UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

October 31, 2012

In response, refer to:
2011/05520

Leslie T. Rogers
Regional Administrator
Federal Transit Administration
201 Mission Street
San Francisco, California 94105-1839

Dear Mr. Rogers:

Thank you for your letter of January 30, 2012, requesting initiation of formal consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 *et seq.*), and the Essential Fish Habitat (EFH) provisions of the Magnuson Stevens Fishery Conservation and Management Act (MSA) for the San Francisco Bay Area Water Emergency Transportation Authority's (WETA) proposed construction of the Central Bay Operations and Maintenance Facility in the City of Alameda, California. The Federal Transit Administration (FTA) proposes to provide financial assistance for construction of this Project.

The enclosed biological opinion is based on our review of the proposed project and describes NMFS' analysis of potential effects to threatened Central California Coast (CCC) steelhead (*Oncorhynchus mykiss*), threatened southern distinct population segment (DPS) of North American green sturgeon (*Acipenser medirostris*), and designated critical habitat for CCC steelhead and green sturgeon in accordance with section 7 of the ESA (Enclosure 1). NMFS' conclusion in the biological opinion is that the project is not likely to jeopardize the continued existence of CCC steelhead or green sturgeon, or adversely modify designated critical habitat. However, NMFS anticipates take of green sturgeon as a result of the project. An incidental take statement with non-discretionary terms and conditions is included with the enclosed biological opinion.

This letter also transmits NMFS' Conservation Recommendations as required by EFH provisions of the MSA (16 U.S.C. 1801 *et seq.*) (Enclosure 2). NMFS has reviewed the proposed project for potential effects on EFH and determined that the project would adversely affect EFH for various federally managed fish species under the Pacific Salmon, Coastal Pelagic, and Pacific Groundfish Fishery Management Plans (FMPs). Section 305(b)(4)(B) of the MSA requires the

federal action agency to provide NMFS with a detailed written response within 30 days to these EFH Conservation Recommendations, including a description of the measures adopted by the FTA for avoiding, minimizing, or mitigating the impact of the project on EFH (50 CFR 600.920(j)). In the case of a response that is inconsistent with NMFS' recommendations, the federal action 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 proposed action and the measures needed to avoid, minimize, or mitigate such effects.

Please contact Gary Stern at 707-575-6060, or by email at gary.stern@noaa.gov, if you have any questions concerning this section 7 consultation, or if you require additional information.

Sincerely,

Kevin Chu

for Rodney R. McInnis
Regional Administrator

Enclosures

cc: Chris Yates, NMFS, Long Beach, CA
Bryant Chesney, NMFS, Long Beach, CA
Holly Costa, U.S. Army Corps of Engineers, San Francisco, CA
Michael Gougherty, WETA, San Francisco, CA
Alexander Smith, FTA, San Francisco, CA
Copy to file ARN 151422SWR2011SR00553

Enclosure 1

BIOLOGICAL OPINION

ACTION AGENCY: Federal Transit Administration, San Francisco

ACTION: San Francisco Water Emergency Transportation Authority, Central Bay Operations and Maintenance Facility, Alameda, California.

CONSULTATION CONDUCTED BY: National Marine Fisheries Service, Southwest Region

TRACKING NUMBER: 2011/05520

DATE ISSUED: **October 31, 2012**

I. CONSULTATION HISTORY

By letter dated August 3, 2010, to NOAA's National Marine Fisheries Service (NMFS), the environmental consulting firm, ICF International, requested a list of all candidate, proposed, and listed threatened or endangered species that could occur in or near Alameda Point in Alameda, CA. NMFS responded by letter dated August 9, 2010, and informed ICF International that the Distinct Population Segment (DPS) of threatened Central California Coast (CCC) steelhead (*Oncorhynchus mykiss*) and the southern DPS of North American green sturgeon (*Acipenser medirostris*) may occur in the project area. NMFS also indicated that the area is designated as critical habitat for both CCC steelhead and the southern DPS of green sturgeon.

By letter dated November 1, 2011, the U.S. Army Corps of Engineers (Corps) initiated formal consultation pursuant to section 7 of the Endangered Species Act (ESA) with NMFS for the proposed issuance of a Department of Army permit to the San Francisco Bay Area Water Emergency Transportation Authority (WETA) to construct the Central Bay Operations and Maintenance Facility at Alameda Point in the City of Alameda, California. The Corps' letter transmitted to NMFS the Project's July 2011 Biological Assessment and Essential Fish Habitat Assessment prepared by ICF International, and WETA's application for a Department of Army permit.

On December 15, 2011, the Corps informed NMFS by electronic mail message that the Federal Transit Authority (FTA) was assuming federal lead agency for purposes of the ESA section 7 consultation with NMFS, and the Corps was rescinding their request for consultation.

On February 1, 2012, NMFS received a written request from FTA to initiate formal consultation pursuant to section 7 of the ESA for WETA's proposed construction of the Central Bay Operations and Maintenance Facility in Alameda, California (Project). FTA's letter dated January 30, 2012, transmitted an updated biological assessment prepared by ICF International, dated January 2012.

Based on the NMFS review of the Project's January 2012 biological assessment, a letter dated February 29, 2012, from NMFS to FTA requested additional information regarding the Project. Specifically, the NMFS letter requested information regarding the new facility's berthing floats, gangways, pile driving, construction techniques and dredged material disposal locations.

By letter dated March 16, 2012, to NMFS, WETA responded to NMFS' letter of February 29, 2012, and provided additional information regarding the facility design and construction methods.

A meeting was held between NMFS and WETA on April 3, 2012, in Santa Rosa with representatives from WETA's environmental consultants, ICF International and URS Corporation. FTA was invited to the meeting, but chose not to participate. WETA clarified the project description and construction techniques. Avoidance and minimization measures were developed jointly by NMFS and WETA representatives to address the effects of overwater shading at the gangways, pile and seawall removal, elevated sound levels during pile driving, and disposal of dredged materials. WETA agreed to update their biological assessment to reflect the new and modified minimization measures.

WETA, in coordination with ICF International, revised the Project's Biological Assessment and EFH Assessment. The revised assessment was transmitted to NMFS by letter from WETA dated April 30, 2012.

A telephone call on June 4, 2012, between Gary Stern, NMFS, and Michael Gougherty, WETA, resulted in the Project's adoption of a July 31 to November 30 timing window for all in-water construction and dredging.

In response to a request by Gary Stern, NMFS, for clarification on aspects of the Project, Jeff Thomas, ICF International, provided information by electronic mail message on September 18, 2012, regarding the concrete fixed pier, the seawall, future dredging, and vessel traffic. On behalf of WETA, Jeff Thomas informed NMFS that the fixed concrete pier has been eliminated from the Project. The fixed pier was originally proposed to support the removal and installation of boat engines. This functional need was eliminated from the Project. In place of the concrete fixed pier, WETA proposes to construct a small overwater gangway landing. Further clarifications were provided to NMFS by electronic mail messages from Michale Gougherty, WETA, on October 15, 2012, and October 18, 2012.

II. DESCRIPTION OF PROPOSED ACTION

The FTA proposes to provide financial assist to WETA for construction of the Central Bay

Operations and Maintenance Facility at Alameda Point in Alameda, California. The Operations and Maintenance Facility will serve as the Central San Francisco Bay base for WETA's ferry fleet, and it will include the Operations Control Center and Emergency Operations Center. The project site is located within the Alameda Naval Air Station Base Realignment and Closure area (now referred to as Alameda Point) in the City of Alameda, Alameda County, California (Figure 1). WETA is the lead planning agency and local public agency for the Project. Construction is scheduled to occur in 2014-2015. All in-water construction and dredging will be limited to the period between July 31 and November 30.

The proposed Central Bay Operations and Maintenance Facility will be located southeast of the intersection of West Hornet Avenue and Ferry Point Road near Pier 3 along the Alameda waterfront in Central San Francisco Bay. The new facility will occupy approximately 0.36 acres of landside space and one acre of waterside space in San Francisco Bay. It will provide berthing space for boats, maintenance services (such as fueling, engine oil changes, spare parts storage, and concession supply), and light repair facilities for WETA's Central San Francisco Bay ferry fleet. As WETA's Operations Control Center, the facility will also provide a centralized location for day-to-day management and oversight of services and crews.

NMFS does not anticipate any interrelated or interdependent actions associated with the proposed action.

A. Landside Project Elements and Construction Activities

The proposed landside portion of the Project includes a four-story, approximately 25,000-square-foot building. The building will provide maintenance functions and storage for vessel spare parts, office and meeting space for WETA staff, crew facilities, and concession support.

Landside facilities also include four below grade vaults for diesel fuel. Each tank could store up to 12,000 gallons. The fuel tanks will be National Fire Protection Association-approved and installed in buried concrete. For safety, the vaults will be equipped with vapor and liquid detection systems as well as a fire suppression system. Systems will be provided to recover liquid from the vaults.

Stormwater runoff from the site will be collected with a new system of onsite catch basins and pipes. Site run-off will be treated by oil-water separators and treatment vaults prior to connecting to an existing 12-inch storm drain.

Landside construction activities consist of site preparation, demolition, ground improvement, building construction, and utility installation. Construction equipment will include backhoes, excavators, haul trucks, track-mounted drilling rigs, wheeled hydraulic crane, and delivery and support trucks.

B. Waterside Project Elements and Construction Activities

The waterside facilities consist of berthing slips for up to 11 passenger ferries and associated gangway structures. The berthing slips will provide mooring for the safe docking and holding of vessels. Berthing slips will be supplied by fresh water, sanitary sewer, electricity, diesel fuel, waste pump-out and fire suppression. Although no regular passenger loading and off-loading is anticipated at this site, berths would be capable of loading and unloading passengers in the event of an emergency. An on-shore davit[1] will be constructed for the transfer of equipment between shore and water, movement of spill response equipment, and transfer of small boats to the water in the event of an emergency. An existing deteriorated seawall will be replaced with a new concrete secant-pile seawall.

Prior to construction of the berthing facility, the remaining portions of a small recreational marina will be removed. In the mid-1950's the Navy constructed a small-boat floating marina on this site for use by residents at the former Alameda Naval Air Station. Following the closure of the Navy base, the marina's building was demolished. The Project will remove all remaining portions of the floating marina, including 35 existing concrete piles.

Demolition of the remnant recreational marina and construction of the new marine facilities will be performed with support and material barges, work boats, a barge-mounted pile driver, a wheeled crane, a support boat, and an occasional tug. Both an impact hammer and vibratory hammer will be used to remove existing piles and install new piles.

1. Berthing Floats and Gangways

The berthing facility will include a system of ramps and platforms for access between the gangway and vessel doors, and for access to the floating dock for line handling and servicing of vessels. The berthing floats will consist of compartmented concrete pontoons approximately 125 feet by 8 feet in dimension. Berths will be equipped with fenders and mooring fittings for safe docking and holding of vessels. Gangways will be aluminum structures approximately 90 feet long by 8 feet wide. Walking surfaces will grated for light penetration.

2. Gangway Landing

A gangway landing approximately 20 feet by 40 feet will be constructed with concrete and located mid-length along the new seawall (see seawall description below). The landing will provide support for the gangway to the berthing floats and also contain a small storage area. Four 24-inch diameter steel piles will be installed by impact hammer to support the gangway landing. To construct the gangway landing, water-tight forms will be installed on the piles and casting of the concrete landing will be performed in isolation from the waters of San Francisco Bay.

[1] A davit is a crane-like device used to suspend or lower equipment.

3. Pile Driving

Up to 50 new steel piles and 30 plastic piles will be installed for construction of the gangway landing, berthing floats, and gangways. Steel piles will be installed by an impact hammer and plastic piles will be installed by a vibratory driver. A protective coating comprised of an inert material that does not leach into the aquatic environment may be added to the steel piles. Table 1 presents a summary of the piles anticipated to be installed for the marine facilities.

Table 1. Summary of piles that will be installed.

Locations	**Pile Diameter (inches)**	**Pile Type**	**Number of Piles**	**Installation Method**	**Attenuation Device(s)**
Gangway Landing	24	Steel	4	Impact hammer	Bubble curtain
Float Guide Piles	24	Steel	15	Impact hammer	Bubble curtain
Dolphin Piles	30	Steel	19	Impact hammer	Bubble curtain
Fender Panel Piles	18	Steel	12	Impact hammer	Bubble curtain
Fender Piles	12 to 18	Plastic	30	Vibratory Driver	None

4. Seawall

An existing 160-foot long concrete seawall along the shoreline of the site delineates the landside portion of the Project from the waterside portion. The existing seawall is approximately 8 feet high, tilted and cracked. The toe of the wall is located 1-2 feet above mean high high water (MHHW). Riprap and broken concrete span the area between the seawall and the waters of San Francisco Bay. Removal of the existing seawall will be performed with a land-based backhoe and pneumatic hammer. Removal is expected to occur over 2 to 5 days and generate approximately 60-90 cubic yards of rubble. All concrete rubble will be hauled off-site for processing as recycled aggregate material. A combination of temporary catchments and the precise demolition methods will be used to prevent debris from falling in the water.

The seawall will be replaced with a new concrete secant-pile wall. The new seawall will also be built above the MHHW along 230 feet of shoreline and to a height of 8.5 feet. The new seawall will overlap with the footprint of the existing seawall and extend an additional 70 feet to the east. The contractor will used temporary catchments to prevent debris from falling in the water and prevent uncured concrete from contacting the waters of San Francisco Bay.

5. Dredging

Dredging is required to achieve the navigable parameters of the vessels and berths at the project site. The Project proposes to dredge the berthing area to a depth of 12 feet mean low low water (MLLW) and an additional 2 feet of depth will be removed for an over-depth allowance. Dredging is anticipated to remove approximately 47,100 cubic yards of material (26,700 cubic yards to -12 feet and an additional 20,400 cubic feet for the -2 feet of over-depth allowance) from a 5.5 acre area. Dredging will occur over a 90-day period with a 10-cubic yard bucket clamshell dredge and a scow barge. The Dredged Material Management Office has reviewed the results of sediment tests from the Project's proposed dredge site and determined materials are suitable for disposal at the San Francisco Deep Ocean Disposal Site (SF-DODS) or placement as wetland cover at a wetland beneficial re-use site.

