCJPA, the Corps, USFWS, the Refuge, and SCVWD to discuss the information needed to complete the NMFS assessment.
July 30, 2015:	During a biweekly conference call with the SFCJPA, Corps, USFWS, and SCVWD, NMFS requested the SFCJPA and SCVWD schedule a future, focused meeting among themselves, USFWS (Regulatory and Refuge), Corps, and NMFS to discuss a scenario in which certain elevations of marsh plain would be allowed to passively revegetate.
August 19, 2015	NMFS provided via electronic mail to SFCJPA and the Corps comments on the additional information provided by the SFCJPA between May and July 2015 (*e.g.*, additional hydraulic and hydrologic information).
August 26, 2015:	NMFS participated in a conference call with SFCJPA and SCVWD to provide clarification on the additional hydrologic and hydraulic information NMFS requested on August 19, 2015.
September 3-24, 2015:	NMFS received via electronic mail from SFCJPA updated versions of the Draft O&M Plan (SFCJPA 2015); Temporary Water Diversion Plan; Draft MMP; and hydraulic and hydrologic information.
September 24, 2015:	NMFS participated in a conference call with SFCJPA, Corps, USFWS, and SCVWD to inform the Corps and SFCJPA that NMFS believes the information provided completes the consultation request package.
October 13, 2015:	NMFS attended a meeting with SFCJPA, SCVWD, Corps, USFWS Regulatory, Refuge, and SFRWQCB to discuss the tidal marsh design elevations and revegetation activities. During the meeting NMFS requested that the SFCJPA modify the proposed tidal marsh elevations to increase tidal salt marsh complexity and enhance ESA-listed fish habitat. The SFCJPA and SCVWD agreed to consider modifications and follow-up with NMFS within two weeks.

October 20, 2015: Via electronic mail to the SFCJPA, SCVWD, and Corps, NMFS requested additional hydrologic information (*e.g.*, HEC-RAS model results for the 1 percent, 5 percent, and 50 percent [March-June] exceedance flows).

November 5, 2015: During the biweekly project update call, NMFS informed the SFCJPA and Corps that SFRWQCB Estuarine Geomorphologist, Christina Toms, spoke with NMFS on October 26, 2015, regarding modifications to the Project's marshplain designs. NMFS explained the SFRWQCB believed that a passive approach to creating channel complexity in the tidal salt marsh would not be successful in the action area due to intense fluvial influences and that alternative methods would need to be taken to enhance ESA-listed fish habitat, specifically adult fish passage conditions. NMFS informed the SFCJPA that they will provide a memo summarizing their analysis of the Project's impacts on fish habitat and recommendations on the types of habitat enhancements that would be needed to enhance fish habitat within two weeks. NMFS also confirmed that they could rush completion of the Opinion, with a goal of completing it by December 15, 2015.

November 23, 2015: NMFS provided the Corps, SFCJPA, and other resource agency representatives a technical memo prepared by fish passage engineer, Dave White, which summarized the fish passage issues associated with high channel velocities under some streamflow conditions in the project reach, and suggested design elements to provide velocity refuge in the project reach.

November 30, 2015: In response to recommendations provided in the NMFS November 23, 2015, fish passage review memorandum, the SFCJPA submitted to NMFS and the Corps a preliminary proposal for the location, number and type of steelhead migration features to be incorporated in to project.

December 1, 2015: A telephone conference call with representatives of NMFS, SFCJPA, USFWS and SCVWD was held to discuss SFCJPA's proposed steelhead fish passage features. NMFS informed the group that the proposal will likely address the most significant high velocity areas by creating resting sites behind boulders and rootwads. The SFCJPA agreed to incorporate these features into the project and continue to work with NMFS to develop the specific designs for each feature.

December 2, 2015: The SFCJPA provided a revised proposal for steelhead fish passage features based on the December 1, 2015, conference call with NMFS.

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 Clean Water Act of 1973 (33 U.S.C. Section 1344) to the SFCJPA to construct a 1.5 mile flood protection and habitat restoration project along San Francisquito Creek from San Francisco Bay to East Bayshore Road, near the cities of East Palo Alto and Palo Alto in San Mateo and Santa Clara counties, California (Figures 1-5). The SFCJPA is a regional government agency whose members include the Cities of Palo Alto, Menlo Park, and East Palo Alto, the San Mateo County Flood Control District, and the SCVWD. The purpose of the proposed activity is to improve flood protection (up to a 100-year flood flow event coupled with the influence of tides and projected sea level rise), restore and enhance habitat functions, and improve recreational opportunities within the project area. Major project elements include: levee setback and improvements, construction of floodwalls, extension of a pedestrian bridge, excavation of sediment deposits within the channel to maximize flood conveyance, relocation and removal of utilities, and revegetation of tidal marsh habitats. Construction of the project elements would likely take two years to complete. The project is scheduled to begin in 2016 and to be completed by 2018.

"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). There are no interdependent or interrelated actions associated with the proposed action.

1.3.1. Construct Floodwalls and Rebuild, Relocate, and Degrade Levees

Approximately 5,650 linear feet of floodwalls will be constructed along the channel at the top of levees to increase flow capacity and maintain consistency with the California Department of Transportation's (Caltrans) enlargement of the U.S. 101/East Bayshore Road Bridge over the San Francisquito Creek. On the East Palo Alto side (north bank), concrete floodwalls up to 4 feet above top of bank (up to 13 feet from channel bottom) will be constructed along approximately 500 linear feet near Friendship Bridge (pedestrian bridge crossing the creek) (STA 28+00 to STA 33+00) (Figure 4) and along 2,300 linear feet of channel between Daphne Way (STA 52+50) and U.S. Highway 101/East Bayshore Road (STA 75+50) (Figure 5). On the Palo Alto side (south bank), sheetpile floodwalls up to 4 feet above top of bank (up to 13 feet from channel bottom) will be constructed along approximately 2,850 linear feet from Geng Road (STA 47+50) to Highway 101/East Bayshore Road Bridge (STA 76+00) (Figures 4 and 5).

Downstream of the floodwalls, the SFCJPA will rebuild the East Palo Alto Levee (northern levee) in its current location and relocate the Palo Alto Levee/Palo Alto Municipal Golf Course Levee (southern levee). Approximately 3,400 linear feet of the existing levee on the north side of the channel would be rebuilt to a greater strength and/or height from just downstream of Friendship Bridge (STA 21+00) (Figure 3) to Daphne Way (STA 55+00) to increase channel capacity (100-year water surface elevation). Approximately 55,000 cubic yards (cy) of fill will be used to reinforce and increase the height of the northern levee. Approximately 2,727 linear feet of the southern levee will be relocated and/or reinforced between the area just downstream of Friendship Bridge (STA 22+73) and the area just downstream of Geng Road (STA 50+00). A portion of the levee will be relocated up to 200 feet east into the Palo Alto Municipal Golf Course and raised to increase channel capacity. This set back of the southern levee will create space for a floodplain terrace. Approximately 84,700 cy of fill will be used for the southern levee relocation. The elevation increase of both the northern and southern levees varies by up to 4 feet based on existing conditions and the necessary modifications at each station.

The SFCJPA will build about 10,176 linear feet of maintenance roads on the newly raised and relocated levees. The maintenance roads will also serve as pedestrian/bicycle trails. The roads will be up to 16 feet wide and paved with crushed granite, except for a 2,658 section on the south bank (STA 27+50 through 54+08), that will be paved with asphalt as part of the Bay Trail.

The SFCJPA will raise and grade a portion of the currently unmaintained levee between the creek and the Faber Tract (Faber Tract Levee) closer to its original design elevation to stabilize the levee and preserve existing frequency, volume, and velocities of fluvial discharge to the Faber Tract to optimize conditions for USFWS protected species that inhabit the Faber Tract marsh. Fill will be added to reinforce and raise the Faber Tract Levee up to 2 feet along 550 linear feet (STA 21+00 to STA 26+50) to reduce concerns regarding levee erosion and the potential for mass wasting leading to levee failure. In addition, the SFCJPA will incorporate a 6H:1V levee side slope on the side sloping into the Faber Tract. The 6H:1V levee side slope will help protect the levee toe from potential erosion due to flow overtopping along a 400-foot distance as the levee transitions upstream to a higher elevation closer to the Friendship Bridge. Approximately 12,000 cy of clean imported fill will be used to reinforce and redesign the Faber Tract levee.

The SFCJPA will degrade a 600 linear foot section of the northern levee east of the Faber Tract (referred to as the Bay Levee) to restore the tidal-fluvial interface in the marsh area east of the Faber Tract and to reduce water surface elevations in the creek between Friendship Bridge and the Bay. About 2,820 cy of sediment/soil will be removed along 600 linear feet (0.73 acres) of the Bay Levee (STA 3+50 to 9+50) (Figure 3) downstream of the Faber Tract in a marsh area that is already subject to daily tides from the Bay.

1.3.2. Excavate Sediment and Install Rock Slope Protection

About 175,890 cy of sediment will be removed from along 5,775 linear feet of the creek channel and associated channel expansion area to increase creek capacity and to maximize conveyance. In-channel sediment will not be reused because it is unlikely to provide suitable material for levee embankment use.

The JPA will install approximately 4,000 linear feet (3.71 acres) of rock-slope protection (RSP) at various locations along the length of the channel side of the Project to protect the levees against erosion and to stabilize the floodwalls. The RSP on the levees will be installed from the toe of the levee up the bank approximately 10 to 15 feet.

1.3.3. Construct Friendship Bridge Boardwalk Extension

The existing Friendship Bridge will be retained and a 202 linear foot boardwalk will be constructed from the retained eastern footing of the bridge and across the newly-expanded marshplain to connect with the realigned southern levee. The boardwalk will be the same width as the Friendship Bridge (140 feet long and 10 feet wide), constructed of timber deck and concrete piles, and require twenty 18-inch diameter concrete piles. The elevation of the low mark of the boardwalk will be set above the highest anticipated flood elevation, with the lowest point of the bridge a minimum of 5 feet above the marshplain terrace beneath it.

1.3.4. Relocate or Remove Utilities

The SFCJPA will remove, abandon, or replace several utility components for electricity, gas, and sanitary sewer, and stormwater runoff present within the Project right-of-way. SFCJPA will remove various storm drain pipelines existing within the golf course and at the top of the current levees that will be under the future southern levee and widened creek channel post project. This work will be concurrent with the levee and channel work. The SFCJPA will realign a sanitary sewer line that currently crosses the creek near the Friendship Bridge (STA 32+00 at the south bank to 34+50 at the north bank). As proposed, this task will involve open trenching with a minimum depth below ground surface of 3.5 feet for the new line. The sanitary sewer line would be encased in armored steel where it crosses the creek. This work would be concurrent with the levee construction work so will not have separate impacts to waters of the San Francisquito Creek. The SFCJPA will remove about 390 linear feet of existing sanitary sewer line.

The SFCJPA will coordinate with Pacific Gas and Electric (PG&E) to perform electricity and gas transmission system work before creek channel and levee construction work begins. PG&E's work is considered part of the Project and will be covered under the Corps' 404 permit for the Project. PG&E will realign the existing electricity transmission system that currently crosses over the creek from STA 52+00 (south bank) to R-line STA 48+00 (north bank). The new line will be shifted 250 feet south and cross over the creek at STA 51+00 (south bank) to STA 52+00 on the north bank. A transmission pole will be removed from both banks; replacing two existing poles, one on each bank; and adding two new poles on the north bank for the new line. In addition, PG&E will remove wires from six towers that run north to south along the far north bank right-of-way between STA 30+00 to STA 56+00. Of these six towers, one will be raised by 15 feet. The realigned section will connect to the southern-most pole in this series. Any replacement poles will be made of light-duty steel.

PG&E will replace the foundation of an existing electric transmission tower located in the floodplain of the future channel alignment footprint at STA 48+00, approximately 2,000 feet upstream of the Friendship Bridge. PG&E will demolish the existing foundation, build a temporary shoo-fly support, and build a permanent concrete foundation at the existing foundation site. The electricity tower on the old foundation will be lifted and placed onto the permanent concrete foundation with an area of 625 square feet. An access ramp will be built on the inboard side of the levee for this tower.

PG&E will abandon in place 3,000 linear feet of the gas transmission line located in the Project right-of-way, of which about 1,350 linear feet is in the new channel realignment footprint. THE SFCJPA will remove the abandoned gas transmission lines. PG&E estimates that the old line is 4.7 feet below grade beneath the creek channel. The SFCJPA will confirm the elevation during excavation activities.

The new gas line will be aligned south to north in the golf course, then will cross east to west through the Project right-of-way upstream of the Friendship Bridge from STA 32+00 (south bank) to STA 34+00 (north bank), and will extend west to a connection in East Palo Alto. The pipeline tunnel under the Creek will be bored by horizontal direction drilling at 25 feet below ground. The other portions of the pipeline will be installed by cut and fill at a minimum of 4 feet below ground surface.

PG&E will place three trench spoils piles equidistant from south to north along the south bank. Each pile is planned to be 100 feet by 100 feet. On the north bank, PG&E will place another 100 foot by 100 foot spoils pile next to the borehole site. The suitability of the spoils for reuse to cover the new pipeline will be determined after they are appropriately assessed during the utility activities, and any unused spoils will be hauled from the site and appropriately disposed of at an approved upland facility.

1.3.5. Revegetation

The action area encompasses 4.34 acres of diked marsh wetlands, 0.33 acres of freshwater marsh wetlands, 112.26 acres of tidal salt marsh wetlands, 1.13 acres of freshwater pond, 22.39 acres of tidal channel and bay waters, and 0.37 acres of tidal pans. The project construction is anticipated to impact a total of 3.13 acres of diked marsh, 4.51 acres of tidal salt marsh habitat, and 2.43 acres of tidal channel and bay waters. The diked marsh community is found on the landward side of the levees along San Francisquito Creek and within the Golf Course; and the tidal salt marsh vegetation is found throughout the Faber Tract and along both sides of San Francisquito Creek. The Project will result in the removal of between 162 and 256 trees. Of the potential of 256 trees to be removed, 220 of these are on the south side of the creek and the remaining 36 are on the north side.

After levee construction is complete, the tidal marsh area would be terraced and revegetated with high-marsh plants appropriate to the elevation relative to tidal levels in accordance with the MMP for the Project (SCVWD 2014). The high-marsh (above mean higher high water) will be planted with include alkali weed (*Cressa truxillensis*), saltgrass (*Distichlis spicata*), alkali heath (*Frankenia salina*), marsh jaumea (*Jaumea carnosa*), and perennial pickleweed (*Salicornia pacifica* [*S. virginica*]). The high-marsh transition planting area will be planted with fat hen (*Atriplex patula*), alkali weed, saltgrass, alkali heath, gumweed (*Grindelia* spp.), marsh jaumea, and western marsh rosemary (*Limonium californicum*). Native marsh plants will be used to revegetate the terraced land. Plants appropriate to the high marsh will be planted near the stream channel. Plants native to marsh transition areas would be planted in areas more distant from the creek channel and in the upper half of the Project area as elevation gains. Approximately 19,600 high marsh and high marsh transition wetland plants and cuttings are planned for installation. Plants will be sourced from the San Francisquito Creek watershed and Baylands areas.

A temporary irrigation system will be installed for use during the planting and three-year establishment phase, in order to provide a back-up water supply to the newly-installed vegetation in the event of a period of drought during the winter or spring rainy season, and for irrigation as needed during the summer. Irrigation frequency is expected to be reduced as the site develops during the establishment phase. The supplemental irrigation ensures an adequate supply of moisture to the young plants until they are fully established in the site's soils.