WETA reports sedimentation rates in the area are low and there is insufficient data to predict future dredging needs. Therefore, future maintenance dredging needs are unknown at this time. Best estimates by WETA predict future maintenance dredging could occur at a frequency of once every 5 to 10 years, and approximately one foot of sediment would be removed over the entire 13.5-acre vessel operating area (approximately 22,000 cubic yards of material). Future dredging would be performed with a clamshell dredge working 10-12 hours per day. Dredging will be restricted to the period between July 31 and November 30. Dredged materials from future dredging operations will be disposed at SF-DODS, or a wetland beneficial re-use site.

6. Operations and Maintenance

The vessel types held at the facility will include small crew boats and ferry vessels. The facility would typically operate from 5 a.m. to 11 p.m. every day. On any given day, up to 58 employees will be on the premises. Employees will include maintenance crew, supervisor, WETA manager, concessionaire, Operations Control Center staff, Emergency Operations Center staff, and ferry crew members.

Upwards of 11 ferries will transit the berthing facility four times each day (departure in the morning, arrival mid-day, departure mid-day, and arrival at the end of day). This is the maximum number of ferries and transits because not all ferries would make the mid-day return.

C. Avoidance and Minimization Measures

The Project proposes the following avoidance and minimization measures to reduce impacts to the aquatic environment:

(1) All in-water construction and dredging will be limited to the period between July 31 and November 30.

(2) A Stormwater Pollution Prevention Plan (SWPPP) will be prepared and include best

management practices to address the potential discharge of pollutants, and ensure the proper handling of materials.

(3) A Spill Prevention, Control and Countermeasures (SPCC) Plan will be prepared and specify restrictions and procedures for fuel storage location, fueling activities, and equipment maintenance.

(4) Monitoring of turbidity will be performed during dredging at a distance of approximately 500 feet. If turbidity levels exceed San Francisco Bay Basin Plan Standards, operational controls or silt curtains may be used.

(5) A 500-foot access corridor has been established to protect wildlife along shoreline at the adjacent Alameda National Wildlife Refuge. All construction, maintenance and ferry vessels will utilize this access corridor and adhere to a maximum 5 mile per hour speed limit.

(6) During the driving of all steel piles with an impact hammer, a bubble curtain will be used to attenuate sound levels. Underwater sound levels will be monitored and results will be used real-time to maximize the effectiveness of the bubble curtain. A hydroacoustic monitoring plan will be prepared and submitted to NMFS for review and approval prior to the initiation of construction.

(7) Following the completion of dredging, WETA will conduct "z-layer" sediment sampling to assess conditions on the newly exposed Bay bottom. If sediments contain bioaccumulative contaminants above certain thresholds (e.g., specified in the Project's biological assessment), further actions will be pursued to prevent exposure to aquatic organisms.

B. Description of the Action Area

The action area is defined as all areas affected directly or indirectly by the Federal action and not merely the immediate area involved (50 CFR 402.02). The landside portion of the action area consists of approximately 15,500 square feet (0.36 acre) area within the former Alameda Naval Air Station. The waterside portion of the action area consists of approximately one acre of waterside space in Central San Francisco Bay where the new facility will be constructed, a 13.5-acre nearshore area to be dredged, and the 6.5-square nautical mile deepwater ocean disposal site for dredged materials (SF-DODS) approximately 50 miles offshore from the City of San Francisco in the Pacific Ocean. The San Francisco Bay portion of the action area includes areas that will be affected by noise and turbidity during construction, dredging, and future operations. The area in San Francisco Bay which will be subject to sound levels that could result in the injury or mortality of listed fish (*i.e.*, in excess of 206 dB peak sound pressure level for any single strike and/or accumulated sound exposure level of 187 dB referenced to one micropascal, as described in the effects section below) is presented in Figure 2.

III. ANALYTICAL FRAMEWORK

In accordance with policy and regulation, the jeopardy analysis in this biological opinion relies on four components: (1) the Status of the Species, which evaluates the CCC steelhead DPS and southern DPS of North American green sturgeon range-wide conditions, the factors responsible for that condition, and the species' likelihood of both survival and recovery; (2) the Environmental Baseline, which evaluates the condition of this listed species in the action area, the factors responsible for that condition, and the relationship of the action area to the likelihood of both survival and recovery of this listed species; (3) the Effects of the Action, which determines the direct and indirect effects of the proposed Federal action and the effects of any interrelated or interdependent activities on this species in the action area; and (4) Cumulative Effects, which evaluates the effects of future, non-Federal activities in the action area on this species.

A. Jeopardy Analysis

The jeopardy determination is made by adding the effects of the proposed Federal action and any Cumulative Effects to the Environmental Baseline and then determining if the resulting changes in species status in the action area are likely to cause an appreciable reduction in the likelihood of both the survival and recovery of this listed species in the wild.

The jeopardy analysis in this biological opinion places an emphasis on the range-wide likelihood of both survival and recovery of this listed species and the role of the action area in the survival and recovery of this listed species. The significance of the effects of the proposed Federal action is considered in this context, taken together with cumulative effects, for purposes of making the jeopardy determination. We use a hierarchical approach that focuses first on whether or not the effects on salmonids in the action area will impact their respective population. If the population will be impacted, we assess whether this impact is likely to affect the ability of the population to support the survival and recovery of the DPS or Evolutionary Significant Unit (ESU).

B. Adverse Modification Analysis

This biological opinion does not rely on the regulatory definition of destruction or adverse modification of critical habitat at 50 CFR §402.02, which was invalidated by *Gifford Pinchot Task Force v. USFWS*, 378 F.3d 1059 (9th Cir. 2004), amended by 387 F.3d 968 (9th Cir. 2004). Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.

The adverse modification analysis in this biological opinion relies on four components: (1) the Status of Critical Habitat, which evaluates the range-wide and watershed-wide condition of critical habitat for the CCC steelhead DPS and southern DPS of North American green sturgeon in terms of primary constituent elements (PCEs – sites for spawning, rearing, and migration), the factors responsible for that condition, and the resulting conservation value of the critical habitat overall; (2) the Environmental Baseline, which evaluates the condition of critical habitat in the

action area, the factors responsible for that condition, and the conservation value of critical habitat in the action area; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the PCEs in the action area and how that will influence the conservation value of affected critical habitat units; and (4) Cumulative Effects, which evaluates the effects of future, non-Federal activities in the action area on the PCEs and how that will influence the conservation value of affected critical habitat units.

For purposes of the adverse modification determination, we add the effects of the proposed Federal action on CCC steelhead DPS and southern DPS of North American green sturgeon critical habitat in the action area, and any Cumulative Effects, to the Environmental Baseline and then determine if the resulting changes to the conservation value of critical habitat in the action area are likely to cause an appreciable reduction in the conservation value of critical habitat range-wide. If the proposed action will negatively affect PCEs of critical habitat in the action area we then assess whether or not this reduction will impact the value of the DPS critical habitat designation as a whole.

C. Use of Best Available Scientific and Commercial Information

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

- Initial Study/Mitigated Negative Declaration for the San Francisco Bay Water Emergency Transportation Authority Central Bay Operations and Maintenance Facility, March 2011.

- Characterization of Alameda Point channel sediments: dredge materials sampling and analysis results. Maintenance dredging program: Episode 3. Prepared for Moffatt and Nichol, Walnut Creek, CA and the City of Alameda, Alameda, CA. June 2011.

- Application for Department of Army Permit, San Francisco Bay Water Emergency Transportation Authority Central Bay Operations and Maintenance Facility, July 2011.

- Biological Assessment and Essential Fish Habitat Assessment for the San Francisco Bay Water Emergency Transportation Authority Central Bay Operations and Maintenance Facility, January 2012.

- Sample analysis report for the dredging of sediment in support of the construction of the San Francisco Bay Water Emergency Transportation Authority Central Bay Operations and Maintenance Facility, USACE: File #2011-003355, June 2012.

Information was also provided in emails messages, site visits, and telephone conversations between March 2012 and October 2012. For information that has been taken directly from published, citable documents, those citations have been referenced in the text and listed at the end of this document. A complete administrative record of this consultation is on file at the NMFS North Central Coast Office (Administrative Record Number 151422SWR2011SR00553).

IV. STATUS OF THE SPECIES AND CRITICAL HABITAT

This biological opinion analyzes the effects of the proposed construction and operation of the WETA Central Bay Operations and Maintenance Facility on the following Federally-listed species (Distinct Population Segments [DPS]) and designated critical habitats:

Central California Coast steelhead (*Oncorhynchus mykiss*) DPS
Threatened (71 FR 834; January 5, 2006)
Critical habitat (70 FR 52488; September 2, 2005)
North American Green Sturgeon (*Acipenser medirostris*) southern DPS
Threatened (71 FR 17757; April 7, 2006)
Critical habitat (74 FR 52300; September 8, 2008)

A. Species Description, Life History, and Status

In this opinion, NMFS assesses four population viability parameters to help us understand the status of CCC steelhead and southern DPS green sturgeon and their populations' ability to survive and recover. These population viability parameters are: abundance, population growth rate, spatial structure, and diversity (McElhany et al. 2000). NMFS has used existing information to determine the general condition of each population and factors responsible for the current status of each DPS.

We use these population viability parameters as surrogates for numbers, reproduction, and distribution, the criteria found within the regulatory definition of jeopardy (50 CFR 402.02). 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.

1. <u>CCC Steelhead</u>

a. General Life History

Steelhead are anadromous forms of *O. mykiss*, spending some time in both freshwater and saltwater. 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. Steelhead young usually rear in freshwater for 1 to 3 years before migrating to the ocean as smolts, but rearing periods of up to 7 years have been reported. Migration to the ocean usually occurs in the spring. Steelhead may remain in the ocean for 1 to 5 years (2 to 3 years is most common) before returning to their natal streams to spawn (Busby et al. 1996). The distribution of steelhead in the ocean is not well known. Coded wire tag recoveries indicate that most steelhead tend to migrate north and south along the continental shelf (Barnhart 1986). Adult steelhead typically migrate from the ocean to freshwater between December and April, peaking in January and February (Fukushima and Lesh 1998).

Juvenile steelhead migrate as smolts to the ocean from January through May, with peak migration occurring in March, April and May (Barnhart 1986, Fukushima and Lesh 1998). Barnhart (1986) reported 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 (McCormick 1994). Smolts may use estuaries for rearing and acclimation prior to seawater entry.

Turbidity (i.e., water clarity) also can influence the behavior, distribution and growth of juvenile salmonids (Cordone and Kelley 1961; Newcombe and McDonald 1991; Redding et al. 1987; Newcombe and Jensen 1996; 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 nephlometric turbidity units (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.

b. 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 dependent upon immigration from nearby CCC steelhead DPS populations to ensure their viability (McElhaney et al. 2000, Bjorkstedt et al. 2005).

[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).

While historical and present data on abundance are limited, CCC steelhead numbers are substantially reduced from historical levels. A total of 94,000 adult steelhead were estimated to spawn in the rivers of this DPS in the mid-1960s, including 50,000 fish in the Russian River - the largest population within the DPS (Busby et al. 1996). Recent estimates for the Russian River are on the order of 4,000 fish (NMFS 1997a). Abundance estimates for smaller coastal streams in the DPS indicate low but stable levels with recent estimates for several streams (Lagunitas, Waddell, Scott, San Vincente, Soquel, and Aptos creeks) of individual run sizes of 500 fish or less (62 FR 43937). Some loss of genetic diversity has been documented and attributed to previous among-basin transfers of stock and local hatchery production in interior populations in the Russian River (Bjorkstedt et al. 2005). 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 1980s. 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, NMFS 1997a, Good et al. 2005, Spence et al. 2008.

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). Research monitoring data from 2008/09 and 2009/10 of adult CCC steelhead returns shows a decline in adults across the range of the DPS compared to the last ten years (Jeffrey Jahn, personal communication, 2010). 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 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).

PCEs of designated critical habitat for CCC steelhead include estuarine areas free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult

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

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. 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: 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 (Busby et al. 1996, 70 FR 52488). 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. Green Sturgeon

a. 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 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 (Nelson et al. 2010, Huff et al. 2011). Subadult and adult

green sturgeon move between coastal waters and estuaries (Lindley et al. 2008, Lindley et al. 2011), but relatively little is known about how green sturgeon use these habitats. Lindley et al. (2011) report 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 optimal temperatures ranging from 11 to 17˚C (Van Eenennaam et al. 2005). Eggs hatch after 6–8 days, and larval feeding begins 10–15 days post-hatch. Metamorphosis of larvae into juveniles typically occurs after a minimum of 45 days (post-hatch) when fish have reached 60–80 mm total length (TL). After hatching larvae migrate downstream and metamorphose into juveniles. Juveniles spend their first few years in the Sacramento-San Joaquin Delta (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 total length (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 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 appear to 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 less than one week (Hearn et al. 2010). Post-spawning, Heublein et al. (2009) reported tagged southern DPS green sturgeon displayed two outmigration strategies; 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., less than one week).

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 on the lower Sacramento River 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) analysed 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). Manual tracking of acoustically-tagged green sturgeon in the San Francisco Bay estuary indicates they are generally bottom-oriented, but make occasional forays to surface waters, perhaps to assist their movement (Kelly et al. 2007). Dumbauld et al. (2008) report green sturgeon utilize soft substrate in estuaries, presumably feeding on benthic invertebrates. Preliminary data from mapping surveys conducted in Willapa Bay, Washington, showed densities of "feeding pits" (depressions in the substrate believed to be formed when green sturgeon feed) were highest over shallow intertidal mud flats, while harder substrates (e.g., gravel) had no pits (M. Moser, unpublished data). Within the San Francisco estuary, green sturgeon are encountered by recreational anglers and during sampling by CDFG in the shallow waters of San Pablo Bay.

b. 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 is comes mainly from four sources: 1) incidental captures in the CDFG white sturgeon 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 ways (short time series, non-target species, etc.) and do not support more than a qualitative evaluation of changes in green sturgeon abundance.

CDFG's white sturgeon monitoring program incidentally captures southern DPS green sturgeon. Trammel nets are used to capture white sturgeon and CDFG (2002) utilizes a multiple-census or Peterson mark-recapture method to estimate the size of subadult and adult sturgeon population. 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 CDFG 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 to enumerated adult green sturgeon in the upper Sacramento River (i.e., DIDSON). These surveys estimated 175 to 250 sturgeon (±50) in the mainstem Sacramento River during the 2010 and 2011 spawning seasons (E. Mora, personal communication, January 2012). 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 most recent status review update concluded the southern DPS green sturgeon is 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). Based on this information, the southern DPS green sturgeon was listed as threatened on April 7, 2006 (71 FR 17757).

Critical habitat was designated for the southern DPS of green sturgeon on October 9, 2009 (74 FR 52300) and includes coastal marine waters within 60 fathoms depth from Monterey Bay, California to Cape Flattery, Washington, including 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 alterations to the Sacramento-San Joaquin River 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.

B. Factors Responsible for Steelhead and Green 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, 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, reduced marine-derived nutrient transport, and ocean conditions.

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 and green sturgeon 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 (Busby et al. 1996, Adams et al. 2002, Good et al. 2005), and lagoon management (Smith 1990, Bond 2006).

2. Commercial and Recreational Harvest

Until recently, commercial and recreational harvest of southern DPS green sturgeon was allowed under State and Federal law. The majority of these fisheries have been closed (NMFS 2005). Ocean salmon fisheries off California are managed to meet the conservation objectives for certain stocks of salmon listed in the Pacific Coast Salmon Fishery Management Plan, 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.

3. Artificial Propagation

Releasing large numbers of hatchery fish can pose a threat to wild salmon and 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).

4. Natural Stochastic Events

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

5. Marine Mammal Predation

Predation is not known to be a major factor contributing to the decline of West Coast salmon and steelhead populations relative to the effects of fishing, habitat degradation, and hatchery practices. Predation may have substantial impacts in localized areas. Harbor seal (*Phoca vitulina*) and California sea lion (*Zalophus californianus*) numbers have increased along the Pacific Coast (NMFS 1997b).

In a peer reviewed study of harbor seal predation in the Alsea River Estuary of Oregon, the combined results of multiple methodologies led researchers to infer that seals consumed 21 percent (range = 3–63 percent) of the estimated prespawning population of coho salmon. The majority of the predation occurred upriver, at night, and was done by a relatively small proportion of the local seal population (Wright et al. 2007). However, at the mouth of the Russian River, Hanson (1993) reported that the foraging behavior of California sea lions and harbor seals with respect to anadromous salmonids was minimal, and predation on salmonids appeared to be coincidental with the salmonid migrations rather than dependent upon them.

6. 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. Nutrient loss may be contributing to the further decline of ESA-listed salmonid populations (Gresh et al. 2000).

7. 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). Changes in ocean conditions likely affect ocean survival of all west coast salmonid populations (Good et al. 2005, Spence et al. 2008), and may be affecting green sturgeon populations, as well.

C. Global Climate Change

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 California 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 salmonids and green sturgeon. Estuarine productivity is likely to change based on changes in freshwater flows, nutrient cycling, and sediment amounts (Scavia et al. 2002). In marine environments, ecosystems and habitats important to salmonids and green sturgeon are likely to experience changes in temperatures, circulation and chemistry, and food supplies (Feely et al. 2004, Brewer 2008, Osgood 2008, Turley 2008). The projections described above are for the mid to late 21st Century. In shorter time frames, climate conditions not caused by the human addition of carbon dioxide to the atmosphere are more likely to predominate (Cox and Stephenson 2007; Smith et al. 2007).

V. ENVIRONMENTAL BASELINE

The Environmental Baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including designated critical habitat), and ecosystem in the action area. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impacts of State or private actions which are contemporaneous with the consultation in process (50 CFR §402.02).

A. Action Area Overview

The action area consists of two locations: one within Central San Francisco Bay; the other is the offshore dredge material disposal site (SF-DODS) in the Pacific Ocean. San Francisco Bay is the largest estuary on the west coast of North America. Located about halfway up the California coast from the Mexican border, it is the natural exit point of 40 percent of California's freshwater outflow. The climate is Mediterranean; most precipitation falls in winter and spring as rain throughout the Central Valley and as snow in the Sierra Nevada and Cascades. The freshwater outflow pattern is seasonal; highest outflow occurs in winter and spring. Current and wave patterns in the action area are largely generated by the tides interacting with the bottom and shoreline configurations. It also receives inputs from stormwater runoff, and wastewater from municipal and industrial sources that vary in volume depending on the location and seasonal weather patterns. SF-DODs is a 6.5-square nautical mile area located approximately 50 miles offshore from the City of San Francisco in the Pacific Ocean.

The San Francisco Bay portion of the action area consists of densely developed Alameda waterfront areas and nearshore estuarine areas adjacent to former Alameda Naval Air Station. Water depths at construction and dredging sites range from less than 5 feet to 40 feet at MLLW. The transition zone between the upland areas to the subtidal zone primarily consists of rock rip rap, concrete rubble, and an existing deteriorated seawall. The majority of benthic aquatic habitats within the project area are soft mud and/or clay sediments. Some hard bottom habitat is present along the shoreline and seawall. Review of Merkel & Associates (2009) indicates eelgrass is not present in the project area nor is there suitable habitat for eelgrass. For disposal of dredged materials, SF-DODS is located in open ocean waters approximately 50 miles offshore from the Golden Gate in the Pacific Ocean. Ocean waters at SFDODS are approximately 10,000 feet deep and site contains strong currents.

B. Status of Species and Critical Habitat in Action Area

1. <u>CCC Steelhead</u>

The San Francisco Bay portion of the action area is used as a migration corridor by listed CCC steelhead. Adult CCC steelhead migrate from the Pacific Ocean through the San Francisco Bay estuary as they seek the upstream spawning grounds of their natal streams. CCC steelhead

migration through San Francisco Bay to freshwater tributaries primarily occurs from December through March.

Juvenile (smolt) steelhead migrate from their natal streams through San Francisco Bay estuary to the ocean. Emigration timing is highly variable, but peak migrations downstream typically occur through the Bay during March, April and May. During the course of their downstream migration, juvenile steelhead can utilize the estuary for seasonal rearing. 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 limit the ability of the Bay to support juvenile rearing.

Studies of juveniles in the Bay show quick transits and limited growth. 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 a 40-mile length of the estuary. More recent studies conducted by the California Fish Tracking Consortium (CFTC) provide information regarding the length of residence time in San Francisco Bay by Central Valley salmonid smolts. Thousands of Central Valley late fall-run Chinook salmon and Central Valley steelhead smolts were tagged with acoustic transmitters and released in the Sacramento River from 2006 through 2010. Most of these fish migrate downstream relatively quickly having a median transit time of 2.7 days for salmon and steelhead smolts to travel over 25 miles from the Carquinez Strait to the Golden Gate (Hearn et al. 2010).

SF-DODS is located off the continental shelf in the open ocean with water depths of approximately 10,000 feet. Dredged materials disposed at this location are expected to rapidly dissipate due to the site's strong ocean currents. This area of open ocean is not suitable for CCC steelhead due to the great water depth and lack of foraging habitat. CCC steelhead are not expected to be present at SFDODS.

2. <u>CCC Steelhead Critical Habitat</u>

The San Francisco Bay portion of the action area is designated critical habitat for CCC steelhead. PCE's essential for the conservation of CCC steelhead are estuarine areas free of obstruction and excessive predation with: (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). Within the action area, essential features of critical habitat include the estuarine water column, foraging habitat, and food resources used by steelhead as part of their juvenile downstream migration and adult upstream migration. These essential features of estuarine PCEs within the action area are partially degraded and limited due to altered and diminished freshwater inflow, shoreline development, shoreline stabilization, non-native invasive species, discharge and accumulation of contaminants, and periodic dredging for navigation.

3. Green Sturgeon

Green sturgeon are both anadromous and iteroparous[4], and adults pass through the San Francisco Bay estuary during spawning, and post-spawning migrations. Pre-spawn green sturgeon enter the Bay between late February and early May, as they migrate to spawning grounds in the Sacramento River (Heublein et al. 2009). Post-spawning adults may be present in the bay after spawning in the Sacramento River in the spring and early summer for months prior to emigrating into the ocean. Juvenile green sturgeon move into the Delta and San Francisco estuary early in their juvenile life history, where they may remain for 2-3 years before migrating to the ocean (Allen and Cech, Jr. 2007; Kelly et al. 2007). Sub-adult and non-spawning adult green sturgeon utilize both ocean and estuarine environments for rearing and foraging. Due to these life-history characteristics, juvenile, sub-adult and adult green sturgeon may be present in the San Francisco Bay portion of the action area during project activities.

As with CCC steelhead, green sturgeon are not expected to be present at SF-DODS. SF-DODS is not suitable for green sturgeon due to the great water depth and lack of foraging habitat.

4. Green Sturgeon Critical Habitat

The San Francisco Bay portion of the action area is located within designated critical habitat for the southern DPS of green sturgeon. PCEs for green sturgeon in estuarine areas are: food resources, water flow, water quality, migratory corridor, water depth, and sediment quality. These PCEs for green sturgeon critical habitat in the area are partially degraded. Habitat degradation in the action area is primarily due to altered and diminished freshwater inflow, shoreline development, shoreline stabilization, non-native invasive species, discharge and accumulation of contaminants, and periodic dredging for navigation.

C. Factors Affecting the Species Environment in the Action Area

Profound alterations to the environment of the San Francisco Bay estuary began with the discovery of gold in the middle of the 19th century. Dam construction, water diversion, hydraulic mining, and the diking and filling of tidal marshes soon followed, launching the San Francisco Bay area into an era of rapid urban development and coincident habitat degradation. There are efforts currently underway to restore the habitat in the Bay, if not directly within the action area, at least within surrounding tributaries and the estuary itself. There have also been alterations to the biological community as a result of human activities, including hatchery practices and the introduction of non-native species.

The land bordering the action area has been highly modified by urban development along the Alameda shoreline and the adjacent Port of Oakland. Alameda contains commercial and high density residential development and high use streets. The hydrology of the action area is modified as a result. The terrestrial portions of the action area receive water from direct

[4] They have multiple reproductive cycles over their lifetime.

precipitation, which flows into storm drains and into combined stormwater and sewage treatment system. Water and sediment quality within the action area is affected by stormwater runoff, industrial activities, and other urban influences.

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

No formal or informal consultations pursuant to section 7 of the ESA have been previously conducted by NMFS within the San Francisco Bay portion of the action area. For the SF-DODS portion of the action area, NMFS has completed a programmatic consultation with the Corps of the Long Term Management Strategy of Disposal of Dredged Materials in the San Francisco Bay Region (LTMS). The LTMS programmatic consultation resulted in the issuance of a biological opinion on September 18, 1998, to the Corps and the U.S. Environmental Protection Agency. The consultation and biological opinion included the disposal of dredged material at SF-DODS. The September 18, 1998, biological opinion concluded the LTMS program was not likely to jeopardize the continued existence of listed fish species under the jurisdiction of NMFS, or adversely modify or destroy designated critical habitat.

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 Central San Francisco Bay watershed. 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. Through fall of 2012, no research or enhancement activities have occurred in the Central San Francisco Bay.

VI. EFFECTS OF THE ACTION

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

With the Project's proposed in-water construction and dredging window of July 31 to November 30, juvenile and adult CCC steelhead are not anticipated to be in the project area during in-water activities. Green sturgeon are present in San Francisco Bay year-round and may be in the vicinity of the Project during construction and dredging. Construction activities associated with the proposed Project are expected to temporarily affect threatened green sturgeon through elevated levels of underwater sound during pile driving and degradation of water quality during construction and dredging. When completed, the operation of ferry boats to and from the new facility may affect threatened steelhead and green sturgeon through temporary increases in turbidity and noise disturbance.

The potential effects of the action are presented in detail below. NMFS does not anticipate any adverse effects to listed species or critical habitat from the on-land portion of the proposed Project, because the Project will implement measures (i.e., proper storage and handling of fuels and other contaminants, accidental spill plan, and storm water management plan) that prevent the runoff and discharge of pollutants from landside activities to the waters of San Francisco Bay. The measures associated with landside activities are expected to render any potential effects on listed species or critical habitat discountable.

A. Effects of Construction Activities on Listed Species and Critical Habitat

Construction activities by the proposed Project consist of demolition of remaining structures at the on-site marina, construction of berthing floats and gangways, replacement of a concrete seawall, and construction of a gangway landing. These activities will likely result in temporary impacts to water quality and elevated underwater sound levels during pile driving. The potential effects of in-water construction are presented below.

1. Sound Pressure Impacts on Fish from Pile Driving

a. Overview of Pile Driving Impacts.

Pile driving activities may affect steelhead and green sturgeon through exposure to high underwater sound levels and degradation of water quality. The underwater sound pressure waves that have the potential to adversely affect to steelhead and green sturgeon originate with the contact of the hammer with the top of the pile. The impact of the hammer on the top of the pile causes a wave to travel down the pile and causes the pile to resonate radially and longitudinally like a gigantic bell. Most of the acoustic energy is a result of the outward expansion and inward contraction of the walls of the pile as the compression wave moves down the pile from the hammer to the end of the pile buried in the bay bottom. Water is virtually incompressible and the outward movement of the pile (by a fraction of an inch) followed by the pile walls pulling back inward to their original shape, sends an underwater pressure wave propagating outward from the pile in all directions. The pile resonates sending out a succession of waves even as it is pushed several inches deeper into the bay bottom. Piles can be composed of wood, steel, or concrete. Different types of piles result in different levels of underwater noise. For the Central Bay Operations and Maintenance Facility Project, WETA proposes to use an impact hammer to

install steel piles and a vibratory hammer to install plastic piles.