Annual monitoring will be conducted over a 5-year period. Performance goals related to revegetation efforts will aid in determining if the site is progressing incrementally toward meeting the year-5 success criteria (SFCJPA 2015c). Year 5 monitoring will determine if the success criteria have been achieved. Monitoring will be overseen or conducted by a qualified biologist with experience in vegetation monitoring. Final success will not be considered to have been achieved until temporary irrigation has been off for at least two years. The specific performance goals and criteria that will be used to determine if all revegetation was successful will be described in a Final MMP.

1.3.6. Dewatering of the Project Area

The project area is located in a reach of San Francisquito Creek that is influenced by tides and freshwater flow from the San Francisquito Creek watershed. Therefore, both a stream flow and tidal diversion will be necessary to dewater the project area for construction purposes. Water diversion will be implemented to maintain the work site as water-free as possible for the duration of in-channel work. The full width of the channel from tops of bank will be dewatered. Water incursion is expected from Bay tides, natural and urban runoff flows from upstream, outfalls downstream from the U.S. 101/East Bayshore Road Bridge, and discharges from the O'Connor Pump Station in East Palo Alto and the Palo Alto Pump Station.

Water diversion will include cofferdams upstream (to intercept stream flows) and downstream (to block tidal Bay waters) of the work site. Stream flows upstream of the site will be pumped through pipes that bypass the work site. Discharges from the two municipal pump stations located adjacent to the creek will be pumped from the clear wells into the diversion pipes as well. In addition, water that is diverted from the channel during dewatering will be retained, tested, and treated, as necessary, in order to meet all water quality effluent limitations as specified in the SFRWQCB, San Francisco Bay Region, Basin Plan (Basin Plan). Diversion pipe flow velocity dissipaters will be installed downstream of the cofferdam on existing banks. Pumps will be used to dewater the work site. Pumps will be required to: 1) reroute water from the stream, which accumulates above the upstream cofferdam; 2) dewater the construction area above the downstream cofferdam or where ponded; and 3) to reroute outflow at each of the two municipal pump stations (see below).

The cofferdams will be installed for the in-channel construction period between June 15th and October 15th at various locations, depending on the construction element, during the two construction seasons (see Table 1). Utilities and levee construction and dewatering will be completed in one season, and floodwall construction the following season.

Table 1. Cofferdam locations (approximate).

Construction Element	Downstream Location/Cofferdam Height	Upstream Location/Cofferdam height
Utilities Downstream Levee Construction	STA 13+00/12 ft	58+00/8ft
Upstream Floodwall Construction	49+00/10 ft	Within 50 ft upstream of U.S. 101 West Bayshore Road Bridge/ 8 ft

Groundwater depths are anticipated to be in the range of 1 to 3 feet below existing channel invert, so dewatering sumps may be required for excavation and will be utilized as necessary.

Dewatering for the utility crossings, levee work, and floodwall construction will be performed with the installation of a 36-inch diameter bypass pipe from above the upstream cofferdam to below the downstream cofferdam to allow anticipated construction season streamflows to avoid contacting the work area. The downstream cofferdams will be installed first and during the lowest tide during normal construction hours. The upstream cofferdams will be installed during the minimum streamflow expected during normal working hours. Diversion pipes and pumps will be in place and operational before cofferdams are installed. Cofferdams will remain in place and functional throughout the in-stream construction periods. Cofferdams will be removed at annual cessation of in-channel work, and channel and bank will be restored to pre-construction condition.

Dewatering for the Bay Levee deconstruction will be achieved by a floating silt curtain on both sides of the Bay Levee (STA 4+50 to 10+00) to prevent sediment from entering the adjacent marshland, creek, and San Francisco Bay. The silt curtains will be resistant to wind and high water velocity.

Cofferdams will be constructed of steel sheet pile embedded no less than 15 feet below the channel invert, gravel bags, and plastic sheeting. The piles will be installed with a backhoe or hammer attached to a backhoe. Gravel bags will be stacked against the sheet piles to the desired height. Gravel material will be between 0.4 and 0.8 inch in diameter, and will be clean and free from clay balls, organic matter, and other deleterious materials. The gravel bags will be placed on top of the plastic sheeting, which will be laid upon the channel invert or bank to prevent leakage. The gravel bags will be arranged so that each layer of gravel bag placed will be staggered in pyramid-like fashion. After the final height has been reached, the original plastic sheeting will be placed on top of the sandbags. To hold the plastic sheeting in place, gravel bags will be placed above the top plastic sheeting.

Water collected from the dewatered reach between cofferdams will be discharged through municipal storm drains to the City of East Palo Alto's pump station adjacent to the channel (O'Conner Street Pump Station). Additional water from urban sources will also be routed to this pump station, which normally outflows to the work area. To prevent flows from the East Palo Alto and Palo Alto pump stations from entering the work area, outflows will be pumped from the wet wells directly to the channel downstream of the downstream cofferdam or join the pump station outflow pipe to the stream diversion pipe.

The SFCJPA will ensure SFRWQCB and State Water Resources Control Board (SWRCB) water quality standards for receiving waters will be met during creek dewatering discharges, dewatering of excavations, and diverting creek and stormwater flows. Specifically, the instantaneous discharge pH will be in the range of 6.5 to 8.5 and shall not vary from ambient pH by more than 0.5 pH units; the discharge dissolved oxygen concentration will be no less than 5.0 milligrams per liter (mg/L) as an hourly average for discharging into tidal water and 7.0 mg/L (hourly average) for discharging into non-tidal receiving waters; dissolved sulfide will not be greater than 0.1 mg/L; the receiving water turbidity measured as nephelometric turbidity units (NTU) will not be greater than 10 percent of natural conditions in areas where natural turbidity is greater than 50 NTU (daily average); and the receiving waters will not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses.

The SFCJPA will identify an acceptable location or locations at which to measure background turbidity. Receiving water and discharge turbidity will be monitored at least one time every 8 hours on days when discharges from excavations or any other dewatering processes may occur.

1.3.7. Fish Collection and Relocation

Because the project will require water diversion and dewatering of work sites, fish within the project area will be collected and relocated in order to minimize their risk of being harmed or killed. The fish collection and relocation activities will be conducted by a NMFS/CDFW-approved biologist. Methods used to capture and relocate fish in the project area may include dip net and seine. Due to the high conductivity of brackish waters, electrofishing will not be used. The SFCJPA will submit a fish relocation plan to NMFS and CDFW for review no less than 90 days prior to beginning these activities for each phase of construction.

1.3.8. Operation and Maintenance

The SFCJPA has entered into a Construction Management Agreement with the SCVWD to designate the SCVWD as the lead agency responsible for project construction and post-project revegetation monitoring and management. The SFCJPA has also delegated responsibility for routine operation and maintenance of the Project, outside the scope of construction-related maintenance and monitoring activities, to the City of East Palo Alto and the SCVWD. Routine operations and maintenance include providing the proper care to levee embankments, floodwalls, channels, interior drainage system, and pump stations required for the efficient operation of the Project. The only operation and maintenance activity proposed by the SFCJPA as part of the Project is levee maintenance, vegetation management, and removal of trash and debris. The primary routine maintenance activities will consist of mowing levees to facilitate inspections, removal of trash and debris from the channel and channel benches, and control of burrowing rodents. Mowing will occur on the sides of the levee, which, on the inboard side of the levee, extend to the tidal marsh. Maintenance activities will be performed in accordance with the Best Management Practices Handbook (Attachment F to the SCVWD 2014-2023 SMP).

Additional future maintenance within the completed flood channel could include sediment removal, vegetation removal, levee repair, floodwall maintenance, removal of woody debris from the channel, repair of rock slope protection, maintenance of access roads, and repair and maintenance of outfalls and culverts. These activities, within specified limits and mitigation measures, are conducted as part of the SCVWD's Stream Maintenance Program (SMP). NMFS and the Corps completed formal section 7 consultation in 2014 on a 10-year (2014-2023) SMP conducted by SCVWD within stream channels of Santa Clara County, including San Francisquito Creek. A biological opinion was issued to the Corps on April 29, 2014 (See Section 2.3.3.2 for more detail). At this time, no maintenance activities outside the actions described above and outside the purview of SCVWD's SMP are anticipated.

1.3.9. <u>Proposed Best Management Practices and Fish Protection Measures</u>

Based on a fish passage analysis performed by NMFS, the SFCJPA proposes to install six structures in the flood control channel that are designed to provide velocity refuge for upstream migrating adult steelhead. Five of the structures will be constructed with rock and rootwads as a "constructed log jam". The sixth structure will be a rock spur structure extending from the lower tip of the Friendship Bridge Island into the low flow channel. All six structures will be placed in or adjacent to the low flow channel at approximately 300 feet intervals in the middle reach of the project. These structures will be designed to create velocity breaks and fish resting areas during high flow events and low tide conditions.

During project construction, operation and maintenance activities, the project will implement BMPs to avoid and/or minimize potential impacts to special-status species and their designated critical habitat. All activities will be performed in accordance with Best Management Practices Handbook (Attachment F to the SCVWD 2014-2023 SMP). The BMP handbook is a comprehensive document that includes minimization measures related to hazards and hazardous materials, hydrology and water quality, bank protection, stormwater management, discharge activities, grading and excavation, sediment removal and storage, vegetation management and removal, and other topics.

1.4 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).

San Francisquito Creek Watershed drains approximately 47.5-square miles on the eastern side of the Santa Cruz Mountains. Major tributaries include Bear Creek, Corte Madera Creek, and Los Trancos Creek, which converge to form San Francisquito Creek. The project area has a Mediterranean climate, typical of the California's central coast, with cool, wet winters and a long, mild dry season. Rainfall in the winter averages approximately 35 inches per year, falling mainly between the months of October and March. Portions of the upper San Francisquito Creek watershed are perennial and support spawning and rearing habitat for CCC steelhead. Sections of the mainstem of San Francisquito Creek dry by late spring or early summer in most years (Launer and Spain 1998; Metzger 2002; Stokes 2006).

The action area consists of the lower 1.5 miles of San Francisquito Creek in an existing flood control channel and adjacent marsh areas. The action area encompasses 4.34 acres of diked marsh wetlands, 0.33 acres of freshwater marsh wetlands, 112.26 acres of tidal salt marsh wetlands, 1.13 acres of freshwater pond, 22.39 acres of tidal channel and bay waters, and 0.37 acres of tidal pans. The diked marsh community is found on the landward side of the levees along San Francisquito Creek and within the Golf Course; and the tidal salt marsh vegetation is found throughout the Faber Tract and along both sides of San Francisquito Creek. From upstream to downstream, the constructed channel flows southwest to northeast through the cities of East Palo Alto and Palo Alto. The proposed project is located between where U.S. Highway 101 crosses San Francisquito Creek at the border of southern San Mateo and northern Santa Clara counties and the confluence of San Francisquito Creek with San Francisco Bay. This 7700 linear foot reach of San Francisquito Creek is located in a moderately urbanized, low gradient area, historically occupied by extensive tidal marshes at the edge of San Francisco Bay. The project location experiences daily tidal fluctuations.

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 expected, 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.

The adverse modification analysis considers the impacts of the Federal action on the conservation value of designated critical habitat. This biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.[1]

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[1] Memorandum from William T. Hogarth to Regional Administrators, Office of Protected Resources, NMFS

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.

For critical habitat, NMFS determines the range-wide status of critical habitat by examining the condition of its physical or biological features (also called "primary constituent elements" or PCEs) - which were identified when critical habitat was designated. Species and critical habitat status are discussed in section 2.2 of this biological opinion.

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 and critical habitat has been published in a number of documents including peer reviewed scientific journals, primary reference materials, and governmental and non-governmental reports. Additional information regarding the effects of the project's actions on the listed species in question, their anticipated response to these actions, and the environmental consequences of the actions as a whole was formulated from the aforementioned resources referenced in the Consultation History section. Information was also provided in electronic mail messages and telephone conversations between April 2013 and November 2015. 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.

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status 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. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses

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(Application of the "Destruction or Adverse Modification" Standard Under Section 7(a)(2) of the Endangered Species Act) (November 7, 2005).

the current function of the essential physical and biological features that help to form that conservation value.

2.2.1. Species Description, Life History, and Status- CCC Steelhead

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

The population viability parameters are used as surrogates for numbers, reproduction, and distribution; the criteria to be analyzed pursuant to the regulatory definition of jeopardy (50 CFR §402.02). For example, the first three parameters are used as surrogates for numbers, reproduction, and distribution. We relate the fourth parameter, diversity, to all three regulatory criteria. Numbers, reproduction, and distribution are all affected when genetic or life history variability is lost or constrained. This results in reduced population resilience to environmental variation at local or landscape-level scales.

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 percent) 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.

General reviews for steelhead in California document much variation in life history (Barnhart 1986; Busby *et al.* 1996; Shapovalov and Taft 1954). Although variation occurs, in coastal California steelhead usually live in freshwater for 1 to 2 years before emigrating to the ocean. Juvenile steelhead emigration from San Francisco Bay natal streams occurs episodically during winter and spring months, and generally occurs during high flow events. Barnhart (1986) reports that peak smolt migration occurs in March and April, and steelhead smolts in California typically range in size from 140 to 210 millimeter (mm) (fork length). Steelhead of this size can withstand higher salinities than smaller fish, and are more likely to occur for longer periods in tidally influenced estuaries, such as San Francisco Bay. Steelhead smolts in most river systems must pass through estuaries prior to seawater entry. Once they leave their natal streams, steelhead will spend 1 to 3 years in the ocean before returning to spawn.

Based on the timing of adult migration from the ocean to freshwater, CCC steelhead are classified as winter-run steelhead. Adult CCC steelhead typically enter freshwater between December and April, peaking in January and February (Fukushima and Lesh 1998). 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. 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. Other intragravel parameters such as the gravel permeability, water temperature, substrate composition, and organic material in the substrate effect the survival of eggs to fry emergence (Chapman 1988; Everest *et al.* 1987; Shapovalov and Taft 1954). Adult steelhead may spawn 1 to 4 times over their life span.

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 1991b; Myrick and Cech 2005). Optimal temperatures for steelhead growth range between 10 and 20 degrees (°) Celsius (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).

Turbidity (*i.e.*, water clarity) also can influence the behavior, distribution, and growth of steelhead (Cordone and Kelley 1961; Newcombe and Jensen 1996; Newcombe and MacDonald 1991; Redding *et al.* 1987; Sigler *et al.* 1984). The impacts of turbidity on juvenile salmonids are largely linked to factors such as background turbidity levels and the duration of turbid conditions. Bisson and Bilby (1982) found that juvenile coho salmon that were acclimated to clear water did not exhibit significant sediment avoidance until the turbidity reached 70 NTUs. Sigler *et al.* (1984) observed avoidance of turbid water by juvenile steelhead and coho when exposed to turbidities as low as 38 NTUs and 22 NTUs, respectively, for a period of 15-17 days. Sigler *et al.* (1984) also observed that fish kept in these turbid conditions had lower growth rates than fish kept in clear water for the same amount of time.

2.2.1.2. Status of CCC Steelhead DPS and Critical Habitat

Historically, approximately 70 populations[2] of steelhead existed in the CCC steelhead DPS (Spence *et al.* 2008; Spence *et al.* 2012). Many of these populations (about 37) were independent, or potentially independent, meaning they had a high likelihood of surviving for 100 years absent anthropogenic impacts (Bjorkstedt *et al.* 2005). The remaining populations were

[2] 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).

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) . Recent estimates for the Russian River population are unavailable since monitoring data is limited. Abundance estimates for smaller coastal streams in the DPS indicate low population levels that are slowly declining, with recent estimates (2011/2012) for several streams (Redwood [Marin County], Waddell, San Vicente, Soquel, and Aptos creeks) of individual run sizes of 50 fish or less (Nature Conservancy 2013). Some loss of genetic diversity has been documented and attributed to previous among-basin transfers of stock and local hatchery production in interior populations in the Russian River (Bjorkstedt *et al.* 2005). 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. 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).