Available information indicates that fish may be injured or killed when exposed to elevated underwater sound pressure waves generated by steel piles installed with impact hammers. Pathologies associated with very high sound levels are collectively known as *barotraumas*. Barotraumas are pathologies associated with exposure to drastic changes in pressure. These include hemorrhage and rupture of internal organs, including the swim bladder and kidneys in fish. Death can be instantaneous, occur within minutes after exposure, or occur several days later. An important characteristic of the underwater sound that causes injury is the frequency. During pile installation, most energy is contained within the frequency range (100-1,000 Hertz) which may result in reverberation of the swim bladder and other internal organs in fish.

Exposure to sound for longer periods can also accumulate over time to injure and kill fish (Hastings 1995). Hastings (1995) found mortality rates of 50 percent and 56 percent for gouramis (*Trichogaster sp*.) when exposed to continuous sounds at 192 dB referenced to one micropascal squared second (dB re: 1μPa^2-s) at 400 Hz and 198 dB re: 1μPa^2-s at 150 Hz, respectively. For goldfish (*Carassius auratus*), mortality rates of 25 percent were observed when exposed to sounds of 204 dB re: 1μPa^2-s at 250 Hz for 2 hours or less. Hastings (1995) also reported that acoustic "stunning," a potentially lethal effect resulting in a physiological shutdown of body functions, immobilized gourami within eight to thirty minutes of exposure to the aforementioned sounds. These sound pressure levels can also result in hearing damage to fish (Enger 1981; Hastings et al. 1995, 1996). Additional detrimental effects on fish from sound levels such as those noted above include stress and masking. Masking occurs when there is interference with the audibility of a sound caused by the presence of another sound. Masking can adversely affect fish by reducing predator avoidance capability, interfering with communication necessary for navigation, and interfering with reproduction (Scholik and Yan 2001; Shin 1995; Popper 1997).

In the *Compendium of Pile Driving Sound Data*, Illingworth and Rodkin (2007) present pile driving case studies to provide information regarding the underwater sound pressure levels generated with the installation of steel and concrete piles by different hammer types. Several of the case studies presented in the *Compendium of Pile Driving Sound Data* (Illingworth and Rodkin 2007) were conducted within the San Francisco Bay region. To assess the anatomy and physiology of fishes and improve our understanding of the potential impacts of pile driving sound on fish, the California Department of Transportation (Caltrans) and the Federal Highways Administration established the Fisheries Hydroacoustic Work Group (FHWG). The FHWG is composed of representatives from the Southwest and Northwest regions of NMFS, U.S. Fish and Wildlife Service, California Department of Fish and Game, and the U.S. Army Corps of Engineers. During the period between 2005 and 2008, several white papers were prepared which collected available information on the effects of sound on fishes, identified data gaps, and identified future studies to address areas of uncertainty relative to the measurement of sound and the response of fishes to sound. With input from the FHWG, Caltrans' consultants prepared "Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving

on Fish" (ICF Jones & Stokes, Illingworth and Rodkin, Inc. 2009). Based on the work of the FHWG and additional information currently available, a dual metric criteria of 206 dB referenced to one micropascal (re: 1μPa) peak sound pressure level (SPL) for any single strike and an accumulated sound exposure level (SEL) of 187 dB re: $1\mu Pa^2$-s are used by NMFS to correlate physical injury to fish greater than 2 grams in size from underwater sound produced during the installation of piles with impact hammers[5]. As distance from the pile increases, sound attenuation from transmission loss reduces sound pressure levels and the potential harmful effects to fish also decrease. Disturbance and noise associated with construction at the pile driving site may also startle fish and result in dispersion from the action area.

A study in Puget Sound, Washington suggests that pile driving operations disrupt juvenile pink and chum salmon (*Oncorhynchus spp.*) behavior (Feist et al. 1992). Though no underwater sound measurements are available from that study, comparisons between juvenile salmon schooling behavior in areas subjected to pile driving/construction and other areas where there was no pile driving/construction indicate that there were fewer schools of fish in the pile-driving areas than in the non-pile driving areas. Based on these observations, pile-driving operations may disrupt normal foraging, schooling, and migratory behaviors of juvenile anadromous salmonids.

Currently, there is very little data available regarding effects of pile driving on green sturgeon. However, green sturgeon use estuarine environments for foraging and migration in a manner similar to anadromous salmonids. Thus, it is reasonable to assume that green sturgeon could experience similar disruption of behavioral patterns, as discussed above for salmonids during pile driving operations. Additionally, there is evidence of high sound pressure levels generated by pile driving resulting in the mortality of sturgeon. During construction of the Benicia-Martinez Bridge in May 2002, 98-inch diameter piles were driven by a large impact hammer in water 40 to 50 feet deep. Without the benefit of a sound attenuation device, such as an air bubble curtain, peak underwater sound pressure levels during a single strike ranged from 227 dB (re 1 μPa) at approximately 16 feet from the pile to 178 dB at approximately 3,600 feet from the pile (Illingworth and Rodkin 2007). Fish killed and collected at the Benicia-Martinez Bridge during pile driving in May 2002 included a 24-inch juvenile white sturgeon (Caltrans, unpublished data 2002).

The degree to which an individual fish exposed to underwater sound will be affected (ranging from a startle response to immediate mortality) is dependent on a number of variables such as the species of fish, size of the fish, presence of a swimbladder, sound pressure intensity and frequency, shape of the sound wave (rise time), depth of the water around the pile, and the bottom substrate composition and texture. Both salmonids and sturgeon possess physostomous swimbladders (Smith 1982). As indicated by Keevin and Hempen (1997), fish with swimbladders are more susceptible to injury than fish which lack swimbladders. Sturgeon are

[5] June 12, 2008, memorandum from the Fisheries Hydroacoustic Working Group regarding the agreement in principle for interim criteria for injury to fish from pile driving activities.

known to have large swimbladders (Nelson 1994). In addition, both salmonids and sturgeon are hearing generalists[6] (ICF Jones and Stokes, and Illingworth and Rodkin, Inc., 2009; Popper 2005). Based on the above information, there is likely a similar behavioral response by listed anadromous salmonids and green sturgeon to elevated levels of underwater sound produced when driving piles in or near water. Until new information indicates otherwise, NMFS believes a 150 dB root-mean-square pressure (RMS) threshold for behavioral responses for salmonids and green sturgeon is appropriate.

b. Project Specific Considerations.

Several site-specific conditions should be considered when conducting an assessment of the potential effects of pile driving associated with construction projects. Effects on an individual fish during pile driving are dependent on variables such as environmental conditions at the project site, specific construction techniques, and the construction schedule. As stated above, a dual metric criteria of 206 dB re: 1μPa peak SPL for any single strike and an accumulated SEL of 187 dB re: 1μPa^2-s are currently used by NMFS as thresholds to correlate physical injury to fish greater than 2 grams in size from underwater sound produced during the installation of piles with impact hammers. As distance from the pile increases, sound attenuation reduces sound pressure levels and the potential harmful effects to fish also decrease. Behavioral effects may extend radially from the pile to the sound level threshold of 150 dB RMS.

Water depths are known to influence the rate of sound attenuation and travel distance. In deep water areas, high sound pressure waves travel further. Within shallow water, much of the acoustic energy is absorbed by the bottom and reflected off the surface back down to the bottom and even backwards towards the pile. The rate of attenuation is much higher in shallower water reducing the expected area of adverse effects as compared to deeper water. Pile driving for the proposed Project will occur in water depths ranging from less than 5 feet deep to 40 feet deep at MLLW.

Sound attenuation devices are commonly used to reduce the level of elevated sound pressure levels during pile driving. Cofferdams can be used to completely dewater the area around the pile and will effectively reduce the level of sound pressure levels transmitted into the water column. However, cofferdams can create additional impacts to fish during construction and dewatering. Creating a curtain of air around the sound source (i.e. pile being driven) has proven to be a very effective means of reducing underwater SPLs. Encapsulating the piles with an air bubble curtain does not require dewatering of the site. Bubble curtains reduce the radiation of sound from the pile into the water by making the sound pass through a “curtain” of low-density air bubbles. Hydroacoustic monitoring has shown that air bubble curtains can decrease the overall level of SPLs in the adjacent water column and decrease the extent to which the adverse sound-related impacts occur. ICF Jones and Stokes, and Illingworth and Rodkin, Inc. (2009)

[6] Hearing generalists sense sound directly through their inner ear but also sense sound energy from the swim bladder. Hearing specialists are more complex and have evolved different mechanisms to couple the swim bladder (or other gas-filled structure) to the ear.

report the use of a bubble curtain is capable of providing up to 20 dB of attenuation during impact hammer driving depending on the size of the pile. In general, sound attention rates increase with more bubbles and (to a point) a thicker curtain (ICF Jones and Stokes, and Illingworth and Rodkin Inc. 2009).

For the Central Bay Operations and Maintenance Facility, WETA proposes to use a bubble curtain to attenuate underwater sound levels during installation of all steel piles. Based on the use of a bubble curtain and pile sizes proposed for this Project, the assessment of acoustic impacts presented in this biological opinion assumes an estimated reduction of 10 dB in sound pressure. Although reductions as high as 20 dB have been measured, as a general rule, sound reductions of greater than 10 dB with attenuation systems cannot be reliably predicted (ICF Jones and Stokes, and Illingworth and Rodkin, Inc., 2009).

The timing and duration of pile driving influences the level of potential impact on fish. Some species of fish occur seasonally in Central San Francisco Bay and in-water construction activities can be scheduled to avoid periods when the target fish species is mostly likely to be present. The duration of pile driving also influences the level of risk to fish. If pile driving extends continuously for hours or days, the chance of encounters with fish in the vicinity increases, accordingly. If pile driving is occurring near shore at low tide, fewer large fish are likely to be present due to shallow water depths.

For the proposed Project, pile driving with an impact hammer would occur over a period of 9 to 10 days for construction of the facility. The installation of these piles will occur between July 31 and November 30. This time period avoids the migration season of CCC steelhead, but threatened green sturgeon are found in San Francisco Bay year-round and could be present during pile driving by this Project.

c. Assessment of Pile Driving Effects.

Pile driving effects would be limited to threatened green sturgeon, because CCC steelhead are not expected to be in the project area during the in-water construction period of July 31 through November 30. Potential effects of elevated sound levels generated by pile driving on green sturgeon are presented below.

Sound monitoring data collected from recent pile driving projects indicate that sound pressure levels resulting from the proposed Project's pile driving activities is likely to, at times, exceed the dual metric criteria and therefore potentially injury listed fish in the San Francisco Bay portion of the action area (Table 2). Potential injury and mortality of listed fish could occur within a radial distance up to 660 feet when sound pressure levels exceed the 187 dB SEL cumulative threshold. Behavioral effects could occur within a radial distance up to 3,281 feet when sound pressure levels exceed the 150 dB RMS threshold for behavioral responses. For the single strike threshold for injury and mortality, NMFS predicts sound pressure levels of 206 dB peak should not occur at a distance greater than 7 feet from the 30-inch piles and at a distance of

3 feet from the 24-inch piles, but that sound pressure levels of 206 dB peak or greater could occur within 7 feet and 3 feet, respectively[7]. For this assessment, NMFS utilized a practical spreading loss model for sound transmission and monitoring data from the *Compendium of Pile Driving Sound Data* (Illingworth and Rodkin 2007) to estimate the likely area surrounding the pile where sound pressure levels may injure, kill or affect the behavior of fish.

For the purposes of this analysis, we have used the maximum distances peak SPLs and accumulated SELs could travel as a reasonable worst case scenario. The project description does not indicate the days on which the 30-inch piles will be driven, nor does it preclude the driving of 30-inch piles immediately preceding or following the driving of smaller piles on the same day. Therefore, even though Table 2 (below) indicates that peak SPLs of 206 dB associated with smaller piles should be less than 7 feet and accumulated SELs should be less than 660 feet, this effects analysis assumes that all 30, 24, and 18-inch steel piles will have a 7-foot, 206 dB peak range and a 660-foot, 187 dB accumulated SEL range.

Table 2. Sound levels associated with impact hammer pile driving (peak and RMS sound levels are referenced to one micropascal and SEL levels are referenced to one micropascal squared-second).

Pile type and size	Max single strike peak at 33 feet (10 m)	Accumulated SEL at 33 feet (10 m)	Single strike RMS at 33 feet (10 m)	Distance (feet) to 206 dB peak	Distance (ft) to 187 dB accumulated SEL/day	Distance (feet) to 150 dB RMS
30-inch steel	195 dB	207 dB	180 dB	7 feet	660 feet	3,281 feet
24-inch steel	193 dB	201 dB	179 dB	3 feet	262 feet	2,815 feet
18-inch steel	186 dB	199 dB	170 dB	n/a	151 feet	705 feet

Although the spreadsheet utilized by NMFS can predict sound pressure levels at a distance of less than 33 feet (*i.e.*, 10 meters) from a pile, hydroacoustic measurements in the field generally cannot be made this close to a pile. Near-field effects of sound waves, on-site equipment, the air bubble curtain, and safety typically don't allow for hydroacoustic monitoring to be performed within a few feet of a pile. At this close range, NMFS believes it is unlikely that exceedence of the 206 dB peak single strike threshold by this Project will result in the injury or mortality of green sturgeon and the basis for this finding is presented below.