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

A more recent viability assessment of CCC steelhead concluded that populations in watersheds that drain to San Francisco Bay are highly unlikely to be viable, and that the limited information available did not indicate that any other CCC steelhead populations could be demonstrated to be viable[3] (Spence *et al.* 2008). Monitoring data from the last ten years of adult CCC steelhead returns in Lagunitas and Scott creeks show steep declines in adults in 2008/2009. In 2011/2012 population levels began to increase, but still remained lower than levels observed over the past ten years (Nature Conservancy 2013). The most recent status update found that the status of the CCC steelhead DPS remains "likely to become endangered in the foreseeable future" (Williams *et al.* 2011), as new and additional information available since Good *et al.* (2005), does not

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

appear to suggest a change in extinction risk. On December 7, 2011, NMFS chose to maintain the threatened status of the CCC steelhead (76 FR 76386).

Critical habitat was designated for CCC steelhead on September 2, 2005 (70 FR 52488) and includes PCEs essential for the conservation of CCC steelhead. These PCEs include estuarine areas free of obstruction and excessive predation with the following essential features: (1) water quality, water quantity and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; (2) natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and (3) juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation (70 FR 52488).

The condition of CCC steelhead critical habitat, specifically its ability to provide for their conservation, has been degraded from conditions known to support viable salmonid populations. NMFS has determined that present depressed population conditions are, in part, the result of the following human-induced factors affecting critical habitat[4]: logging, agricultural and mining activities, urbanization, stream channelization, dams, wetland loss, and water withdrawals, including unscreened diversions for irrigation. Impacts of concern include alteration of streambank 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 streambank erosion, loss of shade (higher water temperatures) and loss of nutrient inputs (70 FR 52488 ; Busby *et al.* 1996). Water development has 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. Overall, current condition of CCC steelhead critical habitat is degraded, and does not provide the full extent of conservation value necessary for the recovery of the species.

2.2.2. <u>Species Description, Life History, and Status- Southern DPS Green Sturgeon</u>

2.2.2.1. Green Sturgeon General Life History

Green sturgeon is an anadromous, long-lived, and bottom-oriented fish species in the family Acipenseridae. Sturgeon have skeletons composed mostly of cartilage and lack scales, instead possessing five rows of characteristic bony plates on their body called "scutes." On the underside of their flattened snouts are sensory barbels and a siphon-shaped, protrusible, toothless mouth. Large adults may exceed 2 meters in length and 100 kilograms in weight (Moyle 1976). Based on genetic analyses and spawning site fidelity, NMFS determined that North American green sturgeon are comprised of at least two DPSs: a northern DPS consisting of populations originating from coastal watersheds northward of and including the Eel River (“northern DPS

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

green sturgeon"), with spawning confirmed in the Klamath and Rogue river systems; and a southern DPS consisting of populations originating from coastal watersheds south of the Eel River ("southern DPS green sturgeon"), with spawning confirmed in the Sacramento River system (Adams *et al.* 2002).

Green sturgeon is the most marine-oriented species of sturgeon (Moyle 2002). Along the West Coast of North America, they range in nearshore waters from Mexico to the Bering Sea (Adams *et al.* 2002), with a general tendency to head north after their out-migration from freshwater ((Lindley *et al.* 2011). While in the ocean, archival tagging indicates that green sturgeon occur in waters between 0 and 200 meters depth, but spend most of their time in waters between 20–80 meters and temperatures of 9.5–16.0°C (Huff *et al.* 2011; Nelson *et al.* 2010). Subadult and adult green sturgeon move between coastal waters and estuaries (Lindley *et al.* 2011; Lindley *et al.* 2008), but relatively little is known about how green sturgeon use these habitats. Lindley *et al.* (2011) reported multiple rivers and estuaries are visited by aggregations of green sturgeon in summer months, and larger estuaries (*e.g.*, San Francisco Bay) appear to be particularly important habitat. During the winter months, green sturgeon generally reside in the coastal ocean. Areas north of Vancouver Island are favored overwintering areas, with Queen Charlotte Sound and Hecate Strait likely destinations based on detections of acoustically-tagged green sturgeon (Lindley *et al.* 2008; Nelson *et al.* 2010).

Based on genetic analysis, (Israel *et al.* 2009) reported that almost all green sturgeon collected in the San Francisco Bay system were southern DPS. This is corroborated by tagging and tracking studies which found that no green sturgeon tagged in the Klamath or Rogue rivers (*i.e.*, Northern DPS) have yet been detected in San Francisco Bay (Lindley *et al.* 2011). However, green sturgeon inhabiting coastal waters adjacent to San Francisco Bay include northern DPS green sturgeon.

Adult southern DPS green sturgeon spawn in the Sacramento River watershed during the spring and early summer months (Moyle *et al.* 1995). Eggs are laid in turbulent areas on the river bottom and settle into the interstitial spaces between cobble and gravel (Adams *et al.* 2007). Like salmonids, green sturgeon require cool water temperatures for egg and larval development, with an upper thermal limit for developing embryos of 17˚C (Van Eenennaam *et al.* 2005). Eggs hatch after 6–8 days, and larval feeding begins 10–15 days post-hatch. Larvae grow into juveniles typically after a minimum of 45 days (post-hatch) when fish have reached 60–80 mm total length (TL) and have migrated downstream. Juveniles spend their first few years in the Delta and San Francisco estuary before entering the marine environment as subadults. Juvenile green sturgeon salvaged at the State and Federal water export facilities in the southern Delta are generally between 200 mm and 400 mm TL (Adams *et al.* 2002), which suggests southern DPS green sturgeon spend several months to a year rearing in freshwater before entering the Delta and San Francisco estuary. Laboratory studies conducted by Allen and Cech (2007) indicated juveniles approximately 6 month old were tolerant of saltwater, but approximately 1.5-year old green sturgeon appeared more capable of successful osmoregulation in salt water.

Subadult green sturgeon spend several years at sea before reaching reproductive maturity and returning to freshwater to spawn for the first time (Nakamoto *et al.* 1995). Little data are available regarding the size and age-at-maturity for the southern DPS green sturgeon, but it is likely similar to that of the northern DPS. Male and female green sturgeon differ in age-at-maturity. Males can mature as young as 14 years and female green sturgeon mature as early as age 16 (Van Eenennaam *et al.* 2006). Adult green sturgeon are believed to spawn every two to five years. Recent telemetry studies by Heublein *et al.* (2009) indicate adults typically enter San Francisco Bay from the ocean and begin their upstream spawning migration between late February and early May. These adults on their way to spawning areas in the upper Sacramento River typically migrate rapidly through the estuary toward their upstream spawning sites. Preliminary results from tagged adult sturgeon suggest travel time from the Golden Gate to Rio Vista in the Delta is generally 1-2 weeks. Post-spawning, tagged southern DPS green sturgeon displayed two outmigration strategies (Heublein *et al.* 2009); outmigration from Sacramento River prior to September 1 and outmigration during the onset of fall/winter stream flow increases. The transit time for post-spawning adults through the San Francisco estuary appears to be very similar to their upstream migration (*i.e.*, 1-2 weeks).

During the summer and fall, an unknown proportion of the population of non-spawning adults and subadults enter the San Francisco estuary from the ocean for periods ranging from a few days to 6 months (Lindley *et al.* 2011). Some fish are detected only near the Golden Gate, while others move as far inland as Rio Vista in the Delta. The remainder of the population appear to enter bays and estuaries farther north from Humboldt Bay, California to Grays Harbor, Washington (Lindley *et al.* 2011).

Green sturgeon feed on benthic invertebrates and fish (Adams *et al.* 2002). Radtke (1966) analyzed stomach contents of juvenile green sturgeon captured in the Sacramento-San Joaquin Delta and found the majority of their diet was benthic invertebrates, such as mysid shrimp and amphipods (Corophium spp). Dumbauld *et al. (2008)* report that immature green sturgeon found in Willapa Bay, Grays Harbor, and the Columbia River Estuary, fed on a diet consisting primarily of benthic prey and fish common to these estuaries (ghost shrimp, crab, and crangonid shrimp), with burrowing thalassinid shrimp representing a significant proportion of the sturgeon diet. Dumbauld *et al.* (2008) observed feeding pits (depressions in the substrate believed to be formed when green sturgeon feed) in soft-bottom intertidal areas where green sturgeon are believed to spend a substantial amount foraging.

2.2.2.2. Status of Southern DPS Green Sturgeon and Critical Habitat

To date, little population-level data have been collected for green sturgeon. In particular, there are no published abundance estimates for either northern DPS or southern DPS green sturgeon in any of the natal rivers based on survey data. As a result, efforts to estimate green sturgeon population size have had to rely on sub-optimal data with known potential biases. Available abundance information comes mainly from four sources: 1) incidental captures in the CDFW white sturgeon (*Acipenser transmontanus*) monitoring program; 2) fish monitoring efforts associated with two diversion facilities on the upper Sacramento River; 3) fish salvage operations at the water export facilities on the Sacramento-San Joaquin Delta; and 4) dual frequency sonar identification in spawning areas of the upper Sacramento River. These data are insufficient in a variety of ways (short time series, non-target species, etc.) and do not support more than a qualitative evaluation of changes in green sturgeon abundance.

CDFW's white sturgeon monitoring program incidentally captures southern DPS green sturgeon. Trammel nets are used to capture white sturgeon and CDFW utilizes a multiple-census or Peterson mark-recapture method to estimate the size of subadult and adult sturgeon population (https://www.dfg.ca.gov/fish/Resources/Sturgeon/). By comparing ratios of white sturgeon to green sturgeon captures, estimates of southern DPS green sturgeon abundance can be calculated. Estimated abundance of green sturgeon between 1954 and 2001 ranged from 175 fish to more than 8,000 per year and averaged 1,509 fish per year. Unfortunately, there are many biases and errors associated with these data, and CDFW does not consider these estimates reliable. For larval and juvenile green sturgeon in the upper Sacramento River, information is available from salmon monitoring efforts at the Red Bluff Diversion Dam (RBDD) and the Glenn-Colusa Irrigation District (GCID). Incidental capture of larval and juvenile green sturgeon at the RBDD and GCID have ranged between 0 and 2,068 green sturgeon per year (Adams *et al.* 2002). Genetic data collected from these larval green sturgeon suggest that the number of adult green sturgeon spawning in the upper Sacramento River remained roughly constant between 2002 and 2006 in river reaches above Red Bluff (Israel and May 2010). In 2011, rotary screw traps operating in the Upper Sacramento River at RBDD captured 3,700 larval green sturgeon which represents the highest catch on record in 16 years of sampling (Poytress *et al.* 2011).

Juvenile green sturgeon are collected at water export facilities operated by the California Department of Water Resources (DWR) and the Federal Bureau of Reclamation (BOR) in the Sacramento-San Joaquin Delta. Fish collection records have been maintained by DWR from 1968 to present and by BOR from 1980 to present. The average number of southern DPS green sturgeon taken per year at the DWR facility prior to 1986 was 732; from 1986 to 2001, the average per year was 47 (70 FR 17386). For the BOR facility, the average number prior to 1986 was 889; from 1986 to 2001 the average was 32 (70 FR 17386). Direct capture in the salvage operations at these facilities is a small component of the overall effect of water export facilities on southern DPS green sturgeon; entrained juvenile green sturgeon are exposed to potential high levels of predation by non-native predators, disruption in migratory behavior, and poor habitat quality. Delta water exports have increased substantially since the 1970s and it is likely that this has contributed to negative trends in the abundance of migratory fish that utilize the Delta, including the southern DPS green sturgeon.

During the spring and summer spawning period, researchers with University of California Davis have utilized dual-frequency identification sonar (*i.e.*, DIDSON) to enumerate adult green sturgeon in the upper Sacramento River. These surveys estimated 175 to 250 sturgeon (±50) in the mainstem Sacramento River during the 2010 and 2011 spawning seasons. However, it is important to note that this estimate may include some white sturgeon, and movements of individuals in and out of the survey area confound these estimates. Given these uncertainties, caution must be taken in using these estimates to infer the spawning run size for the Sacramento River, until further analyses are completed.

The southern DPS green sturgeon was listed as threatened on April 7, 2006 (71 FR 17757). NMFS determined that the southern DPS green sturgeon was likely to become endangered in the foreseeable future due to the substantial loss of spawning habitat, the concentration of a single spawning population in one section of the Sacramento River, and multiple other risks to the species such as stream flow management, degraded water quality, and introduced species (NMFS

2005). A recent status review update concluded that there has been no significant change in the status of Southern DPS green sturgeon since they were listed as Threatened in 2006 (NMFS 2015). This was based on an evaluation of new information generated since the 2006 which indicated that some threats, such as those posed by fisheries and impassable barriers, have been reduced. It also identified an emerging threat posed by nearshore and offshore energy development that requires continued attention into the future. Overall, the new information did not provide conclusive data indicating that habitat conditions and factors have changed in severity or degree of threat since 2006, and that additional research is needed. Since many of the threats cited in the original listing still exist, on August 11, 2015, NMFS chose to maintain the threatened status of the southern DPS green sturgeon (NMFS 2015).

Critical habitat was designated for the southern DPS of green sturgeon on October 9, 2009 (74 FR 52300). Critical habitat includes coastal marine waters within 60 fathoms depth from Monterey Bay, California to Cape Flattery, Washington, and includes the Strait of Juan de Fuca to its United States boundary. Designated critical habitat also includes the Sacramento River, lower Feather River, lower Yuba River, Sacramento-San Joaquin Delta, Suisun Bay, San Pablo Bay, and San Francisco Bay in California. PCEs of designated critical habitat in estuarine areas are food resources, water flow, water quality, mitigation corridor, depth, and sediment quality. In freshwater riverine systems, PCEs of green sturgeon critical habitat are food resources, substrate type or size, water flow, water quality, migratory corridor, depth, and sediment quality. In nearshore coastal marine areas, PCEs are migratory corridor, water quality, and food resources.

The current condition of critical habitat for the southern DPS of green sturgeon is degraded over its historical conditions. It does not provide the full extent of conservation values necessary for the recovery of the species, particularly in the upstream riverine habitat of the Sacramento River. In the Sacramento River, migration corridor and water flow PCEs have been impacted by human actions, substantially altering the historical river characteristics in which the southern DPS of green sturgeon evolved. In addition, the Delta may have a particularly strong impact on the survival and recruitment of juvenile green sturgeon due to their protracted rearing time in brackish and estuarine waters.

2.2.3. Factors Responsible for Steelhead and Sturgeon Stock Declines

NMFS cites many reasons (primarily anthropogenic) for the decline of steelhead (Busby *et al.* 1996) and southern DPS of green sturgeon (Adams *et al.* 2002; National Marine Fisheries Service (NMFS) 2005). The foremost reason for the decline in these anadromous populations is the degradation and/or destruction of freshwater and estuarine habitat. Additional factors contributing to the decline of these populations include: commercial and recreational harvest, artificial propagation, natural stochastic events, marine mammal predation, and reduced marine-derived nutrient transport.

The following section details the general factors affecting the CCC steelhead and southern green sturgeon in California. The extent to which there are species specific differences in these factors is not clear; however, the freshwater and estuarine ecosystem characteristics necessary for the maintenance of self-sustaining populations of steelhead and green sturgeon are similar. Therefore, most of these factors below affect both steelhead and green sturgeon.

2.2.3.1. Habitat Degradation and Destruction

The best scientific information presently available demonstrates a multitude of factors, past and present, have contributed to the decline of west coast salmonids by reducing and degrading habitat by adversely affecting essential habitat features. Most of this habitat loss and degradation has resulted from anthropogenic watershed disturbances caused by urban development, agriculture, poor water quality, water resource development, dams, gravel mining, forestry (Adams *et al.* 2002; Busby *et al.* 1996; Good *et al.* 2005), and lagoon management (Bond 2006; Smith 1990).

The final rule listing Southern DPS green sturgeon indicates that the principle factor for the decline in the DPS is the reduction of spawning to a limited area in the Sacramento River (71 FR 17757). The constriction of spawning areas is caused by passage impediments associated with several dams, weirs, and diversions on the Sacramento River and its tributaries. While some of these passage impediments have been improved (*e.g.*, RBDD), significant numbers of these structures continue to impede passage of green sturgeon to spawning areas.

2.2.3.2. Commercial and Recreational Harvest

Ocean salmon fisheries off California are managed to meet the conservation objectives for certain stocks of salmon listed in the Pacific Coast Salmon FMP, including any stock that is listed as threatened or endangered under the ESA. Early records did not contain quantitative data by species until the early 1950's. In addition, the confounding effects of habitat deterioration, drought, and poor ocean conditions on salmonids make it difficult to assess the degree to which recreational and commercial harvest have contributed to the overall decline of salmonids and green sturgeon in West Coast rivers.

Since being listed in 2006, landing and sales of green sturgeon is prohibited. A recent analysis of green sturgeon bycatch (Lee et al. 2015) estimated the number of Southern DPS green sturgeon bycatch in federally managed fisheries (*e.g*., LE groundfish bottom trawl, IFQ groundfish bottom trawl, and at-sea hake fisheries) was 20.9 in 2011, 12.1 in 2012, and 5.5 in 2013, below NMFS's authorized take level of 28 per year (NMFS 2012).

2.2.3.3. Artificial Propagation

Releasing large numbers of hatchery fish can pose a threat to wild steelhead stocks through genetic impacts, competition for food and other resources, predation of hatchery fish on wild fish, and increased fishing pressure on wild stocks as a result of hatchery production (Waples 1991).

2.2.3.4. Natural Stochastic Events

Natural events such as droughts, landslides, floods, and other catastrophes have adversely affected steelhead and green sturgeon populations throughout their evolutionary histories. The effects of these events are exacerbated by anthropogenic changes to watersheds such as logging, roads, and water diversions. These anthropogenic changes have limited the ability of steelhead and green sturgeon to rebound from natural stochastic events and further depressed populations to critically low levels.

2.2.3.5. Marine Mammal Predation

The population of some marine mammal species, such as the Harbor seal (*Phoca vitulina*) and California sea lion (*Zalophus californianus*), have increased along the Pacific Coast (NMFS 1999). Although predation by these mammals is not believed to be a major factor in overall population decline, there may be substantial localized impacts on steelhead particularly during the migration season (Hanson 1993). CDFW notes predation on Southern DPS green sturgeon by California sea lions in the Sacramento River, bays, and Delta[5]. Steller and California sea lion abundance has increased in recent decades (NMFS 2013).

2.2.3.6. Invasive Species

San Francisco Bay is considered one of the most invaded estuaries in the world (Cohen and Carlton 1998). Invasive species contribute up to 99 percent of the biomass of some of the communities in the Bay (Cloern and Jassby 2012). Invasive species can disrupt ecosystems that support native populations. While there have been numerous invasions in the Bay, the best documented and studied invasive is the nonnative overbite clam (*Corbula amurensis*). It is a small clam native to rivers and estuaries of East Asia that is believed to be introduced in the ballast waters of ships entering the Bay in the late 1980s. The overbite clam can utilize a broad suite of food resources and withstand a wide range of salinities, including a tolerance of salinities less than 1 part per thousand (Nichols *et al.* 1990). Its introduction has corresponded with a decline in phytoplankton and zooplankton abundance due to grazing by the overbite clam (Kimmerer *et al.* 1994). Prior to its introduction, phytoplankton biomass in the Bay was approximately three times what it is today (Cloern 1996; Cloern and Jassby 2012), and the zooplankton community has changed from one having large abundances of mysid shrimp, rotifers, and calanoid copepods to one dominated by copepods indigenous to East Asia (Winder and Jassby 2011).

Kogut (2008) noted that overbite clams passed through the gut of white sturgeon alive. NMFS assumes that this may occur with green sturgeon too. Clams passing alive through a sturgeon's gut may lead to adverse effects on calorie and nutrient intake of sturgeon and may be a mechanism to assist in distribution of overbite clams to novel areas.

[5] California Department of Fish and Wildlife submitted comments in response to NMFS' invitation to review the green sturgeon Southern DPS draft status review in 2013.

2.2.3.7. Reduced Marine-Derived Nutrient Transport

Marine-derived nutrients from adult salmon carcasses have been shown to be vital for the growth of juvenile salmonids and the surrounding terrestrial and riverine ecosystems (Bilby *et al.* 1996; Bilby *et al.* 1998; Gresh *et al.* 2000). Declining salmon and steelhead populations have resulted in decreased marine-derived nutrient transport to many watersheds. This has contributed to the further decline of ESA-listed salmonid populations (Gresh *et al.* 2000).

2.2.3.8. Ocean Conditions

Recent evidence suggests poor ocean conditions played a significant role in the low number of returning adult fall run Chinook salmon to the Sacramento River in 2007 and 2008 (Lindley *et al.* 2009). The decline in ocean conditions likely affected ocean survival of all west coast salmonid populations (Good *et al.* 2005; Spence *et al.* 2008). Changing ocean conditions could also impact Southern DPS green sturgeon since subadults and adults use ocean habitats for migration and potentially for feeding. Based on their use of coastal bay and estuarine habitats, subadults and adults can occupy habitats with a wide range of temperature, salinity, and dissolved oxygen levels, so predicting the impact of climate change in these environments is difficult (Kelly *et al.* 2007; Lindley *et al.* 2008).

2.2.3.9. Global Climate Change

One factor affecting the rangewide status of CCC steelhead and Southern DPS green sturgeon, and aquatic habitat at large is climate change. The acceptance of global climate change as a scientifically valid and human caused phenomenon has been well established by the United Nations Framework Convention on Climate Change (UNFCCC), the Intergovernmental Panel on Climate Change, and others (Davies *et al.* 2001; Oreskes 2004; UNFCCC 2014). The most relevant trend in climate change is the warming of the atmosphere from increased greenhouse gas emissions. This warming is inseparably linked to the oceans, the biosphere, and the world's water cycle. Changes in the distribution and abundance of a wide array of biota confirm a warming trend is in progress, and that it has great potential to affect species' survival (Davies *et al.* 2001). In general, as the magnitude of climate fluctuations increases, the population extinction rate also increases (Good *et al.* 2005). Global warming is likely to manifest itself differently in different regions.

Modeling of climate change impacts in California suggests average summer air temperatures are expected to increase (Lindley *et al.* 2007). Heat waves are expected to occur more often, and heat wave temperatures are likely to be higher (Hayhoe *et al.* 2004). Total precipitation in California may decline; critically dry years may increase (Lindley *et al.* 2007; Schneider 2007). The Sierra Nevada snow pack is likely to decrease by as much as 70 to 90 percent by the end of this century under the highest emission scenarios modeled (Luers *et al.* 2006). Wildfires are expected to increase in frequency and magnitude, by as much as 55 percent under the medium emissions scenarios modeled (Luers *et al.* 2006). Vegetative cover may also change, with decreases in evergreen conifer forest and increases in grasslands and mixed evergreen forests. The likely change in amount of rainfall in Northern and Central Coastal streams under various warming scenarios is less certain, although as noted above, total rainfall across the state is expected to decline. For the California North Coast, some models show large increases (75 to 200 percent) while other models show decreases of 15 to 30 percent (Hayhoe *et al.* 2004). Many of these changes are likely to further degrade salmonid habitat by, for example, reducing stream flows during the summer and raising summer water temperatures. Estuaries may also experience changes detrimental to green sturgeon. Estuarine productivity is likely to change based on changes in freshwater flows, nutrient cycling, and sediment amounts (Scavia *et al.* 2002). The projections described above are for the mid to late 21st Century. In shorter time frames natural climate conditions are more likely to predominate (Cox and Stephenson 2007; Smith and Murphy 2007).

2.3 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).

2.3.1. Status of Critical Habitat in Action Area

Designated critical habitat for CCC steelhead includes all aquatic habitat within the action area. Within the action area, essential features of critical habitat include estuarine areas. The critical habitat designation for CCC steelhead specifies that:

> *…estuarine areas should be free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation. These features are essential to conservation because without them juveniles cannot reach the ocean in a timely manner and use the variety of habitats that allow them to avoid predators, compete successfully, and complete the behavioral and physiological changes needed for life in the ocean. Similarly, these features are essential to the conservation of adults because they provide a final source of abundant forage that will provide the energy stores needed to make the physiological transition to fresh water, migrate upstream, avoid predators, and develop to maturity upon reaching spawning areas* (70 FR 52488).

These essential features of designated critical habitat for adult and juvenile steelhead within the action area are partially degraded and limited due to channelization, high water velocities, limited water depth and natural cover, lack of emergent marsh, and reduced channel complexity (*i.e.*, floodplains and side channels).

The project's action area is located within designated critical habitat for the southern DPS of green sturgeon. PCEs essential for green sturgeon critical habitat in estuarine areas include food resources, water flow, water quality, migratory corridor, water depth, and sediment quality. These PCEs for green sturgeon critical habitat in the action area are partially degraded. NMFS believes the overall PCE for rearing of green sturgeon is degraded due to the poor overall condition of the habitat, including a lack of emergent marsh, limited depth and cover, and reduced channel complexity. Adult southern DPS green sturgeon are only known to spawn in deep, turbulent pools in the upper Sacramento River below Keswick Dam and therefore spawning would not occur in the San Francisquito Creek watershed.

2.3.2. Status of Listed Species in the Action Area

2.3.2.1. CCC Steelhead

The San Francisquito Creek watershed CCC steelhead population represents one of only a few known remaining runs in tributary streams to South San Francisco Bay. The mainstem of San Francisquito Creek provides access between the headwaters of the watershed and San Francisco Bay and, thus, is essential for the immigration of steelhead adults and the emigration of smolts. Juvenile and adult abundance data for this watershed are very limited.

Based on the limited surveys that have been conducted, adult steelhead currently occur in San Francisquito Creek and its tributaries (Launer and Spain 1998; Leidy *et al.* 2005). Most steelhead presence data are based on observations from local residents/biologists and pertain primarily to the upper watershed. Launer and Spain (1998) conducted observations of fish and amphibian communities in San Francisquito Creek through the Stanford University (approximately 6 miles upstream of the action area) property during the summer of 1997. Based on their observations, they estimated a few thousand juvenile steelhead inhabited that segment of the creek, which represents a small fraction of the total available rearing habitat available to steelhead in the watershed. In the summer of 2004, juvenile steelhead were captured and relocated at two sites on the upper mainstem of San Francisquito Creek. Juvenile steelhead densities at the two sites were approximately 17 and 12 fish per 100 feet respectively (D.W. Alley and Associates 2004).

During the course of their downstream migration, juvenile steelhead may utilize the estuarine reaches of San Francisquito Creek and San Francisco Bay for seasonal rearing, but available information suggests that fish are actively migrating and currently they do not reside in estuarine reaches or the San Francisco Bay estuary (Chapman *et al.* 2015). Historically, the tidal marshes of San Francisco Bay provided a highly productive estuarine environment for juvenile anadromous salmonids. However, loss of habitat, changes in prey communities, and water-flow alterations and reductions have degraded habitat and likely limit the ability of the Bay and the action area to support juvenile rearing. MacFarlane and Norton (2002) found that fall-run Chinook experienced little growth, depleted condition, and no accumulation of lipid energy reserves during the relatively limited time the fish spent transiting the 40-mile length of the estuary. Sandstrom *et al.* (2013) found that CCC steelhead smolts emigrated more rapidly through the Bay than the Napa River and the ocean.

Steelhead use of the action area would be primarily as migratory habitat for adults and smolts migrating in and out of the watershed during the winter and spring months. As noted earlier, reaches upstream of the U.S. Highway 101 Bridges go dry in most years and therefore summer rearing habitat is not available at this location (Launer and Spain 1998; Leidy *et al.* 2005; Metzger 2002). In the action area, NMFS expects juvenile and smolt steelhead presence during construction activities is unlikely due to the lack of connection with upstream freshwater rearing areas in the summer months, the timing of project construction (*i.e.*, at the end of the smolt out-migration season), and the poor quality of rearing habitat described above.

2.3.2.2. Southern DPS Green Sturgeon:

Sub-adult and non-spawning adult green sturgeon are found in San Francisco Bay during the summer months; however, acoustic tagging studies suggest the duration of residence by an individual is typically 6 weeks . There are no known records of green sturgeon utilizing San Francisquito Creek. Green sturgeon have occasionally been captured by CDFW during trawl surveys in southern San Francisco Bay, and acoustic tagging studies have reported tagged green sturgeon in the vicinity of the Dumbarton Bridge, approximately 2.5 miles north of the Project (ECORP Consulting, Inc. unpublished data 2011).

While no surveys for green sturgeon have been conducted in the action area, tidal sloughs are used as foraging habitat by green sturgeon. Green sturgeon prey on demersal fish (*e.g.*, sand lance) and benthic invertebrates similar to those that green sturgeon are known to prey upon in estuaries of Washington and Oregon . Green sturgeon are known to be generalist feeders and may feed opportunistically on a variety of benthic species encountered. For example, the invasive overbite clam has become the most common food of white sturgeon, and for the green sturgeon that have been examined to date (CDFG 2002). Based on distribution data and foraging habits of green sturgeon, NMFS assumes they are present in the action area when tidal conditions permit. Based on the poor condition of habitat in the action area for green sturgeon (*i.e.*, shallow waters, poor cover, and limited foraging habitat) NMFS expects very few green sturgeon will be present in the action area during project construction.

2.3.2.3. Factors Affecting Species Environment within San Francisquito Creek and the Action Area

Factors affecting watershed reaches upstream of the action area have impacted steelhead, and to a significantly lesser degree affected green sturgeon. Jones and Stokes (2006) conducted a limiting factors analysis for steelhead in the San Francisquito Creek. Based on their conclusion, multiple factors are impacting the survival and abundance of steelhead in San Francisquito Creek. They identified poor overwintering habitat (*i.e.*, a lack of deep, complex pools) as the primary limiting factor for juvenile survival. Although the availability of summer rearing habitat was not found to be a limiting factor, they noted that summer rearing habitat was degraded due to a lack of deep pools, low abundance of large woody debris, limited coarse substrate accumulations caused by channelization, urban development, and stream flow regulation. Steelhead outmigration success is limited by seasonal drying which may be further impacted by fish passage impediments in San Francisquito Creek. In dry to average years, low spring outmigration flows severely limits passage for out-migrating smolts. Multiple dams in the upper watershed have blocked approximately 33 percent of the historic steelhead spawning habitat in the San Francisquito Creek watershed (Spence *et al.* 2008).

The lower reaches of San Francisquito Creek are heavily channelized and bordered by levees and dikes. Some areas of stream bank are armored with concrete to prevent erosion. In the action area, San Francisquito Creek is tidally influenced. The action area consists of a flood control channel with two tight curves, two long straight sections, and one soft bend. The current channel is confined by earthen levees for most of its length except in a small 300 foot long reach in the middle of the channel where the levees have partially degraded. Channel widths from the top of the northern to southern levees ranges between 110 to 200 feet. The flood control channel has an irregular v-shaped low flow channel bordered by a gentle sloping marshplain. The Palo Alto Municipal Golf Course is located on the south side of the creek within a portion of the action area.