Several factors make it unlikely that sturgeon would be present or injured in the area immediately adjacent to a pile being driven by this Project. First, the placement of an air bubble curtain will occupy 5-10 feet of the radial distance immediately outward from the pile. Air bubble curtains

[7] The 206 dB peak threshold is not expected to be exceeded at any distance during installation of the 18-inch diameter steel piles.

are constructed by the placement of one or more horizontal concentric rings of perforated tubing (such as PVC) around the pile. Air is pumped through the tubes and into the rings to emit a curtain of bubbles that encapsulate the pile. To optimize the sound attenuation capability of the curtain, the amount of bubbles and thickness of the curtain are maximized by adjusting the flow of compressed air delivered to the perforated tubing. Thus, equipment and the air bubble curtain itself will physically take up 5-10 feet immediately outward of the pile. Secondly, activation of the air bubble curtain immediately prior to the initiation of pile driving is expected to startle fish adjacent to the pile and likely result in a flight response. Additional noise will be created by the air compressors operating the bubble curtain, and boats and barges containing the pile driving equipment and crew will be operating immediately overhead. This noise will likely be perceived by fish as a stimulus indicating potential danger in its immediate environment, and sturgeon are not expected to remain in the area directly adjacent to a pile (greater than a 33-foot radial distance from the pile) during driving. Sonalyist (1996) report a variety of fish species demonstrate an avoidance reaction in the near-field (*i.e.* immediately adjacent to the sound source) to underwater sounds. Sonalyist (1996) did not define "near-field" as a specific distance, but ICF Jones and Stokes and Illingworth and Rodkin Inc. (2009) use 33 feet (10 meters) for near-field effects and to estimate the area of acoustic impact. At the Head of Old River in the Delta, Bowen and Bark (2010) reported a non-physical barrier comprised of an air bubble combined with sound and lights deterred the movement of up to 80 percent of juvenile salmon with a smaller fraction passing through the barrier. Thirdly, the short duration of the pile driving actions (9-10 days) to install the pilings for the Project will also limit the amount of exposure incurred by green sturgeon in the action area.

Table 2 presents sound levels anticipated to occur during impact hammer driving. The 30-inch diameter steel piles are the largest piles to be installed by this Project, and would produce the highest sound levels. To install all nineteen 30-inch diameter piles, noise impacts associated with driving occur over a period of two days, will be limited to daylight hours, and will not be continuous. A total of nineteen 24-inch steel piles will be installed for construction of the new ferry maintenance facility and the driving of these piles will occur over a period of 6 days, will be limited to daylight hours, and will not be continuous. Twelve 18-inch steel piles will be installed by this Project and pile driving will persist over a single day, will be limited to daylight hours, and will not be continuous.

NMFS anticipates the extent of SPLs above an accumulated SEL of 187 dB would extend up to a radial distance of approximately 660 feet from the pile driving activities. Since the proposed Project is located adjacent to a seawall, sound will mainly travel outwards into Central San Francisco Bay. For the largest piles (*i.e.* 30-inch diameter) the area of effect will encompass a relatively small area adjacent to the Alameda shoreline. For the purposes of this analysis, the zone of potential injury or mortality to threatened green sturgeon is the area in which fish could experience a range of barotraumas, including the damage to the inner ear, eyes, blood, nervous system, kidney, and liver. These injuries have the potential to result in the mortality of an individual either immediately or later in time.

Beyond the range of physical injury, extending out to the 150 dB RMS distance, NMFS estimates fish may demonstrate temporary abnormal behavior indicative of stress or exhibit a startle response. As described previously, a fish that exhibits a startle response may not be injured, but it is exhibiting behavior that suggests it perceives a stimulus indicating potential danger in its immediate environment, and startle responses are likely to extinguish after a few pile strikes, or diminish as fish leave the area. Shin (1995) described the behavioral response of snakehead (*Channa argus*) to the noise of pile driving as "agitation" and these fish exhibited a change in swimming behavior. Fewtrell (2003) described the behavioral response of finfish to seismic survey noise as "alarm". Under the water conditions experienced in the action area and in light of their anticipated behavioral action (to leave the area of higher sound pressures for an area with lower sound pressures), green sturgeon are expected to react to the sound produced by pile driving by swimming away from the action area. Adequate water depths and the open water area of Central San Francisco Bay adjacent to the action area will provide startled fish sufficient area to escape and elevated sound levels should not result in significant effects on these individuals. Areas adjacent to the Project's action area provide habitat of similar or higher quality and provide adequate carrying capacity to support individual sturgeon that are temporarily displaced during the 9-10 day period of pile driving.

In general, the effects of the sound generated by this Project's pile driving are expected to be less severe than that for the smaller 2-gram size fish protected by the NMFS dual-metric criteria. However, due to their smaller size, juvenile and sub-adult green sturgeon are, in comparison to adult green sturgeon, more vulnerable to barotramas. Juvenile green sturgeon are typically around 18 inches in length at the time they enter the estuary. Larger fish are, presumably, more tolerant of high levels of sound pressure and would be less affected by pile driving activities. Yelverton et al. (1975) reported injury and mortality rates differed significantly depending on fish size in response to an underwater blast. Mortality rates decreased as fish size increased when exposed to the impulse of an underwater blast (Yelverton et al. 1975). Since adult sturgeon can be very large (up to 2 meters in length), they are likely to be more resilient to injury and capable of recovering more quickly from temporary disturbances associated with pile driving.
The vulnerability of smaller sturgeon to injury or death from pile driving (especially if within close proximity), was demonstrated by high SPLs at the construction site of the Benicia-Martinez Bridge that resulted in the death of a juvenile sturgeon, approximately 24 inches in length.

Although green sturgeon may be subjected to elevated sound levels during pile driving for construction of the Central Bay Operations and Maintenance Facility, NMFS estimates that only a very small number of threatened southern DPS green sturgeon may be injured or killed by the proposed pile driving because few individuals are likely to be exposed to an accumulated SEL of 187 dB or greater. Few green sturgeon are anticipated to be injured or killed, because green sturgeon abundance is expected to be low in vicinity of the Alameda shoreline during the late summer/fall construction period, the duration of all pile driving by the Project is 9-10 days total, and the area of physical injury during pile driving is relatively small in comparison to the size of Central San Francisco Bay.

Depending on the time of year, green sturgeon may be commonly found within San Pablo Bay as indicated by the results of acoustic tag monitoring conducted by the California Fish Tagging Consortium. However, tagging studies have shown that few green sturgeon are present in Central and South San Francisco Bay when compared to San Pablo Bay (Hearn et al. 2010). Tagging studies also show that fewer sturgeon are present in San Francisco Bay during the late summer and fall period (unpublished data, 2009); this period directly overlaps with this Project's proposed construction season of July 31 to November 30. Green sturgeon adults and sub-adults are more frequently found in the San Pablo Bay during the winter, spring, and early summer months (unpublished data, 2009). To date, tagging studies provide little information on juvenile green sturgeon, but sampling has indicated juveniles mostly occur in small groups in the Bay/Delta region (Adams et al. 2002) and are unlikely to occur in more than small numbers in the action area. Therefore, few sturgeon are anticipated to be presented in the vicinity of the Alameda shoreline and in the action area during the 9-10 day period of pile driving.

During pile driving, peak SPLs above 206 dB will be limited to an area of 7 feet or less from the piles. As presented above, within this near-field area, equipment associated with the air bubble curtain will encroach on this space and most fish are expected to disperse with the activation of the air bubble curtain prior to the initiation of pile driving. Thus, the likelihood of an individual green sturgeon's presence in the single strike peak range is very low; the likelihood of injury is proportionate to the low likelihood of presence. For the zone of accumulated SEL (up to 660 feet from the pile being driven), exposed sturgeon would be unlikely to remain in the same location to experience the full duration of the pile driving (*i.e.*, up to 8 hours per day) due to tidal currents and behavioral movements. Thus, few, if any, sturgeon are likely to remain stationary long enough to accumulate SPLs to levels which cause injury or mortality. Research conducted in Puget Sound suggests individual fish are likely to disperse from the immediate vicinity of pile driving. Feist et al. (1992) reported juvenile salmon schools in Puget Sound were fewer in areas subjected to pile driving and likely avoiding the area of elevated sound; thus, it is likely that many other species of fish would also avoid areas with elevated noise levels during pile driving. Although no data are available to quantify the risk of exposure to the accumulated SEL threshold of 187 dB, NMFS believes that, for the reasons stated herein the potential risk of injury and mortality to green sturgeon is low. The noise and SPLs generated by pile driving will be detected by the green sturgeon. Most sturgeon within the action area would be expected to temporarily disperse with this intrusion, or move with tidal currents and behavioral movements. Adjacent areas in Central San Francisco Bay outside the action area provide fish sufficient area with habitat of similar or higher quality to avoid harm from increased sound levels in the action area and provide adequate carrying capacity to support individual sturgeon that are temporarily displaced during the 9-10 day period of pile driving.

As presented above, steel pipe piles struck with an impact hammer are the most likely to produce high sound pressure waves that can injure or kill fish. The Project proposes to use an impact hammer for the installation of all steel piles. The Project also proposes to install 30 plastic piles which are 12 to 18-inches in diameter. A vibratory hammer will be used to install these plastic piles. Sound pressure waves resulting from the driving of plastic piles are different than those of

steel piles. In comparison to steel, pressure levels produced from plastic piles hit with a hammer are lesser extremes in overpressure and underpressure in the sound waveform. These extremes in pressure changes are what produce the harmful sound waveforms exhibited during impact driving of steel piles. Injuries or mortalities of fish from the vibratory driving of plastic piles have never been observed. Hydroacoustic data collected from projects using vibratory hammers and similar piles (Illingworth and Rodkin Inc. 2007) indicates that sound pressure levels created during installation of these piles should not present a risk of physical injury or mortality to listed fish. Vibratory hammers produce SPLs which are considerably lower than impact hammers. Based on the above, the Project's installation of plastic piles (12 to 18-inches diameter) with a vibratory hammer is not expected to produce sound that would result in injury or mortality of individual green sturgeon.

2. Impacts to Water Quality

Water quality in the action area may be degraded during Project construction activities. Disturbance of soft bottom sediments during the removal of piles at the remnant recreational marina and installation of new piles are likely to result in temporary increased levels of turbidity. As described above for pile driving, the effects of construction activities on water quality would be limited to threatened green sturgeon, because CCC steelhead are not expected to be in the project area during the period of construction between July 31 and November 30.

a. Turbidity

High levels of turbidity may affect fish by disrupting normal feeding behavior, reducing growth rates, increasing stress levels, and reducing respiratory functions (Benfield and Minello 1996; Nightingale and Simenstad 2001). There is little direct information available to assess the effects of turbidity in San Francisco Bay estuary on juvenile or adult green sturgeon. However, this benthic species is well adapted to living in estuaries with a fine sediment bottom and is tolerant of high levels of turbidity, because they forage for prey organisms in bottom sediments.

As piles are driven and removed from the Bay floor, fine-grain sediments such as the clay and silt material found in and along the Alameda waterfront will be disturbed and generate increased levels of turbidity in the adjacent water column. The extent of turbidity plumes resulting from Project construction will depend on the tide, currents, and wind conditions during these activities. NMFS expects that the elevated levels of turbidity will be minor and localized due to the type of work performed by this Project. These areas of turbidity are expected to rapidly disperse from the project area with tidal circulation, as strong currents are present within Central San Francisco Bay.

Threatened green sturgeon in the estuary commonly encounter areas of increased turbidity due to storm runoff events, wind and wave action, and benthic foraging activities of other aquatic organisms. Fish generally react by avoiding areas of high turbidity and return when concentrations of suspended solids are lower. The minor and localized areas of turbidity associated with this Project's in-water construction activities are not expected to result in harm or

injury, or behavioral responses that impair migration, foraging, or make green sturgeon more susceptible to predation. If sturgeon temporarily relocate from areas of increased turbidity, areas of similar value are available in Central San Francisco Bay adjacent to the work sites which offer habitat of equal or better value for displaced individuals. Adjacent habitat areas also provide adequate carrying capacity to support individual sturgeon that are temporarily displaced during the Project's construction activities.

b. Contaminants

As described above in the *Environmental Baseline*, water and sediment quality within the action area is affected by stormwater runoff, industrial activities, and other urban influences. Results from testing of sediments within the vicinity of the action area show that sediments along the Alameda shoreline contain elevated concentrations of mercury and PCBs, however bioaccumulation levels are minor (Pacific EcoRisk 2012).

During the installation and removal of piles, bottom sediments will be suspended and contaminants may be released to the water column. However, based on the project description (including the type of activities conducted, the work span, and equipment used) the suspended plumes of sediment and potential contaminants released during construction are expected to be localized and short-term. Any minor and localized elevations in contaminants which might result from those suspended plumes should be quickly diluted by tidal circulation to levels that are unlikely to adversely affect listed green sturgeon and steelhead.

3. Impacts from Construction of the Seawall

The proposed removal of the existing seawall and construction of the replacement seawall may affect threatened green sturgeon. CCC steelhead are not likely to be affected by seawall demolition and construction because this species is not expected to be present in the action area during the construction period. The toe of the existing and new seawall is located 1-2 feet above MHHW; thus all project demolition and construction activities associated with the seawall are designed to occur outside of the waters of San Francisco Bay.

Although demolition activities will occur above the water line, debris could be a source of water pollution that affects fish by depleting the water of dissolved oxygen as the wastes decompose, or by introducing toxic materials to the aquatic habitat. The Project proposes to prevent unwanted materials from entering San Francisco Bay through the use of temporary catchments. In addition, the Project will have a spill contingency plan and supplies on site in case of any hazardous discharges. These proposed containment measures are expected to effectively prevent construction debris from becoming a source of water pollution. With regard to water quality, the effects of seawall demolition on green sturgeon and steelhead are expected to be insignificant or discountable.

Construction of the new concrete seawall will also occur along the upper portion of the shoreline

and above the waters of San Francisco Bay. This area is above the MWWL and work methods have been developed to avoid personnel and equipment from entering the waters of San Francisco Bay. As with demolition of the existing seawall, construction of the new seawall will implement sediment control and debris containment measures to prevent materials from entering the waters of San Francisco Bay. With the implementation of proposed containment measures, construction of the seawall is not expected to impact water quality or disturb fish in the vicinity.

The new seawall structure will be approximately 230 feet in length and extend approximately 70 feet to east further than the existing seawall. The construction of an additional 70 feet of concrete seawall has the potential to reduce the value of shoreline habitat for listed fish by creating a vertical shoreline/water interface and eliminating natural substrate that support aquatic plants and intertidal organisms. Under current conditions, the 70-foot long shoreline area to be modified by the new seawall is primarily comprised of rock rip rap. Since new seawall will be located 1-2 feet above MHHW, the existing rock rip rap below MHHW will remain in place. The area at which the new seawall will be placed is wetted only during extreme high water events and does not provide habitat value for steelhead or green sturgeon. In general, the shoreline within the action area is greatly disturbed by rock rip rap, bulkheads, piers, and Alameda Point is reported to be predominately built of land created by placing fill in the Bay (Baseline Environmental Consulting 2012). Considering the current condition of the shoreline in the action area and that the new seawall will be constructed above MHHW, the proposed replacement seawall is not expected to degrade existing habitat values or result in adverse impacts to designated critical habitat for CCC steelhead or the southern DPS of green sturgeon.