Historically, this reach consisted of a sinuous main channel that transitioned into a distributary tidal marshland approximately 0.5 miles from the mouth of the creek (Hermstad 2009). Historical conditions supported a highly complex habitat structure with multiple entry/exit points, depth variability, more abundant woody debris in the channel, and a more expansive floodplain. All of which contributed to higher water levels at low tide, increased depth variability, and reduced stream velocities through the multichannel marsh. Major re-routing of the lower reaches took place in the late 1920s, with levees constructed on both sides of the creek for flood control and development purposes (Hermstad 2009). Constriction of the marsh within a narrow corridor has led to the current condition of a simplified channel and homogenous marshplain, with no side channels, deep pools, or large woody debris to provide natural cover for fish. Freshwater flow through the action area during the dry season is either non-existent or consists largely of urban runoff.

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

Within the past ten years, pursuant to section 7 of the ESA, NMFS conducted section 7 consultations in the action area:

2.3.3.1. Hwy 101Bridge Replacement Project

NMFS and the Caltrans completed formal section 7 consultation on Caltrans' proposal to replace the U.S. Highway 101 Bridge over San Francisquito Creek, and a biological opinion was issued on May 29, 2011. The biological opinion analyzed the effects of construction and operation of the bridge on CCC steelhead and southern DPS green sturgeon and their critical habitat. The biological opinion concluded that the project was not likely to jeopardize steelhead or green sturgeon, or adversely modify their critical habitat.

2.3.3.2. SCVWD Stream Maintenance Permit

NMFS and the Corps completed formal section 7 consultation on SCVWD's activities to be conducted between 2014 and 2023 in Santa Clara County as part of the SCVWD's SMP. A biological opinion was issued on April 29, 2014. The biological opinion analyzed the effects of maintenance activities on CCC steelhead, South-Central California Coast (S-CCC) steelhead, southern DPS green sturgeon, and their critical habitat. The biological opinion concluded that the project was not likely to jeopardize CCC steelhead, S-CCC steelhead, or southern DPS green sturgeon, or adversely modify their critical habitat.

2.3.3.3. Stanford University's proposed Steelhead Habitat Enhancement Program (SHEP) (NMFS PCTS #SWR-2006-00892 and WCR 2014- 875; and Corps File No. 28630S)

NMFS and the Corps completed formal section 7 consultation regarding Stanford University's proposed SHEP, and a biological opinion was issued on April 21, 2008. The formal consultation evaluated modifications to Stanford's San Francisquito Pump Station and the Los Trancos Diversion. The consultation and resulting biological opinion also evaluated the future operation of the San Francisquito Pump Station and Los Trancos Diversion under the SHEP's minimum bypass flow requirements. The biological opinion concluded the project was not likely to jeopardize the continued existence of threatened CCC steelhead or adversely modify CCC steelhead designated critical habitat.

The Corps requested reinitiation of formal consultation with NMFS in June 2014, to address a bank stabilization structure that failed at the Los Trancos Diversion facility and unsuccessful riparian mitigation plantings that needed to be replanted. The formal consultation analyzed the effects of these actions on CCC steelhead and their critical habitat, and a biological opinion was issued on August 27, 2014. The biological opinion concluded the project was not likely to jeopardize the continued existence of threatened CCC steelhead or adversely modify CCC steelhead designated critical habitat.

2.3.3.4. Stanford University's Habitat Conservation Plan (HCP)

In addition to the above interagency consultation, NMFS conducted an internal section 7 consultation on the proposed issuance of an ESA section 10(a)(1)(B) Incidental Take Permit (ITP) for Stanford's 2011 HCP. NMFS completed a biological opinion on October 19, 2012, which concluded the issuance of a 50-year ITP was not likely to jeopardize the continued existence of threatened CCC steelhead or adversely modify CCC steelhead designated critical habitat. However, NMFS did not proceed with the issuance of the ITP because Stanford requested by letter dated December 6, 2012, that NMFS suspend the processing of their application until such time as the Searsville Alternative Study is complete or advanced to a point where Stanford better understands the best future for Searsville Dam and Reservoir.

2.3.3.5. Research and Enhancement Permits

Research and enhancement projects resulting from NMFS' Section 10(a)(1)(A) research and enhancement permits and section 4(d) limits or exceptions could potentially occur in the action area. Salmonid and sturgeon monitoring approved under these programs includes juvenile and adult net surveys and tagging studies. In general, these activities are closely monitored and require measures to minimize take during the research activities. As of November 2015, no 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.

2.4 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.

In this biological opinion, our approach to determine the effects of the action was based on institutional knowledge and a review of the ecological literature and other relevant materials. We used this information to gauge the likely effects of the proposed project via an exposure and response framework that focuses on the stressors (physical, chemical, or biotic), directly or indirectly caused by the proposed action, to which CCC steelhead and southern DPS green sturgeon are likely to be exposed. Next, we evaluate the likely response of the above listed fish to these stressors in terms of changes to survival, growth, and reproduction, and changes to the ability of PCEs or physical and biological features to support the value of critical habitat in the action area. PCEs, and physical and biological features, include sites essential to support one or more life stages of the species. These sites for migration, spawning, and rearing in turn contain physical and biological features that are essential to the conservation of the species. Where data to quantitatively determine the effects of the proposed action on listed fish and their critical habitat were limited or not available, our assessment of effects focused mostly on qualitative identification of likely stressors and responses.

2.4.1. Effects on Species

2.4.1.1. Steelhead and Green Sturgeon Passage and Rearing Conditions

NMFS fish passage facility design criteria (NMFS 2011) re intended to assist with improving conditions for salmonids that must migrate past man-made structures to complete their life cycle. The criteria were developed by integrating knowledge about fish behavior, physiology, and bio-mechanics with hydraulic, hydrology, and engineering specifications of typical fish passage designs. For a structure to meet NMFS's fish passage requirements it ultimately must provide for the safe, timely, and efficient upstream and downstream passage of anadromous salmonids at impediments created by artificial structures, natural barriers, or altered instream hydraulic conditions.

There are no specific criteria for flood control channels, per se, but design criteria for similar structures (*i.e.*, fishways) can be adapted to flood control channels. NMFS assessed fish passage within the flood control channel using the hydraulic design criteria for culverts and other road crossings. The hydraulic design method is a design process that matches the hydraulic performance of a culvert with the swimming abilities of a target species and age class of fish. It is only suitable in streams with sufficiently low gradient. This method targets distinct species of fish and therefore does not account for ecosystem requirements of non-target species. There are significant errors associated with estimation of hydrology and fish swimming speeds that are resolved by making conservative assumptions in the design process. Determination of the high and low fish passage design flows, water velocity, and water depth is required for this option.

The hydraulic design method requires hydrologic data analysis, open channel flow hydraulic calculations, and information on the swimming ability and behavior of the target group of fish. This design method is intended for the design of new, replacement culverts, and retrofitted culverts. NMFS chose to use this criterion as opposed to another method that heavily relies on geomorphic attributes (*i.e.*, the active channel method or stream simulation method) since the flood control channel exhibits a very simplified geometry and more closely resembles a very long natural bottom culvert than a natural, more complex channel.

The range of fish passage flows is frequently defined by exceedance flows obtained from a flow duration curve for the site. The San Francisquito Creek stream gage, operated by the USGS from 1950 to 2015 (65 years of record), is located near the Junipero Serra Boulevard Road crossing, roughly 6 to 7 miles upstream of the flood control channel. The historic daily average streamflow data from this gaging station was used to construct a flow duration curve for the project site representing flow conditions during the period of assumed adult steelhead migration (December through March).

Design high flow for fishways is the mean daily average streamflow that is exceeded 1 percent of the time on an annual basis, or the 5 percent exceedance flow if the flow duration is based on the period of fish migration. The fish passage design high flow is the highest streamflow for which migrants are expected to be present, migrating, and dependent on the channel or fishway for safe passage. Design low flow for fishways is the mean daily average streamflow that is exceeded 50 percent of the time on an annual basis. If the 50 percent exceedance flow is less than 3 cubic feet per second (cfs), then the low flow design should be for 3 cfs. The fish passage design low flow is the lowest streamflow for which migrants are expected to be present, migrating, and dependent on the channel or fishway for safe passage.

For San Francisquito Creek, the 5 percent exceedance during November through April is approximately 160 cfs which was selected as the high fish passage design flow for upstream steelhead passage. Since this is based on a more expansive timeframe than the peak steelhead migration window (December through March) in which the majority of high flows occur, 160 cfs is likely an underestimate of the 5 percent exceedance flow during the period of migration. For San Francisquito Creek the 95 percent exceedance flow during the period of migration is less than 1 cfs, so the alternative minimum flow of 3 cfs was selected as the low fish passage design flow for upstream steelhead passage.

A different set of criteria is commonly used by NMFS to assess juvenile salmonid passage. NMFS guidance recommends assessing high flow juvenile fish passage by calculating the average water velocity within a facility at the 10 percent annual exceedance flow (NMFS 2001) or the 50 percent exceedance flow for the time period corresponding to juvenile upstream passage (March through June) (NMFS 2011). The 50 percent exceedance flow in San Francisquito Creek during the period of juvenile passage is approximately 2.6 cfs which was selected as the high fish passage design flow for juvenile passage. NMFS guidance recommends the 95 percent annual exceedance flow or 1 cfs, whichever is greater, should be used for juveniles. The 95 percent exceedance flow during the migration period in San Francisquito Creek is less than 1 cfs, so the 95percent annual exceedance is less than that, and therefore the 1 cfs alternative was selected as the low design flow for juvenile passage.

During these design flows, NMFS fish passage guidance requires structures to maintain maximum average water velocities of less than or equal to 1 foot per second (ft/s) to enable juvenile steelhead to move throughout the structure; and between 2 and 6 ft/s to enable adult steelhead passage. The velocity threshold for adult passage is dependent upon the length of the structure in which the fish is migrating through (Table 2). Since the San Francisquito Flood Project reach is approximately 7700 linear feet, NMFS fish passage guidance prescribes a maximum allowable water velocity of 2 ft/s or less to enable adult steelhead passage.

Table 2. Maximum allowable average culvert velocity prescribed for fish passage structures using the hydraulic design criteria (NMFS 2001).

Culvert Length (ft)	Velocity (fps) - Adult Salmonids
<60	6
60-100	5
100-200	4
200-300	3
>300	2

NMFS fish passage guidance prescribed a minimum water depth at the fish passage design flows of 1.0 foot for adult steelhead and 0.5 feet for juvenile steelhead, as measured in the centerline of the channel. Table 3 summarizes NMFS fish passage criteria relevant to the project.

Table 3. Fish passage criteria and design flows for the San Francisquito Creek Flood Control Project.

Steelhead Passage Design Flows	Design Exceedance Flow for migration period, unless otherwise noted (EF)	Streamflow at Design EF(cfs)	Maximum Average Water Velocity (ft/s)	Depth Criteria (ft)
Adult High	5 percent	160	2	1
Adult Low	95 percent or 3cfs, whichever is greater.	3	2	1
Juvenile High	50 percent	5	1	0.5
Juvenile Low	95 percent on annual basis or 1cfs, whichever is greater	1	1	0.5

Steelhead passage conditions at the project specific design flows were assessed by NMFS in the flood control reach using HEC-RAS model results for flows close to the design flows listed in Table 3 which were provided by the SCVWD and SFCJPA. The HEC-RAS results predict the water surface elevations, channel depths, and water velocities at various river stations throughout the project reach for the proposed design. In some instances, cross sections of the channel were provided to illustrate water surface elevation profiles in the reach at certain flows. NMFS requested HEC-RAS results for both the Mean Lower Low Water (MLLW) and Mean Higher High Water (MHHW) tidal stages.

During the MHHW tide stage, tidal backwater extends upstream of the project reach creating suitable passage conditions for juveniles and adults. Tidal backwater also extends upstream of the project reach at the Mean Tide Level (MTL) and all the tidal stages between the MTL and MHHW. NMFS assumes the tidal backwater effect creates suitable fish passage conditions at all tidal stages between MTL and MHHW. This constitutes about 12 hours of the daily tidal cycle.

During the lower end of the tidal cycle (between MLLW and MTL) tidal backwater extent varies between STA 2+27 and the upstream end of the project. This constitutes about 12 hours of the daily tidal cycle. Based on the HEC-RAS results, high design flow stream velocities will exceed the 2 ft/s velocity threshold at some locations during the lower tidal range (MLLW to MTL). To provide hydraulic breaks and resting areas for upstream migrating adult steelhead, the project has proposed the installation of five complex rootwad and boulder structures in the low flow channel between STA 28+97 and 46+07. An additional rock spur structure will also be installed at the downstream tip of Friendship Bridge Island. The rock spur structure will extend into the low flow channel and function as a partial weir. These features have been incorporated into the channel design to function as an analog for native historic velocity refuges and would also provide cover and other habitat benefits for adult and juvenile steelhead. These structures will be strategically placed to avoid excessively long reach(es) with relatively swift water velocities and no resting opportunities. As a result, adult steelhead are expected to ascend the flood control channel at the high design fish passage flow (5 percent exceedance flow) under all tidal conditions.

For the upstream passage of juvenile steelhead, the high design flow stream velocities are anticipated to consistently exceed the 1 ft/s velocity threshold during the low tidal range. This may result in an excessively long reach(es) with relatively swift water velocities at high stream flows and no velocity refuge. Under low flow conditions during periods of low tide, water depths in the channel are not expected to meet the 0.5 ft criterion, and very shallow water depths could impede the movement of steelhead juveniles. However, at this downstream location in San Francisquito Creek, steelhead juveniles are anticipated to be primarily smolts and actively moving downstream. Upstream movement in this reach of stream is not essential since they have reached the tidally-influenced portion of San Francisquito Creek and they are generally committed at this stage to passing into San Francisco Bay, and subsequently the Pacific Ocean. The majority of smolts will likely be moving through the action area during periods of moderate and high flows in the spring when passage conditions are anticipated to be adequate for downstream passage to San Francisco Bay. Under low flow conditions, the alluvial reaches of San Francisquito Creek upstream of the action area experience very shallow depths and smolts will unlikely be descending into the project reach under these conditions. Therefore, the hydraulic and geomorphic conditions in the action area as a result of the Project are not expected to adversely affect smolt steelhead emigrating through the action area.

For green sturgeon, NMFS did not conduct a fish passage assessment because sturgeon are not expected to ascend San Francisquito Creek. Adult and juvenile green sturgeon may enter and depart the project reach during periods of high tide when adequate water depths allow sturgeon access into the project area. No impediments to the passage of green sturgeon in the action area are anticipated by project construction.

2.4.1.2. Dewatering and Fish Relocation

To protect water quality, and avoid direct and indirect mortality of fishes from construction activities, SFCJPA will bypass stream flow around the work area and dewater the work site in areas where in-stream work occurs. The project will require channel dewatered during up to two consecutive dry seasons. A vast majority, if not all, of the water present during the summer months would be tidal waters. The SFCJPA will submit a final dewatering and fish relocation plan to NMFS and the Corps prior to construction. This plan will provide a detailed description of the methods that will be employed, individuals conducting the work, dewatering sites, and relocation sites. All construction will occur during the summer low-flow between June 15 and October 15.

Stream flow diversions and dewatering is expected to cause temporary loss, alteration, and reduction of aquatic habitat, including critical habitat, in the action area. Dewatering activities could harm individual juvenile steelhead and green sturgeon by concentrating or stranding them in residual wetted areas (Cushman 1985) before they are relocated. Juvenile steelhead and green sturgeon could be killed or injured during dewatering activities, though direct mortality is expected to be minimal due to relocation efforts prior to installation of the bypass system. The proposed bypass system, which isolates the work areas to be dewatered; will allow stream flow in the San Francisquito Creek to continue flowing downstream.