B. Effects of Dredging on Listed Species and Critical Habitat

For the Project's initial dredging episode, WETA proposes to remove approximately 47,100 cubic yards of accumulated sediment within a 5.5-acre area at the berthing site. Future dredging episodes may occur at 5 to 10 year intervals. A clamshell dredge with a 10 cubic yard bucket will be used between July 31 and November 30 to place material on a scow barge. All dredged materials will be transported by barge for disposal at SF-DODS approximately 50 miles outside the Golden Gate in water depths of approximately 10,000 feet, or transported to an upland wetland beneficial re-use site. Dredging has the potential to affect listed fish through degradation of water quality, re-suspension of contaminants, and entrainment.

1. Impacts to Water Quality

High concentrations of suspended sediment will occur during dredging near the bottom of the channel as a result of the clamshell dredge bucket contacting the Bay floor. Additional sediment from the clamshell bucket will likely be lost to the water column as the bucket is raised from the bottom and materials placed on a barge. As sediments on the Bay floor are mobilized, contaminants, if present, may also be released to the water column and become biologically available to listed fish and their prey organisms. This mobilization of fine-grain sediment and contaminants at the dredge site can remain in suspension for an extended period of time in the water column.

a. Turbidity

As discussed above for construction activities, high levels of turbidity may affect fish by disrupting normal feeding behavior, reducing growth rates, increasing stress levels, and reducing respiratory functions (Benfield and Minello 1996; Nightingale and Simenstad 2001). The extent of turbidity plumes resulting from dredging operations will depend on the tide, currents, and wind conditions during these activities. Although dredging may result in higher levels of turbidity for longer periods of time than the Project's construction activities, dredging operations will be restricted to the period between July 31 and November 30. This period avoids the migration seasons of both adult and juvenile CCC steelhead; thus, no direct effects to CCC steelhead are expected to occur. Threatened green sturgeon may be in San Francisco Bay year-round and may be exposed to the direct effects of dredging operations by the Project.

During clamshell dredging, sediments may become suspended in the water column by the bucket's impact to the bottom, material washing from the top and side of the bucket as it passes through the water column, sediment spillage as it breaks the water surface, spillage of material during barge loading, and intentional overflow in an attempt to increase the barge's effective load (Nightingale and Simenstead 2001). Clamshell dredges remove bottom sediment through the direct application of mechanical force to dislodge and excavate the material with little loss of sediment. With this technique, the dredged material ascends rapidly through the water column. However, if not properly maintained or operated, clamshell dredges may generate significant concentrations of suspended sediment throughout the water column. Also, dredging in areas with fine sediments are likely to have greater turbidity impacts than dredging in areas with coarse sediments (Sabol et al. 2005). This is because finer grain sediments (silts and clays) are more readily suspended and settle out slower than course sediments, such as sand and gravel.

A study characterizing the spatial extent of turbidity plumes during dredging operations in Oakland Harbor found that a mechanical dredge (closed bucket) generated elevated levels of suspended sediments and turbidity. Ambient Total Suspended Sediment (TSS) concentrations were typically less than 50 mg/l. While exact plume trajectories were dynamic, turbidity levels above ambient were detected up to 1,200 feet both up- and down-current from the source. But in general, significantly elevated TSS concentrations greater than 225 mg/l were detected up to 750 feet from the source (MEC Analytical Instruments, Inc. 2004).

Elevated levels of turbidity from the Project's dredging activities along the Alameda shoreline are expected to result in similar levels as those described above for the Oakland Harbor, because water current conditions and equipment are similar. The durations of such turbidity plumes will largely depend upon the currents at the site. Central San Francisco Bay is the deepest sub-embayment in the San Francisco Bay estuary, and has the strongest tidal currents within the estuary (Chin et al. 2010). Due to the location of the action area, currents are expected to be strong and dissipate turbidity plumes within hours, if not faster. Thus, NMFS anticipates green sturgeon to be exposed to turbidity plumes within approximately 750 radial feet from dredge sites for short durations.

Threatened green sturgeon in the San Francisco Bay estuary commonly encounter areas of increased turbidity due to storm flow runoff events, wind and wave action, and benthic foraging activities. Fish generally react by avoiding areas of high turbidity and return when concentrations of suspended solids are lower. The areas of turbidity associated with this Project's dredging is not expected to result in harm or injury, or behavioral responses that impair migration, foraging, or make green sturgeon or steelhead more susceptible to predation. If sturgeon temporarily relocate from by areas of increased turbidity, habitat of similar value is available in Central San Francisco Bay adjacent to the project site, and other areas in San Francisco Bay offer equal or better habitat value for displaced individuals. Adjacent habitat areas also provide adequate carrying capacity to support individual sturgeon that are temporarily displaced during in-water construction activities that may cause increases in turbidity.

b. Contaminants

As discussed above for construction activities, Central San Francisco Bay in the action area has been subject to loading by anthropogenic contaminants from both point and non-point sources (Perkowski and Beckvar 1997). Dredging can cause contaminated sediments to be suspended in the water column and re-deposited to areas where they become bio-available to listed fish after dredging is completed. Contaminated sediments re-suspended during dredging are expected to follow the same patterns as those described above for turbidity and extend approximately 750 feet from the proposed dredge site. Contaminated sediment released during dredging and deposited in areas outside the dredge footprint will be diluted as they travel through the water column.

Sediment to be removed by dredging was analyzed for contaminant concentrations and to determine the suitable of SF-DODS or beneficial re-use wetland sites for disposal. The sediments were subjected to full Inland Testing Manual testing (as per DMMO guidelines) to characterize these sediments and a Sample Analyses Report (SAR) was prepared (Pacific EcoRisk 2012) describing the results of testing. The sediments were characterized using three types of analyses: 1) analyzing all sediments for conventional and chemical parameters; 2) analyzing all sediments for benthic and water column toxicity; and 3) if the results of conventional and chemical parameter tests show that contaminants of concern exceed pre-determined thresholds, the sediments were analyzed to determine whether those contaminants have the potential to bioaccumulate in test organisms.

The SAR presents the results of the conventional and chemical analyses with comparisons to two reference sources: Bay ambient sediment concentrations (SFRWQCB 1998) and the SF-DODs reference site database. In summary, the key findings by Pacific EcoRisk (2012) from the conventional and chemical analyses were mercury and PCBs exceeded the reference thresholds. Therefore, mercury and total PCBs were subjected to further evaluation for bioaccumulation. The benthic toxicity test results for all composite sediment samples indicated that mercury and PCBs were not biologically available to cause toxicity in the 10-day sediment tests. Comparison of bioaccumulation test tissue mercury and PCB concentrations to the SF-DODS database

indicated that tissues mercury levels were below the SF-DODS reference site. Based on these results, all of the sediments were considered suitable for placement at SF-DODS or placement at a wetland beneficial re-use site. SF-DODS is located approximately 50 miles offshore from the Golden Gate in the Pacific Ocean with water depths of approximately 10,000 feet. If the Project utilizes SF-DODS for disposal, materials will be diluted to levels which significantly reduce the potential for bioaccumulation of contaminants in marine organisms. Additionally, listed anadromous salmonids and green sturgeon are unlikely to be found in the vicinity of SF-DODs, because these species are typically found on the continental shelf in ocean waters less than 500 feet deep. If the Project utilizes a wetland re-use beneficial site for disposal, materials will be placed within an area contained by levees and isolated from the waters of San Francisco Bay. Disposal of dredged materials at wetland re-use sites will have no effect on listed fish or water quality in San Francisco Bay. For these reasons, effects associated with disposal of dredged materials are expected to discountable.

Upon completion, dredging will create a newly exposed surface layer on the Bay floor at depths of -12 to -14 feet[8]. This surface, which was previously buried in sediment, may contain high levels of contaminants which become available for uptake by aquatic organisms. NMFS utilized the results of SAR to assess the potential for contaminants in the sediment to be exposed following dredging. Z-layer test results indicate the post-dredge mudline on the Bay floor will contain better (i.e., cleaner) sediment quality than the existing mudline, due to the removal of contaminated sediments by dredging operations (Pacific EcoRisk 2012). In addition, new sediment is expected to settle in the dredge area and cover the existing sediments quickly. These newly deposited sediments will likely consist of contaminant concentrations near Bay ambient conditions and thus, pose no increase in contaminant risk to steelhead and green sturgeon.

2. Impacts on Fish from Entrainment during Dredging

Dredging has the potential to entrain fish and other aquatic organisms in the clamshell dredge. Entrainment occurs when organisms are trapped during the uptake of sediments and water by mechanical dredging machinery. Benthic infauna are particularly vulnerable to being entrained by dredging uptake, but mobile epibenthic and demersal organisms such as burrowing shrimp, crabs, and fish may also be susceptible to entrainment under some conditions.

Threatened CCC steelhead will not be present in the action area during the July 31 to November 30 dredge period; thus, the potential for entrainment and disturbance of steelhead is discountable. However, green sturgeon could come in contact with the clamshell bucket of the mechanical dredge. Due to the short duration that mechanical dredging equipment is in contact with the bottom, and the relatively small size of the footprint of substrate affected by each dredge bucket, the likelihood of a green sturgeon being entrained is very low. The 10 cubic yard clamshell bucket is relatively small and dredging will be conducted in areas less than 14 feet MLLW. In this shallow water, dredging activities are expected to startle green sturgeon and fish will disperse from the immediately vicinity. Sturgeon that react behaviorally to dredging operations

[8] Dredged to -12 feet with two feet of over-dredge.

will have areas of adequate water depths and the open water in Central San Francisco Bay adjacent to work sites. Thus, startled fish will have sufficient area to escape and disturbance by dredging should not result in more than an insignificant effect on them.

Sturgeon are opportunistic feeders that consume a variety of prey items. In coastal bays and estuaries, green sturgeon feed on shrimp, clams, and benthic fish (Moyle *et al*. 1995; Erickson *et al*. 2002; Moser and Lindley 2007; Dumbauld *et al*. 2008). Proposed dredging activities in the berthing area of the facility may adversely affect benthic infauna at the site by directly removing or burying these organisms (Newell et al. 1998, Van der Veer et al. 1985). There is little information available to quantify the level of potential benthic infauna entrainment during dredging, although it is known to occur. A reduction in benthic organisms at the dredge site could lead to an overall reduction in the quality of sturgeon foraging habitat in the action area. Upon the completion of a dredging episode, benthic organisms will recolonize the site over time. Rates of recovery listed in the literature range from several months to several years for estuarine muds (McCauley et al. 1976, Oliver et al. 1977, Currie & Parry 1996, Tuck et al.1998, Watling et al. 2001). Oliver et al. (1977) reports recolonization can take up to 3 years in areas of strong current and up 10 years in areas of low current. Collie et al (2000) reports some aquatic invertebrates re-colonize areas within a few months of a disturbance activity. Although temporary, forage resources for fish that feed on the benthos are expected to be reduced during this recovery period. Based on site conditions in the action area, NMFS will assume full recovery of prey resources within the direct footprint of the dredged area activities will require at least one year. Due to the small size of the dredge site (approximately 5.5 acres for the initial episode and up to 13.5 acres for future maintenance) and the large amount of alternative forage sites that are located nearby, the temporary reduction in forage species at these sites are not expected to result in the reduced fitness of individual steelhead or sturgeon. Impairment of PCEs of designated critical associated with food resources are expected to recover within 12-18 months following each dredging episode.

C. Effects of Shading and Covering Benthic Habitat

Overwater structures, such as docks and piers, result in shading of water column and benthic habitats. Shading is known to have the potential to reduce growth of submerged aquatic vegetation, decrease primary productivity, alter predator-prey interactions, change invertebrate assemblages, and reduce the density of benthic invertebrates (Helfman 1981; Glasby 1999; Struck et al. 2004; Stutes et al. 2006) all of which may lead to an overall reduction in the quality of fish habitat.

For construction of the Central Bay Operations and Maintenance Facility, the Project will remove the remnants of a former recreational marina which includes approximately 20,220 square feet of overwater structure in the action area. The new facility will include 16,215 square feet of new overwater structure. Thus, upon completion, the Project will result in the net removal of approximately 4,000 square feet of overwater structure in the action area. However, some additional shading will occur periodically from vessels moored for servicing and layover. To minimize the effects of shading by the new facility, walking surfaces will be grated for light

penetration. The net removal of overwater structure will allow light penetration to areas previously shaded and these sites will have the opportunity to re-colonize with submerged vegetation and benthic organisms. In consideration of the net reduction of overwater structure in the action area and the light transmission that will be provided by grated walkways, the effects of shading on submerged benthic areas by the new facility are expected to have negligible effects on listed fish, their prey items, and critical habitat in the action area.

D. Effects of Future Operations on Listed Species and Critical Habitat

Long-term ferry maintenance facility operations such as refueling, fluid leakage, and equipment maintenance at Alameda Point pose some risk of contamination of aquatic habitat and subsequent injury or death to threatened steelhead and green sturgeon. Oils and similar substances from ferry maintenance activities can contain a wide variety of polynuclear aromatic hydrocarbons (PAHs), and metals. Both can result in adverse impacts to listed fish. PAHs can harm the benthic prey items (Eisler 2000). Some of the effects that metals can have on fish are: immobilization and impaired locomotion, reduced growth, reduced reproduction, genetic damage, tumors and lesions, developmental abnormalities, behavior changes (avoidance), and impairment of olfactory and brain functions (Eisler 2000).

To address any potential for the release of toxic substances into the waters of San Francisco Bay, the Project will prepare and implement a Spill Prevention, Control and Countermeasures (SPCC) Plan. The SPCC Plan will specify restrictions and procedures for fuel storage location, fueling activities, and equipment maintenance. In addition, the Project will prepare a Stormwater Pollution Prevention Plan to protect water quality during construction. The SWPPP will include measures to collect and contain the discharge of pollutants from construction sites. Post-construction, stormwater runoff from the site will be collected with a new system of onsite catch basins and pipes. Site run-off will be treated by oil-water separators and treatment vaults prior to connecting to an existing 12-inch storm drain. Due to these measures, NMFS expects that the potential for release of toxic substances as a result of future operations is discountable and are, therefore, unlikely to adversely affect fish.

The new maintenance facility will contain berths for passenger ferry vessels during maintenance and mooring. Ferry boats traveling to and from the berths are expected to disturb bottom sediments and generate increased levels of turbidity in the water column. Noise associated with ferry boat traffic may startle fish. Although there is no water quality or sound data to quantify these levels, observations from similar ferry boat operations in Vallejo, Larkspur, Sausalito and other, similar locations around the San Francisco Bay indicate these impacts will be minor, localized, and limited to short periods of time during the arrival and departure of the ferry boats.

With 11 ferries transiting the berthing facility up to four times each day (departure in the morning, arrival mid-day, departure mid-day, and arrival at the end of day), the total number of future ferry boat arrivals and departures at the Central Bay Operations and Maintenance Facility

is expected to range from 30 to 44 trips per day[9]. Increased levels of turbidity associated with ferry boat arrivals and departures are expected last for a matter of a few minutes during each trip. Under the scenario of 30 to 44 trips per day, cumulative disturbance over a day is expected to range between one and three hours. These short-term increases in turbidity are expected to rapidly return to background levels with tidal circulation. Fish startled by elevated noise levels will have adequate opportunity to avoid boat traffic in adjacent open-water areas in Central San Francisco Bay.

Increased boat traffic in the area could facilitate the spread of the non-native Asian kelp *Undaria pinnatifida*. The invasive kelp is a native of the Western Pacific (e.g., Japan, Korea), is quick-growing and opportunistic, and can quickly become established on ship hulls, moorings, ropes, and docks. Invasive kelp negatively impacts native species by outcompeting native vegetation for space and light. *Undaria* has been documented in California since 2000. In 2009, it was documented in the San Francisco Marina and at several locations along the City of San Francisco waterfront. Ferry traffic associated with this Project may increase the potential spread; however, its potential effect on threatened CCC steelhead and green sturgeon and their critical habitat is not expected to be significant because the action area does not currently support eelgrass or other species of submerged vegetation. Overall, the effects of ferry boat traffic at the site on the aforementioned listed species and designated critical habitat are expected to be discountable or insignificant.

VII. CUMULATIVE EFFECTS

Cumulative effects are defined in 50 CFR § 402.02 as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the federal action subject to consultation". Any future federal actions will be reviewed through separate section 7 consultation processes and not considered here.

NMFS does not anticipate any cumulative effects in the action area other than those ongoing actions already described in the Environmental Baseline above, and resulting from climate change. Given current baseline conditions and trends, NMFS does not expect to see significant improvement in habitat conditions in the near future due to existing land and water development in San Francisco Bay. In the long term, climate change may produce temperature and precipitation changes that may adversely affect listed anadromous salmonids and green sturgeon habitat in the action area. Productivity in the San Francisco Bay is likely to change based on changes in freshwater flows, nutrient cycling, and sediment amounts (Scavia et al. 2002). In marine environments, ecosystems and habitats important to sub-adult and adult salmonids are likely to experience changes in temperatures, circulation and chemistry, and food supplies (Feely et al. 2004, Brewer 2008, Osgood 2008, Turley 2008). Many of these changes may place further stress salmonid and green sturgeon populations.

[9] A single trip is defined as a ferry boat arriving or departing from the facility.

VIII. INTEGRATION AND SYNTHESIS

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 the population, especially when combined with the current depressed population status and human caused impacts. Within the Project's action area in Central San Francisco Bay, the effects of shoreline development, industrialization, and urbanization are evident. These activities have eliminated tidal marsh habitats, introduced non-native species, degraded water quality, contaminated sediment, and altered the hydrology and fish habitat of the action area. As a result, forage species that steelhead and green sturgeon depend on have been reduced, periodic sources of contaminants are introduced from ships, piers, adjacent land areas, and stormwater runoff, and natural shoreline habitat areas have been eliminated.

Since construction and dredging activities for the proposed Project will occur between July 31 and November 30, CCC steelhead are not likely to be present in or near the action area during these activities. However, green sturgeon are expected to occur in the action area during construction and dredging.

During construction and dredging, water quality in the action area may be degraded through the disturbance of bottom sediments. Turbidity effects associated with construction activities will likely result in minor and temporary changes to fish behavior, and are not expected to adversely affect green sturgeon. NMFS does not anticipate any adverse effects to listed species or critical habitat from the on-land portion of the proposed Project, because the applicant will implement measures during construction and post-construction that prevent the runoff and discharge of pollutants from landside activities to the waters of San Francisco Bay.

Dredging may result in higher levels of turbidity for longer periods of time than other in-water activities. The Project proposes to use a mechanical (clamshell) dredge for dredging between July 31 and November 30. This period avoids the migration periods of CCC steelhead in San Francisco Bay and few green sturgeon are expected to be present at or in close proximity to dredge site during dredging activities. Anticipated turbidity levels are not expected to result in harm or injury, or behavioral responses that impair migration, foraging, or make green sturgeon more susceptible to predation. No adverse effects are anticipated at the potential dredge disposal sites, because the wetland restoration re-use sites are isolated from the waters of San Francisco Bay by levees and the SF-DODS is located in the open ocean approximately 50 miles off-shore with water depths of 10,000 feet. At SF-DODS, threatened CCC steelhead and green sturgeon are unlikely to be present because these species are typically found on the continental shelf in ocean waters less than 500 feet deep. Post-dredging, the newly exposed Bay floor surface is expected to contain lower levels of contaminants in the sediments when compared to pre-dredge sediment levels.

Threatened green sturgeon may be adversely affected by elevated underwater sound levels during the driving of large steel piles with an impact hammer. Peak SPLs above 206 dB from a single strike will be limited to the area immediately adjacent to the pile (3 and 7 feet from the pile). It is unlikely individual fish will occur within this close in proximately during construction activities since equipment will likely startle fish away from the pile driving sites before pile driving initiates and a bubble curtain will likely prevent fish from being located within 7 feet of the piles. However, accumulated SELs may result in injury or death to green sturgeon if individuals remain within a distance of 660 feet from the piles being driven. NMFS expects the number of green sturgeon exposed to this effect to be small because the duration of pile driving is short (9-10 days), the area of effect is small, and the abundance of green sturgeon in the action area expected to be low. In addition, exposed sturgeon would be unlikely to remain in the same location to experience the full duration of the pile driving due to tidal currents and behavioral movements. Behavioral effects during pile driving may extend up to 3,281 feet. This noise may discourage green sturgeon from utilizing the action area during construction, but this area represents a small portion of the Central San Francisco Bay and these habitat areas will become available again once the 9-10 days of pile driving is completed.

Removal of the remnant marina and construction of the new berthing facility will result in the elimination of approximately 4,000 square feet of overwater structures. This removal of structure will allow light penetration to areas previously shaded and these sites will have the opportunity to re-colonize with submerged vegetation and benthic organisms.

Upon completion, the new facility will contain berths for passenger ferry vessels during maintenance and mooring. With 11 ferries transiting the berthing facility up to four times each day, water quality may be degraded and fish startled by this disturbance. Increased levels of turbidity and fish disturbance associated with ferry boat arrivals and departures are expected last for a matter of a few minutes during each trip, and the effects of this boat traffic are expected to be insignificant.

Based on the above, a small number of juvenile, sub-adult, and adult green sturgeon are expected to be adversely affected by the Project's proposed pile driving activities. However, it is unlikely that the small potential loss of individuals as a result of the Project will impact future adult returns, due to the large number of individual green sturgeon unaffected by the Project compared to the small number of green sturgeon likely affected by the Project. Due to the life history strategy of green sturgeon which spawn every 3-5 years over an adult lifespan of as much as 40 years (Moyle 2002), the few individuals injured or killed during pile driving are likely to be replaced in subsequent generations of green sturgeon. For CCC steelhead, the Project's construction and dredging window will avoid their migration periods and the effects of Project activities are anticipated to be discountable or insignificant.

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 is likely to decrease by as much as 70 to 90 percent by the end of this century under the

highest emission scenarios modeled. Reductions in the amount of snowfall and rainfall would reduce stream flow levels in Northern and Central Coastal rivers. Estuaries may also experience changes in productivity due to changes in freshwater flows, nutrient cycling, and sediment amounts. For this Project, construction would be completed within the next 2-3 years and the above effects of climate change will not be detected within that time frame. The short-term effects of project construction will have completely elapsed prior to initiation of climate change effects. Since the effects to listed fish associated with the future operation of the facility are insignificant or discountable, future climate change effects will not add to the anticipated effects of this Project.

IX. CONCLUSION

After reviewing the best available scientific and commercial data, the current status of CCC steelhead, the current status of the southern DPS of green sturgeon, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is NMFS' biological opinion that the construction and future operation of the Central Bay Operations and Maintenance Facility in Alameda, California is not likely to jeopardize the continued existence of threatened CCC steelhead and threatened southern DPS green sturgeon.

After reviewing the best available scientific and commercial data, the current status of the critical habitat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is NMFS' opinion that the construction and future operation of the Central Bay Operations and Maintenance Facility in Alameda, California is not likely to adversely modify or destroy critical habitat for CCC steelhead and southern DPS green sturgeon.

X. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by NMFS as an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are nondiscretionary, and must be undertaken by the Federal Transit Administration (FTA) for the exemption in section 7(o)(2) to apply. FTA has a

continuing duty to regulate the activity covered by this incidental take statement. If FTA (1) fails to assume and implement the terms and conditions, or (2) fails to require its designees to adhere to the terms and conditions of the incidental take statement, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, FTA must report the progress of the actions and its impact on the species to NMFS as specified in the incidental take statement (50 CFR §402.14(I)(3)).

A. Amount or Extent of Take

NMFS anticipates that take of threatened southern DPS green sturgeon associated with the construction of the Central Bay Operations and Maintenance Facility in the Alameda, California will be in the form of mortality and/or injury during pile driving for construction of the new facility. The number of green sturgeon that may be incidentally taken during construction activities at the Central Bay Operations and Maintenance Facility is expected to be small.

Finding dead or injured fish will be difficult due to their small size in relation to the size of the action area, the difficulty in observing dead or injured fish in the waters of Central San Francisco Bay due to depth, lack of water clarity, and the presence of predators and scavengers such as birds. Therefore, NMFS will use the area of sound pressure wave impact extending into the water column from each pile, and the time period for pile driving as a surrogate for number of fish. For threatened green sturgeon, those fish located within 660 feet of project site during the installation of the Project's steel piles may be injured or killed. If Project hydroacoustic monitoring indicates that accumulated sound pressure levels greater than 187 dB SEL (re: 1 μPa^2-s) extend beyond 660 feet during the installation of any of the piles, the amount of incidental take may be exceeded.

B. Effect of the Take

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

C. Reasonable and Prudent Measures

NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize take of southern DPS green sturgeon:

1. Ensure construction methods, minimization measures, and monitoring are properly implemented and assists in the evaluation of Project's effects on green sturgeon.

2. Submit reports regarding the construction of the Project and the results of the hydroacoustic monitoring program.

D. Terms and Conditions

The FTA and WETA must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and define the reporting and monitoring requirements.

In order to be exempt from the prohibitions of section 9 of the ESA, FTA, WETA, and their designees must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and present reporting/monitoring requirements. These terms and conditions are nondiscretionary.

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

    a. Prior to the initiation of construction, WETA shall develop and submit to NMFS for review a hydroacoustic monitoring plan that includes underwater sound measurements at various distances and depths from pile driving operations;

    b. WETA shall make available to NMFS data from the hydroacoustic monitoring program on a real-time basis (*i.e.,* daily monitoring data should be accessible to NMFS upon request).

    c. WETA shall 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 opinion.

    d. If any sturgeon or salmonids are found dead or injured during visual observations, the biologist shall contact NMFS biologist Gary Stern by phone immediately at (707) 575-6060 or the NMFS North Central Coast Office at (707) 575-6050. All sturgeon mortalities shall be retained, placed in an appropriately-sized sealable plastic bag, labeled with the date and location of collection, fork length, and be frozen as soon as possible. Frozen samples shall be retained by the biologist until specific instructions are provided by NMFS. The biologist may not transfer biological samples to anyone other than the NMFS North Central Coast Office without obtaining prior written approval from the NMFS North Central Coast Office, Supervisor of the Protected Resources Division. Any such transfer will be subject to such conditions as NMFS deems appropriate.

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

    a. The FTA or WETA shall provide a written report to NMFS by January 15 of the year following construction of the Project. The report shall be submitted to NMFS North Central Coast Office, Attention: Supervisor of Protected Resources Division, 777 Sonoma Avenue, Room 325, Santa Rosa, California, 95404-6528. The report shall contain, at a minimum, the following information:

i. Construction related activities -- The report shall include the dates construction began and was completed; a description of any and all measures taken to minimize effects on ESA-listed fish; and the number of fish killed or injured during the project action.

ii. Hydroacoustic monitoring -- The report shall include the a description of the methods used to monitor sound, the dates that hydroacoustic monitoring was conducted; the locations (depths and distance from point of impact) where monitoring was conducted; the total number of pile strikes per pile, total number of strikes per day, the interval between strikes, the peak/SPL, RMS and SEL per strike, and accumulated SEL per day for each hydroacoustic monitor deployed; and the number of fish killed or injured during the pile driving.

XI. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, or to develop information. NMFS has the following conservation recommendation:

a. FTA and WETA should provide support and funding for salmonid and sturgeon tagging and monitoring programs in the San Francisco Bay.

XII. REINITIATION NOTICE

This concludes formal consultation for the Central Bay Operations and Maintenance Facility in Alameda, California. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the amount or extent of incidental take is exceeded, formal consultation shall be reinitiated immediately.