Before the project site is dewatered, a qualified biologist will capture fish and relocate them away from the project work site to avoid direct mortality and minimize possible impacts during project dewatering and construction of the work site. Fish in the immediate project area will be captured by seine and/or dip net, and then transported and released at an appropriate location. Electrofishing will not be used to capture fish due to potentially high salinity/conductivity levels in the tidal channel. Data to precisely quantify the amount of steelhead that will be relocated prior to construction are not available. However, based on the proposed timing of project construction, NMFS can narrow the life-history-stage to juvenile steelhead because in-channel work activities will occur during the summer low-flow period after emigrating steelhead smolts have left and before adult migration has been initiated. In addition, the project reach is tidally-influenced and the presence of juvenile steelhead during the summer months in this area is expected to be low. However, the areas to be de-watered for project construction are large and the project reach includes 1.5 miles of lower San Francisquito Creek. Therefore, the steelhead that are likely to be captured during relocation activities should not exceed 20 pre-smolting juveniles, each year of construction. Based on distribution data and foraging habits of green sturgeon, their occurrence in the action area is assumed to be rare. Therefore, no individual green sturgeon are anticipated to be captured during relocation activities, each year of construction.

Fish capture and relocation activities pose a risk of injury or mortality to fish species. Fish collecting gear, whether passive (Hubert 1996) or active (Hayes *et al.* 1996) has some associated risk to fish, including stress, disease transmission, injury, or death. The amount of unintentional injury and mortality attributable to fish capture varies widely depending on the method used, the ambient conditions, and the expertise and experience of the field crew. Since fish relocation activities will be conducted by qualified fisheries biologists, direct effects to and mortality of steelhead during capture are expected to be minimized. Data from years of similar salmonid relocation activities indicate that average mortality rate is below one percent (Jeffrey Jahn, NMFS, personal communication, November 2015). Based on this information, NMFS will use 2 percent as the maximum amount of mortality likely from fish relocation for the project, or no more than one fish, each year of construction.

Fish collection is unlikely to be 100-percent effective at removing all individuals, but experienced biologists are expected to remove approximately greater than 95 percent of the fish present. Juvenile steelhead that evade capture and remain in the project area will likely be lost to desiccation or thermal stress during dewatering activities. This will result in the mortality of one steelhead, each year of construction.

Fish encountered during dewatering will be relocated to a downstream or upstream location in similarly brackish conditions. Because the project is located adjacent to the San Francisco Bay, fish relocated downstream will have direct access to ample Bay habitats and adjacent fringe marshes. Fish relocated upstream may endure short-term stress from crowding at the relocation sites. Relocated fish may also have to compete with resident fish for available resources such as food and habitat. Some of the fish released at the relocation sites may choose not to remain in these areas and may move either upstream or downstream to areas that have more habitat and a lower density of fish. As each fish moves, competition remains either localized to a small area or quickly diminishes as fish disperse. NMFS cannot accurately estimate the number of fish affected by competition, but does not believe this impact will affect the survival chances of individual fish or cascade through the watershed population of these species based on the small area that will likely be affected and the small number of steelhead likely to be relocated. As a result, fish are not expected to experience crowding or any reductions in fitness from relocation.

Another manner by which juvenile steelhead and green sturgeon may be harmed or killed during dewatering activities is to be entrained into pumps or discharge lines if these methods are used. To eliminate this risk, the SFCJPA will screen all pumps according to NMFS criteria, to ensure juvenile steelhead and green sturgeon will not be harmed by the pumps during dewatering events.

Juvenile steelhead and green sturgeon foraging within the action area may be inadvertently affected by the loss of benthic aquatic macroinvertebrate production associated with construction disturbance. However, effects to aquatic macroinvertebrates resulting from dewatering will be temporary because construction activities will be limited to the summer period during two consecutive years, drift from upstream will continue through the bypass pipes, and rapid recolonization (about two to three months) of disturbed areas by macroinvertebrates is expected following construction (Cushman 1985; Harvey 1986; Thomas 1985). Furthermore, the project area is located in the tidally-influenced reach of San Francisquito Creek, so benthic aquatic organisms from San Francisco Bay are likely to rapidly recolonize the action area from sources downstream of the project area. Based on the foregoing, the temporary loss of aquatic macroinvertebrates as a result of dewatering activities and channel disturbances is not expected to adversely affect juvenile steelhead or green sturgeon.

2.4.1.3. Construction Related Impacts on Water Quality

Water Quality. In-stream and near-stream construction activities may cause temporary increases in turbidity (reviewed in Furniss *et al.* 1991, Everest *et al.* 1991, and Spence *et al.* 1996), reductions in dissolved oxygen, changes to pH, and other alterations in water quality. NMFS anticipates only short-term changes to ambient water quality conditions will occur during proposed activities (*e.g.,* construction and removal of cofferdams and the initial re-wetting of the channel following the removal of the diversion). High concentrations of suspended sediment can disrupt normal feeding behavior and efficiency (Berg and Northcote 1985; Bjornn *et al.* 1977; Cordone and Kelley 1961), reduce growth rates (Crouse *et al.* 1981), and increase plasma cortisol levels (Servizi and Martens 1992). High turbidity concentrations can reduce dissolved oxygen in the water column, result in reduced respiratory functions, reduce tolerance to diseases, and can also cause fish mortality (Berg and Northcote 1985; Gregory and Northcote 1993; Sigler *et al.* 1984; Waters 1995). Even small pulses of turbid water will cause salmonids to disperse from established territories (Waters 1995), which can displace fish into less suitable habitat and/or increase competition and predation, decreasing chances of survival.

The SFCJPA will ensure water quality during construction will meet RWQCB and SWRCB water quality standards by monitoring water quality at reference sites and works sites at regular time intervals and implementing BMPs (see Sections 1.3.6 and 1.3.9). Water quality will remain close to ambient conditions. These slight alterations to water quality may cause minor behavioral changes (Henley *et al.* 2000), but are not expected to result in injury or mortality (immediate or latent) of fish. Behavioral changes will likely materialize as fish temporarily vacating preferred habitat or temporarily reduced feeding efficiency. These temporary changes in behavior, may reduce growth rates, but are not likely to reduce the survival chances of individual juveniles. Water quality alteration is expected to be limited to the immediate area of construction activities plus varying distances up and downstream (depending on the tidal stage). Fish will be able to move from the areas where degraded water quality may occur to the ample Bay habitats and fringing tidal marshes nearby. Therefore, any short-term impacts associated with changes in water quality during implementation of this project are expected to be insignificant.

Toxic Chemicals. Equipment refueling, fluid leakage, equipment maintenance, and road surfacing activities near the stream channel pose some risk of contamination of aquatic habitat and subsequent injury or death to listed salmonids. The SFCJPA and its contractors propose to maintain any and all fuel storage and refueling site in an upland location well away from the stream channel; that vehicles and construction equipment be in good working condition, showing no signs of fuel or oil leaks, and that any and all servicing of equipment be conducted in an upland location. For instream construction activities, NMFS does not anticipate any localized or appreciable water quality degradation from toxic chemicals or adverse effects to steelhead or green sturgeon associated with the proposed project, as the stream will be dewatered, giving the SFCJPA and its contractors ample opportunity to attend to any spill prior to toxic chemicals reaching the waters of San Francisquito Creek. NMFS anticipates proposed BMPs and responses by the SFCJPA and its contractors to any accidental spill of toxic materials should be sufficient to restrict the effects to the immediate area and not enter the waterway. Therefore, any short-term impacts associated toxic chemicals during implementation of this project are expected to be insignificant.

2.4.2. <u>Effects on Critical Habitat</u>

Designated critical habitat for Southern DPS green sturgeon and CCC steelhead occurs in the action area. The Project may impact designated critical habitat for these species by maintaining the existing condition of minimal natural cover, altering water quality, and temporarily reducing foraging habitat.

2.4.2.1. Natural Cover

Tidal salt marsh vegetation is found throughout the action area. Tidal salt marsh habitat is primarily supported by tidal exchange. Dominant plant species in the tidal salt marsh community include Pacific cordgrass (*Spartina foliosa*), pickleweed, perennial peppergrass (*Lepidium latifolium*), gumplant (*Grindelia stricta*), and alkali heath (*Frankenia salina*). Narrow bands of brackish tidal marsh are present along a few-hundred-foot section of San Francisquito Creek downstream of East Bayshore Road. In the brackish marsh, bulrush (*Schoenoplectus* sp.) is the dominant species rather than cordgrass and pickleweed. Ruderal vegetation intergrades with salt marsh species along the levee banks.

A total of 4.51 acres of tidal salt marsh vegetation will be impacted by construction of the Project. Impacts to tidal salt marsh are primarily from excavation of accumulated sediments on both sides of the channel and the relocation of approximately 1,100 feet of tidal channel. Excavation of sediments will result in the removal of 2.82 acres of tidal salt marsh vegetation. Additional tidal salt marsh vegetation will be removed for: creating roads for construction access (1.33 acres); filling in the low spot of the Faber Tract levee and improving the slope of the levee (0.35 acres); and degrading the Bay Levee (0.01 acres). After project construction is complete, the tidal marsh area would be terraced and revegetated with high-marsh plants appropriate to the elevation relative to tidal levels in accordance with the MMP for the Project (SFCJPA 2015c). Approximately 19,600 native wetland plants and cuttings are planned for installation. Plants will be sourced from the San Francisquito Creek watershed and Baylands areas. The SFCJPA also proposes to install 5 large debris jam structures within the channel to improve adult steelhead passage. These structures are anticipated to provide cover in the form of large woody debris and depth.

Removal of tidal salt marsh vegetation during construction could temporarily reduce the amount of cover utilized by steelhead for protection from predators. The reduction of in-channel vegetation may also temporarily reduce invertebrates in the channel by limiting their food source or substrate in which they live. Similarly, by disturbing the bed and banks of the channel, sediment removal may bury aquatic insects that steelhead and green sturgeon feed on. Overhanging and submerged vegetation provides hiding cover (protection from predators) and disturbance for adult salmonids during their migrations (Bisson *et al.* 1987; Bjornn and Reiser 1991a). Removal of this vegetation exposes them to predation and disturbance. Furthermore, removing vegetation has the potential to reduce the amount of velocity refuges available for adults and juveniles during high stream flow events.

NMFS expects the impacts on natural cover from construction of the Project will significantly reduce the already limited amount of natural cover for steelhead or green sturgeon until re-establishment of vegetation occurs. Installation of the debris jams will improve natural cover for fish within an approximate 2000 linear foot section of the channel. NMFS expects the impacts on natural cover will adversely affect PCEs of steelhead and green sturgeon for the short-term due to the large size of the construction area. Following vegetation reestablishment, PCEs and physical and biological features of critical habitat will be restored to near their current degraded state, and is expected to improve because of the increase in natural cover that will be provided by the debris jams.

The Project proposes to construct the levees, channel, and marshplains to resemble its current condition which is degraded from its historical condition described in Section 2.3.1. Major re-routing of the lower reaches took place in the late 1920s, with levees constructed on both sides of the creek for flood control and development purposes (Hermstad 2009). Constriction of the marsh within a narrow corridor has led to the current condition of a simplified channel and homogenous marshplain, with no side channels, deep pools, or large woody debris to provide natural cover for fish. Installation of five debris jams will improve habitat complexity in the channel. Overall, NMFS believes the proposed Project will improve the current degraded condition of natural cover for steelhead and green sturgeon in the action area.

Future maintenance activities will be limited to levee maintenance, vegetation management, and removal of trash and debris. Maintenance of the levee will employ best management practices to avoid impacts to the surrounding areas and channel. Ongoing maintenance that will be covered by the Project is expected to have minimal impacts on natural cover for steelhead and green sturgeon since the Project only proposes to remove vegetation along the levees. These activities will be located away from the channel, where steelhead and green sturgeon are expected to occur the majority of the time. Therefore, ongoing maintenance in the form of mowing vegetation along the levees is not expected to affect natural cover for steelhead or green sturgeon in the action area.

2.4.2.2. Water Quality

The effects of the Project on water quality were discussed above in section 2.4.1.3 of this opinion and also apply to the critical habitat within the action area. As described above, the effects of the proposed project may result in increased levels of turbidity, reductions in dissolved oxygen, changes to pH, and other water quality alterations. NMFS does not expect the impacts on water quality will adversely affect PCEs and physical and biological features of steelhead or green sturgeon because alterations to water quality will be associated with construction activities which will be temporary. Water quality is expected to remain near ambient levels as a result of the SFCJPA implementing BMPs and monitoring water quality during construction.

2.4.2.3. Foraging

The Project proposes to remove a significant amount of sediment and vegetation during excavation of the channel. Disturbance to benthic habitat from excavation will result in the direct removal of prey resources (*e.g.*, entrained with sediment and vegetation) or the displacement of preferred forage species due to habitat disturbances. These impacts are expected to persist throughout the two-year construction timeframe and extend up to five years beyond the completion of the Project while vegetation is re-establishing.

As described in Section 2.3.2.1 of this opinion, habitat in the action area is degraded and does not contain attributes that would likely support extended foraging by steelhead or green sturgeon. NMFS does not consider the action area a primary foraging site for green sturgeon or steelhead and the impacts incurred from the Project will not likely have a substantial impact on the current value of this habitat to steelhead or green sturgeon. Sturgeon and steelhead likely already use other areas in South San Francisco Bay as preferred foraging sites, and will continue to do so when project construction is completed. Nonetheless, the Project will result in significant alterations to marsh vegetation and the channel benthos for up to two years during construction and five years during marsh vegetation re-establishment. This is expected to reduce the amount of already degraded forage opportunities for green sturgeon during this time. After construction is complete and vegetation re-establishes, forage will likely return to current levels, and may slightly improve as a result of the Project's channel widening in some locations and vegetation management and monitoring activities. Based on this information, NMFS concludes that Project is likely to reduce the quality of the PCEs and physical and biological features for green sturgeon and steelhead critical habitat within the action area over the short-term (seven years), with the potential for minor improvements to the quality of PCEs in the long-term.

2.5 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.

2.5.1. Searsville Dam and Reservoir

Searsville Dam and Reservoir are owned and operated by Stanford University on lower Corte Madera Creek approximately 12 mile upstream of the action area. Construction of Searsville Dam on lower Corte Madera Creek was completed in 1892 by Spring Valley Water Company, and in 1919 the reservoir and some surrounding property became part of the Stanford University. Searsville is a year-round water storage and diversion facility.

Although Searsville Dam is upstream of the action area, sediment transported over the dam is predicted to affect the channel within the action area of this Project. Searsville Reservoir is rapidly filling with sediment due to historical and current episodes of erosion. Stanford is currently reviewing their potential future management options for Searsville Dam and Reservoir, but Stanford has not identified a future course of action. In the absence of future actions by Stanford, the natural filling of Searsville Reservoir will continue until equilibrium between sediment inflow and sediment outflow is reached (Northwest Hydraulic Consultants *et al.* 2002). 2002). Once Searsville Reservoir fills with sediment, Northwest Hydraulic Consultants, Inc. (Northwest Hydraulic Consultants *et al.* 2002) predict bedload consisting primarily of sand will be transported over the dam for the first time in more than 100 years.

The San Francisco District Corps of Engineers Water Resources Section evaluated what specific changes are expected to occur within the action area as a result of Searsville Dam filling with sediment (Corps 2011). The study used the predicted channel bed elevation changes from the (Northwest Hydraulic Consultants *et al.* 2002) study to model a "with-sediment" flow scenario in the action area. Northwest Hydraulic Consultants *et al.* (2002) predicted an average channel bed change of 1.24 feet from sediment deposition over a 70-year period. The Corps' study results predict sediment deposition in the action area may increase flood flow depths by up to 1.5 feet in some locations of the action area during the 100-year flood event (Corps 2011). Deposition of sediment at this volume will not require sediment removal since the project has been designed to accommodate flow elevation increases associated with the predicted 1.24 foot average bed elevation increase.

Periodic sediment removal at current baseline volumes is anticipated as a future maintenance need and will be conducted under the auspices of the SCVWD SMP. Information from SCVWD maintenance records shows removal of approximately 1,200 to 5,300 cubic yards of sediment from the project reach at variable intervals (1- 4 years) between 2000 and 2013. The cumulative effect of sediment originating from Searsville Reservoir could increase, from the current baseline, the frequency and volume of material periodically removed. However, per SCVWD's SMP, sediment removal in San Francisquito Creek will not exceed 300 linear feet along the channel bed and will not exceed the maintenance baseline established by the relevant Maintenance Guidelines. If additional sediment is deposited with the flood channel reach during high flow events, additional sediment removal may be required to maintain the Project's design flow conveyance capacity, yet it would not be covered under the Corps permit for this Project.

Sediment removed by excavation of the channel per the SCVWD SMP is expected to disturb benthic habitat and result in the direct removal of prey resources (*e.g.*, entrained with sediment and vegetation) or the displacement of preferred forage species due to habitat disturbances. However, excavation would occur in relatively small sections of the channel (300 linear feet or less) and be restricted to volumes similar to baseline excavation volumes. Since the project area is located in the tidally-influenced reach of San Francisquito Creek, benthic aquatic organisms from San Francisco Bay are expected to rapidly recolonize the action area from sources downstream following sediment excavation events. Juvenile steelhead and green sturgeon foraging within the action area may be inadvertently affected by the temporary loss of benthic aquatic macroinvertebrate production associated with disturbance by sediment removal activities; however the effect is not expected to be significant due to the localized and short-term nature of the impact, and that adequate foraging areas adjacent to the action area remain available and undisturbed.

2.5.2. Climate Change

The long-term effects of climate change have been presented in the Section 2.3.2.3 - Factors Affecting Species Environment within San Francisquito Creek and the Action Area of this biological opinion. These include changes in streamflow regimes, water temperatures, and rainfall patterns. Climate change poses a threat to CCC steelhead and Southern DPS green sturgeon 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 percent) in precipitation while other models show decreases of 15 to 30 percent (Hayhoe *et al.* 2004). Sea level rise of 16 inches in San Francisco Bay could extend the area of tidal-influence in lower San Francisquito Creek upstream by approximately one mile and (BCDC 2007) convert portions of high marsh habitat (elevations of 0.2 to 0.3 meters) in the lower 0.5 mile of stream to mid marsh habitat (elevations of -0.2 to 0.1 meters) (Point Reyes Bird Observatory Conservation Science 2012).

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 or lower spring high flow events. Climate change is also anticipated to result in further ocean acidification and changes in ocean prey availability (Feely *et al.* 2008; Portner and Knust 2007) which would also negatively impact adult steelhead in the marine environment. Overall, the range and degree of variability in ambient temperature and precipitation are likely to increase due to climate change, and these predictions further highlight the importance of providing suitable instream habitat diversity/complexity in the streams and estuaries where CCC steelhead DPS and southern DPS green sturgeon occur.

2.6 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 2.4) to the environmental baseline (section 2.3) and the cumulative effects (section 2.5), 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) reduce the value of designated or proposed critical habitat for the conservation of the species.

CCC steelhead and southern DPS green sturgeon have experienced serious declines in abundance, and long-term population trends suggest a negative growth rate. Human-induced factors have reduced populations and degraded habitat, which in turn has reduced the population's resilience to natural events, such as droughts, floods, and variable ocean conditions. Global climate change presents another real threat to the long-term persistence of these populations, especially when combined with the current depressed population status and human caused impacts. Within the project's action area in the effects of channelization and urban development are evident. These activities have contributed the lack of emergent marsh and reduced channel complexity (*i.e*., floodplain extent and side channels) in the action area. As a result, forage species that listed salmonids and green sturgeon depend on have been reduced, stream hydrology and hydraulics have been altered, and natural cover characteristic of intact complex tidal salt marshes (*e.g*., deep pools, side channels, and woody debris) have been eliminated.

Construction of the Project will occur during two consecutive construction seasons between June 15 and October 15, when CCC steelhead juveniles may be present within the action area. Based on distribution data and foraging habits of green sturgeon, their occurrence in the action area is assumed to be rare. Therefore, no individual green sturgeon are anticipated to be encountered during dewatering and fish relocation activities. The Project has the potential to affect juvenile steelhead during construction through injury or mortality during fish capture and relocation, desiccation during dewatering, and degradation of water quality. The project has the potential to adversely impact natural cover, water quality, and forage features of CCC steelhead and southern DPS green sturgeon critical habitat.

The Project proposes to build one simplified channel, with relatively narrow floodplains. Although most of the project reach will contain minimal structural complexity, the Project has proposed to construct six structures in the channel for the purpose of creating hydraulic velocity breaks which will serve as both resting areas for upstream migrating steelhead and provide instream cover. The general lack of channel complexity will resemble the current channel configuration, which is a product of historical flood control and development activities in the action area. The Project will slightly widen the flood control channel and recreate marshplains throughout the action area. These actions are expected to provide minor improvements to the current degraded habitat condition within the action area.

The Project proposes to dewater and relocate juveniles steelhead from the action area prior to construction each season. Experienced fish biologists are expected to work effectively to collect and relocate juvenile steelhead. Based on the low mortality rates for similar dewatering and fish relocation efforts, NMFS anticipates few juvenile steelhead will be harmed or killed during implementation of this project. The maximum number of individuals likely to be encountered by the project over the two year construction window is 40 pre-smolting juvenile steelhead. Anticipated mortality from relocation activities are expected to not exceed two (2) percent of the total likely to be encountered each construction season (*i.e*., one individual juvenile steelhead each year). Fish that elude capture and remain in the project area during construction activities will likely be lost to thermal stress or crushed by heavy equipment, but this number is not expected to exceed five (5) percent of the fish within the area dewatered each construction season (*i.e*., one individual juvenile steelhead each year). In total, NMFS expects no more than four (4) juvenile steelhead will be harmed or killed by this project's fish relocation and dewatering. Due to the relatively large number of juveniles produced by each spawning pair, steelhead spawning in the San Francisquito Creek watershed in future years are expected to produce enough juveniles to replace the few that may be lost at the project site due to relocation and dewatering. It is unlikely that the small potential loss of juveniles by this project will impact future adult returns.

During construction, water quality in the action area may be degraded through temporary increases in turbidity, reductions in dissolved oxygen, changes to pH, introduction of toxic chemicals, and other alterations to ambient water conditions. However, due to the implementation of BMPs these water quality alterations are not expected to occur at levels known to cause reductions in fitness to listed fish. Alterations to water quality during construction will be temporary and similar to the natural conditions typically encountered by listed fish (close to ambient conditions). Furthermore, steelhead will have been relocated from work sites and green sturgeon are not expected to be present during construction so their exposure to altered water quality conditions is unlikely. If fish do encounter water quality alterations, they will likely result in minor and temporary changes to fish behavior (*i.e.*, avoidance), and are not expected to adversely affect green sturgeon or steelhead.

The action area experienced major re-routing in the late 1920s, with levees constructed on both sides of the creek for flood control and development purposes (Hermstad 2009). Constriction of the marsh within a narrow corridor has led to the current condition of a simplified channel and homogenous marshplain, with no side channels, deep pools, or large woody debris to provide natural cover for fish. This has led to an overall degraded condition of PCEs and physical and biological features of green sturgeon and steelhead critical habitat. Construction of the Project will have short-term (two years) adverse impacts on critical habitat through the direct disturbance of benthic prey items, natural cover, water quality, and passage conditions. After project construction is complete, the tidal marsh area would be terraced and revegetated so construction impacts will dissipate within the five year vegetation reestablishment period. The SFCJPA also proposes to install five large debris jam structures within the channel to improve adult steelhead passage. These structures are anticipated to provide cover in the form of large woody debris and depth. Installation of the debris jams will improve natural cover for fish within an approximate 2000 linear foot section of the channel. Following vegetation reestablishment, PCEs and physical and biological features of critical habitat will be restored to near their current degraded state, and is expected to improve because of the increase in natural cover that will be provided by the debris jams.

For steelhead, the action area serves as an essential migration corridor to and from one of the few remaining steelhead populations in tributaries to South San Francisco Bay. Migration for steelhead through the completed Project will be adequate, and may improve over current conditions by the addition of the instream wood structures. Also, the project will not reduce the ability of green sturgeon to move into and out of lower San Francisquito Creek. The Project's impacts on forage, and cover features in the action area will result in temporary reduction in steelhead critical habitat value in the action area, yet because of its limited scope and duration, the impacts to critical habitat in the action area will not appreciably reduce the critical habitat value for CCC steelhead.

The current ecological distribution of green sturgeon in the Bay suggests that the action area is not of prime importance for this species. NMFS anticipates no direct impact to green sturgeon during construction of this project. The Project's impacts to aquatic habitat will not result in an appreciable reduction in critical habitat value in the action area or at entire critical habitat designation scale for southern DPS green sturgeon.

The cumulative effects of the operation of Searsville Dam and Reservoir are anticipated to affect CCC steelhead and designated critical habitat in the future in a manner similar to the present day impacts on steelhead and critical habitat in the action area. Sedimentation rates in the action area are only expected to increase slightly once Searsville Reservoir fills with sediment and the annual sediment loads from the upper watershed move past the reservoir to downstream reaches. The predicted changes in bed elevations (plus 1.24 feet) and flood elevations (plus 1.5 feet) within the action area as a result of the filling of Searsville Reservoir (Corps 2011) are not expected to appreciably reduce steelhead or green sturgeon critical habitat value within the action area.

Regarding future climate change effects in the action area, California could be subject to higher average summer air temperatures and lower total precipitation levels. The Sierra Nevada snow pack may decrease by as much as 70 to 90 percent by the end of this century under the highest emission scenarios modeled. Reductions in the amount of precipitation would reduce streamflow levels in Northern and Central Coastal rivers. Estuaries may also experience changes in productivity due to changes in freshwater flows, nutrient cycling, and sediment amounts. For this project, construction would be completed no later than 2020 and the above effects of climate change are unlikely to be detected within that time frame. The short-term effects of project construction will have completely elapsed prior to these climate change effects.

2.7 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, 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 threatened CCC steelhead and threatened southern DPS green sturgeon or destroy or adversely modify their designated critical habitat.

2.8 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 incidental take statement.

2.8.1. Amount or Extent of Take

The number of threatened CCC steelhead that may be incidentally taken during project activities is expected to be small, and limited to the juvenile (pre-smolt) life stage. Take is anticipated to occur during fish relocation and dewatering of construction reaches within the action area between June 15 and October 15 over two years of construction. The number of juvenile steelhead relocated during project construction is anticipated to be no more than 20 per year (40 for the entire two years of construction), and no more than two juvenile steelhead are expected to be injured or killed each year (4 for the entire two years of construction) during fish relocation and dewatering activities.

If more than 40 juvenile steelhead are captured, or more than 4 juvenile steelhead are injured or killed, incidental take will have been exceeded.

Based on distribution data and foraging habits of green sturgeon, their occurrence in the action area is assumed to be rare and no take of southern DPS green sturgeon is anticipated from the Project.

2.8.2. Effect of the Take

In the biological opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

2.8.3. 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).

1. Ensure construction methods, minimization measures, operations and maintenance, and monitoring are properly implemented within the action area.

2. Ensure the steelhead habitat complexity features are designed in a manner that provide adequate resting and holding areas for steelhead migrants.

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

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

5. Monitor and evaluate the performance of the habitat elements (RPM #2), revegetation, and channel morphology components of the project.

6. Prepare and submit reports to document the performance of habitat elements (RPM #2), revegetation, and channel morphology components of the project.

2.8.4. 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 incidental take statement (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.

All plans and reports mentioned below must be submitted to: NMFS North-Central Coast Office Attention: San Francisco Bay Branch Chief, 777 Sonoma Avenue, Room 325, Santa Rosa, California 95404-6528.

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

    a. The permittees must submit the Project's Final Operations and Maintenance Manual and Mitigation and Monitoring Plan for review and approval at least 90 days prior to construction of the Project.

    b. The SFCJPA will allow any NMFS employee(s) or any other person(s) designated by NMFS, to accompany field personnel to visit the project sites during construction activities described in this biological opinion.

    c. If any ESA-listed fish are found dead or injured, the biologist shall contact NMFS biologist Amanda Morrison to review the activities resulting in take and to determine if additional protective measures are required. All ESA-listed fish mortalities shall be retained, placed in an appropriately-sized sealable plastic bag, labeled with the date and location of collection, fork length measured, and be frozen as soon as possible. Frozen samples shall be retained by the biologist until specific instructions are provided by NMFS. The biologist may not transfer biological samples to anyone other than the NMFS North-Central Coast Office without obtaining prior written approval from the North-Central Coast Office, San Francisco Bay Branch Chief. Any such transfer will be subject to such conditions as NMFS deems appropriate.

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

    a. The permittees must submit the Project's 60 percent and 90 percent design plans for steelhead habitat features (*i.e.*, debris jams and rock weir) to NMFS for review and approval at least 90 days prior to the initiation of construction of the Project.

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

   a. The permittees must submit the Project's Final Dewatering and Fish Relocation Plan(s) for review and approval at least 90 days prior to construction of each phase. The Plan(s) must clearly identify the proposed cofferdam locations and fish relocation methods.

   b. All screens used on equipment meant to divert flows must be screened in accordance with the NMFS Fish Screening Criteria for Anadromous Salmonids [available at: http://swr.nmfs.noaa.gov/hcd/fishscrn.pdf] and the Addendum for Juvenile Fish Screen Criteria for Pump Intakes [available at: http://swr.nmfs.noaa.gov/hcd/pumpcrit.pdf].

   c. The SFCJPA shall retain a qualified biologist with expertise in the areas of anadromous fish biology, including handling, collecting, and relocating salmonids and green sturgeon; salmonid and green sturgeon habitat relationships; and biological monitoring of salmonids and green sturgeon. The Corps shall ensure that all biologists working on this project be qualified to conduct fish collections in a manner which minimizes all potential risks to ESA-listed fish.

   d. A qualified biologist shall monitor the construction site during placement and removal of flow diversions and cofferdams to ensure that any adverse effects to steelhead and green sturgeon are minimized. The biologist shall be on site during all dewatering events to ensure that all ESA-listed fish are captured, handled, and relocated safely. The biologist shall notify NMFS biologist Amanda Morrison at (707) 575-6083 or Amanda.Morrison@noaa.gov one week prior to capture activities in order to provide an opportunity for NMFS staff to observe the activities.

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

   f. If any ESA-listed fish are found dead or injured, the SFCJPA must implement Term and Condition 1.c. listed above.

4. The following terms and conditions implement reasonable and prudent measure 4:

   a. The Corps and SFCJPA must provide a written report to NMFS by January 15 of each year following completion of the previous year's construction and fish relocation activities. The report must contain, at a minimum, the following information:

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

      (2) *Fish Relocation.* The report must include a description of the location from which fish were removed and the release site including photographs; the date and time of the relocation effort; a description of water quality at release sites at the time of release, including, at a minimum, water temperature and dissolved oxygen levels; a description of the equipment and methods used to collect, hold, and transport ESA-listed fish; the number of fish relocated by species; the number of fish injured or killed by species and a brief narrative of the circumstances surrounding ESA-listed fish injuries or mortalities; and a description of any problems which may have arisen during the relocation activities and a statement as to whether or not the activities had any unforeseen effects.

5. The following terms and conditions implement reasonable and prudent measure 5:

   a. The SFCJPA must conduct annual inspections of the Project by November of each year that evaluate the performance of fish habitat elements, vegetation re-establishment, and channel design performance as it relates to fish passage conditions, in addition to other elements inspected per the Project's Mitigation and Monitoring and Operations and Maintenance Plans.

6. The following terms and conditions implement reasonable and prudent measure 6:

   a. The Corps and SFCJPA must provide a written report to NMFS by February 1 of each year on the results of annual inspections. The report must include a discussion on the performance of fish habitat elements and channel design performance as it relates to fish passage conditions; a discussion of any unanticipated effects to fish passage or critical habitat; and a description of potential measures that will be taken to mitigate those effects.

2.9 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).

NMFS has no Conservation Recommendations.

2.10 Reinitiation of Consultation

This concludes formal consultation for San Francisquito Creek Flood Reduction, Ecosystem Restoration, and Recreation 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.

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

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide effects, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based, in part, on the EFH assessment provided by the Corps and descriptions of EFH for Pacific coast groundfish (PFMC 2005), coastal pelagic species (PFMC 1998), and Pacific coast salmon (PFMC 1999) contained in the fishery management plans (FMP) developed by the Pacific Fishery Management Council and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

Effects of the proposed project will effect EFH for various federally managed fish species within the Pacific Coast Groundfish (PFMC 2005), Pacific Coast Salmon (PFMC 1999), and Coastal

Pelagic Species (PFMC 1998) FMPs. Furthermore, the project area is located in a Habitat Area of Particular Concern for various federally managed fish species within the Pacific Coast Groundfish FMP.

3.2 Adverse Effects on Essential Fish Habitat

Adverse effects to EFH for coastal pelagic species and Pacific groundfish will occur through (1) altered water quality, and (2) disturbance of benthic biological community, including removal of prey, and physical habitat. No adverse effects to EFH for Pacific salmon are anticipated.

3.2.1. Water Quality

As described in sections 2.4.1.3 and 2.4.2.2 of the biological opinion, in-stream and near-stream construction activities may cause temporary increases in turbidity (reviewed in Everest *et al.* 1991; Furniss *et al.* 1991; Spence *et al.* 1996), reductions in dissolved oxygen, changes to pH, and other alterations in water quality. NMFS anticipates only short-term changes to ambient water quality conditions will occur during proposed activities (*e.g.*, construction and removal of cofferdams and the initial re-wetting of the channel following the removal of the diversion). The SFCJPA will ensure water quality during construction will meet SFRWQCB and SWRCB water quality standards through monitoring and implementing BMPs (see Sections 1.3.6 and 1.3.9). Water quality will remain close to ambient conditions. Water quality alteration is expected to be limited to the immediate area of construction activities plus varying distances up and downstream (depending on the tidal stage). It is expected that fish species encountering the altered water quality conditions will react behaviorally and either move away from or avoid them. These effects are expected to be temporary and there is ample area for fish to move to near the action area.

3.2.2. Benthic disturbance

As described in Section 2.4.2.3 of the opinion, the Project proposes to remove a significant amount of sediment and vegetation during project construction. Disturbance to benthic habitat from excavation will result in the direct removal of prey resources (*e.g.*, entrained with sediment and vegetation) or the displacement of preferred forage species due to habitat disturbances. These impacts are expected to persist throughout the two-year construction timeframe and extend up to five years beyond the completion of the Project while vegetation is re-establishing.

The Project would result in benthic disturbance and potential removal of invertebrate prey within 4.5 acres of tidal salt marsh habitat from sediment removal and 2.4 acres of bay waters from channel realignment, for a total of 6.9 acres of soft substrate habitat. EFH species managed under the Coastal Pelagics and Pacific Groundfish FMPs forage on infaunal and bottom-dwelling organisms, such as polychaete worms and crustaceans. Excavation and dredging activities can adversely affect the benthic invertebrate community by directly removing or burying these organisms (Newell 2002; Van der Veer *et al.* 1985). The Project is likely to result in the temporary loss of EFH prey organisms due to construction activities.

Recolonization studies suggest that recovery (generally meaning the later phase of benthic community development after disturbance when species that inhabited the area prior to disturbance begin to re-establish) may not be quite as straightforward, and can be regulated by physical factors including particle size distribution, currents, and compaction/stabilization processes following disturbance. Rates of recovery listed in the literature range from several months to several years for estuarine muds (Currie and Parry 1996; McCauley *et al.* 1977; Tuck *et al.* 1998; Watling *et al.* 2001) to up to 2 to 3 years for sands and gravels (Gilkinson *et al.* 2005; Oliver *et al.* 1977; Reish 1961; Thrush 2002; Thrush *et al.* 1995; Watling *et al.* 2001). Thus, forage resources for fish that feed on the benthos may be substantially reduced before recovery is achieved. Based on available literature, NMFS will assume full recovery of prey resources will exceed one year following construction.

Additionally, the act of removing sediments and the associated biotic assemblages during construction of the Project creates an area of disturbance that is extremely susceptible to recolonization by invasive species, often resulting in the displacement of native species. As a result, the Project may result in the increased distribution and abundance of invasive species in the action area, which in turn would reduce the amount of native prey resources available to coastal pelagic species and groundfish in the action area.

3.3 Essential Fish Habitat Conservation Recommendation

To compensate for the temporal effects of benthic disturbance on 6.9 acres of soft bottom substrate during two years of construction and for an additional period of year or longer following construction, NMFS recommends the SFCJPA: (1) provide funding to an ongoing restoration project; (2) purchase credits from a conservation/mitigation bank; and/or (3) implement a new restoration project.

For any compensatory mitigation, the habitat replacement should be “in-kind”, such that the replacement habitat value is equal to, or greater than, pre-project habitat value. Determination of habitat replacement value should be based on the contribution of that habitat to the support of species and vegetation affected by the proposed project and be determined in coordination with NMFS.

Compensatory mitigation should occur on-site at an one-to-one mitigation ratio (*e.g.*, 15 acres restored:15 acres impacted) or off-site at a three-to-one mitigation ratio (*e.g*., 45 acres restored:15 acres impacted) and should be habitat replacement in-kind. Ratios greater than one-to-one to account for temporal losses, uncertainty of performance, and differences in functions or values in replacement habitats outside of the action area.

The amount of credits purchased from a conservation/mitigation bank should be equal to a three-to-one ratio, or greater, and should result in habitat replacement in-kind. If the credit system for a bank is not expressed and measured in the same manner as the impacts of proposed project, the SFCJPA should confer with NMFS to determine an acceptable amount of credits to be purchased. The amount of monies provided to a restoration project should be sufficient to fund one-to-one habitat restoration for projects in South San Francisco Bay, or three-to-one at off-site restoration sites.

Fully implementing this EFH conservation recommendation would avoid, minimize, or offset the adverse effects described in section 3.2, above, to approximately 6.9 acres of designated EFH for Pacific coast groundfish, and coastal pelagic species.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the Corps must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations unless NMFS and the Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR §600.920 (k)(l)).

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

3.5 Supplemental Consultation

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

4. 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.

4.1 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. Other interested users could include the SFCJPA, SCVWD, USFWS, BCDC, and the SWQCB. Individual copies of this opinion were provided to the Corps. 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.

4.2 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.

4.3 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, ESA regulations, 50 CFR 402.01 et seq., and the 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 and EFH consultation 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.

5. FIGURES

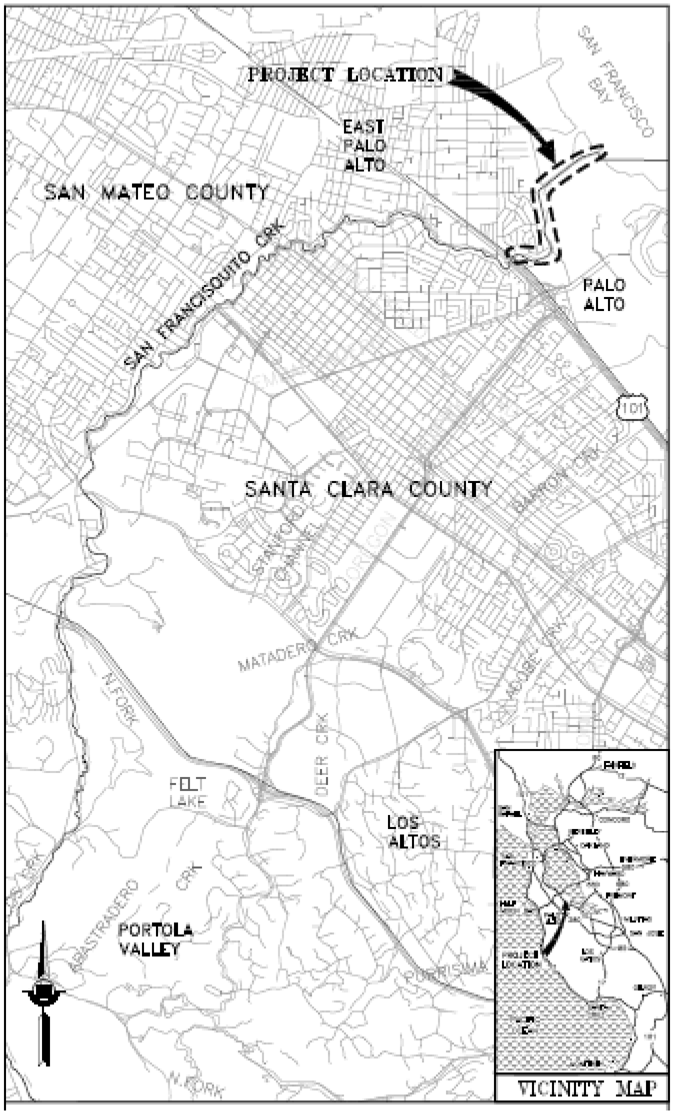

Figure 1. Map showing general location of the Project.

Figure 2. Map of entire project area.

Figure 3. Map of project area from center line STA 0+00 to STA 28+00.

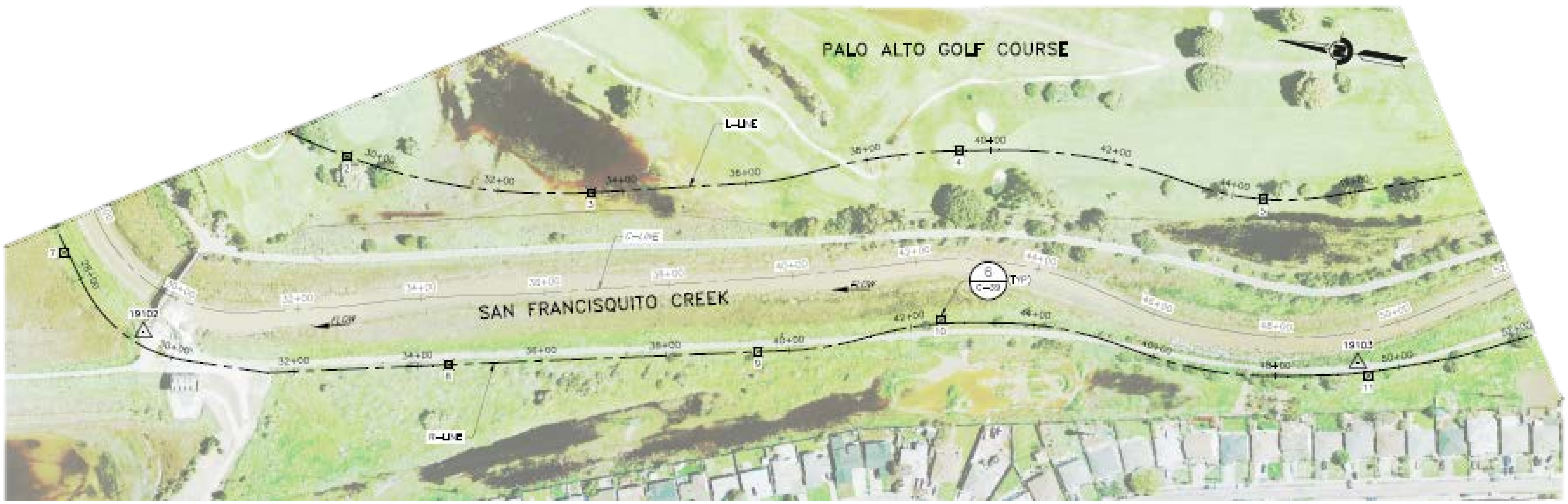

Figure 4. Map of project area from center line STA 28+00 to STA 52+00.

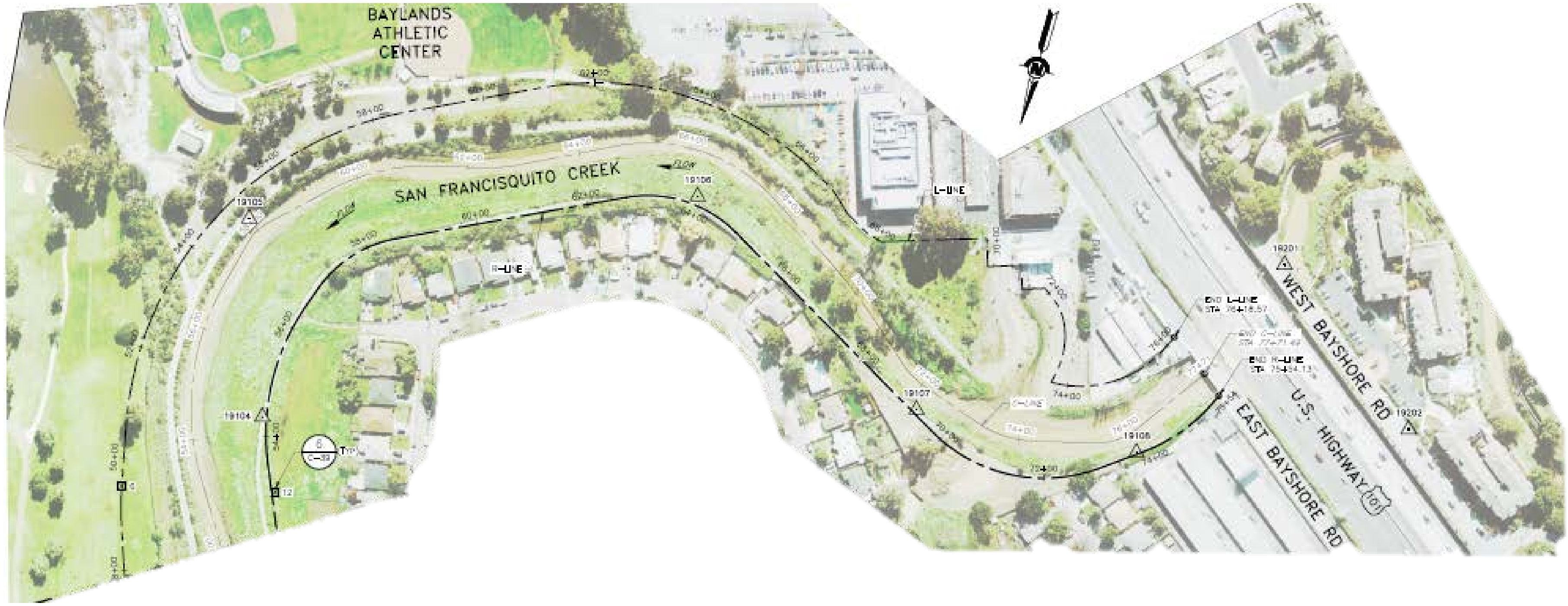

Figure 5. Map of project area from center line STA 52+00 to STA 77+71.

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