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Personal Communication

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Figure 1. Location of WETA's Central Bay Operations and Maintenance Facility in San Francisco Bay.

Figure 2. Area in San Francisco Bay which will be subject to sound levels that could result in the injury or mortality of listed fish (*i.e.*, in excess of 206 dB peak sound pressure level for any single strike and/or accumulated sound exposure level of 187 dB referenced to one micropascal).

Enclosure 2

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

ACTION AGENCIES: Federal Transit Authority

ACTION: Water Emergency Transportation Authority (WETA) Central Bay Operations and Maintenance Facility

CONDUCTED BY: National Marine Fisheries Service, Southwest Region

TRACKING NUMBER: 2011/05520

DATE ISSUED: **October 31, 2012**

Statutory and Regulatory Information

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

Pursuant to the MSA, each federal agency is mandated to consult with NMFS (as delegated by the Secretary of Commerce) with respect to any action authorized, funded, or undertaken, or proposed to be, by such agency that may adversely affect any EFH under this Act. 16 U.S.C. §1855(b)(2). The MSA further mandates that where NMFS receives information from a Fishery Management Council or federal or state agency or determines from other sources that an action authorized, funded, or undertaken, or proposed to be, by any federal or state agency would

adversely effect any EFH identified under this Act, NMFS has an obligation to recommend to such agency measures that can be taken by such agency to conserve EFH. 16 U.S.C. §1855(4)(A). The term "adverse effect" is interpreted at 50 C.F.R. §600.810(a) as any impact that reduces quality and/or quantity of EFH and may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce quantity and/or quality of EFH. In addition, adverse effects to EFH may result from actions occurring within EFH or outside EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

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

Background and Consultation History

This EFH consultation pertains to the proposed Water Emergency Transportation Authority (WETA) Central Bay Operations and Maintenance Facility project in the City of Alameda, California. The Federal Transit Authority (FTA) is the federal action agency and proposes to provide funds to WETA for the project.

NMFS has reviewed information provided from the following sources to evaluate potential impacts to EFH:

- California Environmental Quality Act Initial Study/ Mitigated Negative Declaration (MND) - March 2011
- WETA Consultation Initiation Letter and Biological Assessment- January 30, 2012
- Meeting with NMFS, WETA, and project consultants - April 3, 2012
- Revised Biological Assessment – April 30, 2012
- Sediment Sampling and Analysis Report - May 7, 2012
- Response to NMFS questions, from Mike Gougherty (WETA) - March 16, October 15, October 18, 2012

Proposed Action

The Operations and Maintenance Facility will serve as the Central San Francisco Bay base for WETA's ferry fleet, and it will include the Operations Control Center and Emergency Operations Center. The proposed marine facility will provide berthing slips for up to 11 vessels for servicing and inspection. Vessels would be moored for servicing and layover about 80% of the time. Although no regular passenger loading is anticipated at this site, berths would be capable of loading and unloading passengers in the event of an emergency.

The project proposes:

- Landside facilities including a four-story, 25,000 square foot building, four below-grade vaults for diesel fuel, and on-site catch basins and pipes for stormwater runoff.
- Replacement of existing 160-foot long concrete seawall with a new 230-foot long seawall in the same location above mean high water, but extending an additional 70 feet east.
- Construction of marine facility that would include floating docks (constructed of compartmented concrete pontoons), a gangway and gangway landing, and a system of ramps and platforms, with a total footprint of about 0.46 acres (16,215 square feet). Ramps, gangways, and floating finger docks would be 8 feet wide. Gangways will have grated, aluminum surfaces that provide light penetration. The gangway landing is approximately 20 feet by 40 feet and constructed with concrete. The structures would require installation of up to 50 new steel piles and 30 plastic piles;
- New dredging of approximately 5.5 acres within the basin to -10 feet with an additional -2 feet of allowed overdepth, removing an estimated 47,100 cubic yards of sediment.
- Maintenance dredging within the 13.5 acre vessel operating area. Based on sedimentation rates, approximately 22,000 cubic yards of material would be dredged once every 5 to 10 years.

Avoidance and minimization measures for the project include:

- Vessels will use an existing navigation channel to access the facility;
- A 500-foot access corridor has been established to protect wildlife along the shoreline at the adjacent Alameda National Wildlife Refuge. All construction, maintenance and ferry vessels will utilize this access corridor and adhere to a maximum 5 miles per hour speed limit.
- Monitoring for turbidity will be conducted during dredging (outside the 500 foot mixing zone), ensuring that Basin Plan standards for turbidity are met during dredging activities. If turbidity levels exceed San Francisco Bay Basin Plan standards, operational controls or silt curtains may be used.
- During the driving of all steel piles with an impact hammer, a bubble curtain will be used to attenuate sound levels. Underwater sound levels will be monitored and results will be used real-time to maximize the effectiveness of the bubble curtain. A hydro acoustic monitoring plan will be prepared and submitted to NMFS for review and approval prior to the initiation of construction.
- Following completion of dredging, WETA will conduct "z-layer" sediment sampling to assess conditions on the newly exposed bay bottom. If sediments contain bioaccumulative contaminants above certain thresholds (e.g., specified in the project's biological assessment), further actions will be pursued to prevent exposure to aquatic organisms.

<u>Action Area</u>

The proposed project site is owned by the City of Alameda and was leased to the United States Navy as part of a former Naval Air Station (NAS) Base Realignment and Closure (BRAC) area, now known as Alameda Point. The station was closed in 1997 with approximately 20,220 square feet of overwater structures from an old marina, 35 existing concrete piles, and debris

remaining in the waterside portion of the site. The marine portion of the site ranges from 0 to -40 feet (MLLW) and is protected by a breakwater, with rip-rap shorelines, floating debris from the old dock, and pilings of the Alameda Point Pier. The open-water portion of the site area is primarily unvegetated and substrate is primarily mud/silt/clay. No eelgrass has been documented at the site, but riprap supports two small (less than 5 square feet) patches of pickleweed (*Salicornia*sp.). Oysters have not been documented at the site but have been found at or near the Encinal Boat Launch approximately 0.5 mile southeast of the proposed facility (CEQA 2011). Sediment at the project site proposed for dredging has been characterized and elevated levels of polychlorinated biphenyls (PCBs) and mercury have been identified (Cotsifas 2012).

The proposed project occurs within EFH for various federally managed fish species within the Pacific Groundfish, Pacific Salmon and Coastal Pelagic Fishery Management Plans (FMPs). In addition, the project occurs within areas designated as Habitat Areas of Particular Concern (HAPC) for various federally managed fish species within the Pacific Groundfish FMP. HAPC are described in the regulations as subsets of EFH which are rare, particularly susceptible to human-induced degradation, especially ecologically important, or located in an environmentally stressed area. Designated HAPC are not afforded any additional regulatory protection under MSA; however, federal projects with potential adverse impacts to HAPC will be more carefully scrutinized during the consultation process. As defined in the Pacific Groundfish FMP, the proposed project is within estuary HAPC.

Effects of the Action

Based on information provided in the EFH assessment and developed during consultation, NMFS concludes the proposed action would adversely affect EFH for various federally managed species within the Pacific Groundfish, Pacific Salmon, and Coastal Pelagic FMPs through: (1) temporary and repeated disturbance of benthic habitat including the removal/burial of prey organisms; (2) temporary and long-term increases in levels of turbidity/suspended sediments; (3) noise disturbances; (4) residual contaminant exposure, including metals and organics; (5) alteration to hydrodynamics and physical habitat; (5) changes to permanent shading of benthic and pelagic habitat; and (6) potential spread of invasive species.

Benthic disturbance

Proposed new dredging of 47,100 cubic yards over 5.5 acres and future maintenance dredging of 22,000 cubic yards over 13.5 acres would result in benthic disturbance and removal of invertebrate prey within the dredge footprint. Many EFH species forage on infaunal and bottom-dwelling organisms, such as polychaete worms, crustacean, and other EFH prey types. Dredging may adversely affect these prey species at the site by directly removing or burying these organisms (Newell *et al.* 1998, Van der Veer *et al.* 1985). Forage resources for fish that feed on the benthos may be substantially reduced before recovery is achieved, and future maintenance dredging will result in repeated disturbance at intervals of 5 to 10 years. 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 (McCauley *et al.* 1976, Oliver *et al.* 1977, Currie & Parry 1996, Tuck *et al*.1998, Watling *et al.* 2001) to up to 2 to 3 years for sands and gravels (Reish 1961, Thrush *et al.* 1995, Watling *et al.* 2001, Gilkinson *et al.* 2005). Recolonization can also take up to 1 to 3 years in areas of strong current but up to 5 to 10 years in areas of low current (Oliver *et al.* 1977). Based on available literature, NMFS will assume recovery of prey resources will require more than one year.

Turbidity

NMFS anticipates that proposed dredging will result in short-term degradation and/or loss of EFH through increased turbidity from disturbed sediments within the action area. Long-term impacts may also result from increased turbidity associated with ferry traffic. While fish in San Francisco Bay are exposed to naturally elevated concentrations of suspended sediments resulting from storm flow runoff events, wind and wave action, and benthic foraging activities of aquatic organisms (Schoellhammer 1996), dredging and other human-induced concentrations of suspended sediments may be significantly elevated to have direct effects on fish behavior. If suspended sediment loads remain high for an extended period of time, fish may suffer increased larval mortality (Wilber & Clarke 2001), reduced feeding ability (Benfield & Minello 1996) and be prone to fish gill injury (Nightingale & Simenstad 2001a). Furthermore, the primary productivity of an aquatic area may be reduced if high levels occur for extended periods of times (Cloern 1987).

Proposed turbidity monitoring and use of silt curtains and/or operation controls when needed should control turbidity associated with dredging in the project area.

Noise

Temporary increases in noise levels generated by piling installation and construction activities may adversely affect the ecological functioning of EFH and may cause fish to temporarily leave the area. As discussed in the attached Biological Opinion for the proposed project, use of vibratory hammer and bubble curtain with use of impact hammer will minimize adverse effects to fish from sound pressure waves.

Contaminants

Dredging can negatively impact aquatic habitats by re-suspending bottom sediments and recirculating toxic metals, hydrocarbons, and other bioaccumulative contaminants into the water column (USEPA 2000, SFEI 2008). Any toxic metals and organics associated with fine-grained particulates in the sediment may become biologically available to organisms either in the water column or through food chain processes.

Long-term impacts may be associated with residual chemical concentrations from newly exposed sediment. Dredging residuals are also generated when contaminated sediments are suspended during excavation and re-deposited on the surface of the project area where they may continue to be exposed to the aquatic community after the project is complete. Dredging residuals contribute to long-term risk at the site, including bioaccumulative risk, if they are sufficiently thick and extensive (USACE *et al.* 2009). Any residual toxic metals and organic contaminants absorbed or

adsorbed to fine-grained particulates in the surface layer of sediment may become available to organisms either in the water column or through food chain processes.

Proposed sediment disposal at the Deep Ocean Disposal Site, turbidity conservation measures, and conservation recommendations regarding z-layer testing should address adverse effects of contaminated exposed by proposed project activities.

Hydrodynamics and Physical Habitat

The proposed project could result in impacts to hydrodynamics and physical structure of the project area, including shoreline erosion from ferry wakes and scouring of soft benthic habitat in the dredge channel and adjacent mudflats from ferry propellers. The project includes operating limits for vessels accessing the facility to prevent shoreline erosion, including speed limits and minimum distances from shore. Speed limits would also likely reduce the scour of benthic habitat.

Shading

The new facility consists of approximately 16,215 square feet of overwater structure, which will shade intertidal and subtidal habitats of San Francisco Bay. Shading is known to reduce growth of submerged aquatic vegetation, decrease primary productivity, alter predator-prey interactions, change invertebrate assemblages, and reduce the density of benthic invertebrates (Helfman 1981; Glasby 1999; Struck *et al.* 2004; Stutes *et al.* 2006); all of which lead to an overall reduction in the quality of EFH. Additional shading will occur from vessels moored for servicing and layover. WETA will offset this overwater shading through removal of the approximately 20,220 square feet of existing structure, and use of grated aluminum for surface of new gangway to increase light transmittance.

Invasive Species

Increased boat traffic between the eastern shore of San Francisco Bay and the City of San Francisco waterfront could facilitate the spread of the non-native Asian kelp *Undaria pinnatifida*. The invasive kelp is a native of the Western Pacific (e.g., Japan, Korea) is quick-growing and opportunistic and can quickly become established on ship hulls, moorings, ropes, and docks. Invasive kelp negatively impacts native species by outcompeting for space and light. *Undaria* has been documented in California since 2000. In 2009, it was documented in the San Francisco Marina and at several locations along the City of San Francisco waterfront.

<u>EFH Conservation Recommendations</u>

As described in the above effects analysis, NMFS has determined that the proposed WETA Central Bay Operations project would adversely affect EFH for various federally managed fish species within the Pacific Groundfish, Pacific Salmonid, and Coastal Pelagic FMPs through disturbance to benthic invertebrate from dredging and increased risk of spread of invasive kelp from boat traffic. To avoid, minimize and/or otherwise mitigate for those adverse effects, NMFS provides the following EFH Conservation Recommendations:

1. To prevent the spread and establishment of invasive species related to boat traffic and new hard structures in the estuary, NMFS recommends ongoing monitoring (and, if necessary, an eradication program) for invasive *Undaria pinnatifida* (Asian Kelp). We encourage you to consult with the Smithsonian Environmental Research Center in Tiburon on this measure and notify them if *Undaria pinnatifida* is identified at the site.

2. NMFS recommends a compensatory mitigation package to compensate for impacts from new dredging. NMFS prefers direct or in-kind mitigation. Because there are limited examples of new dredging in San Francisco Bay and, thus, limited examples for compensatory mitigation for impacts from new dredging, we encourage coordination of these efforts through San Francisco Bay Joint Venture program (SFBJV) and/or the Dredge Material Management Office (DMMO). Mitigation for this project may be combined with WETA's proposed Berkeley Ferry Terminal dredging mitigation.

Please be advised that regulations 50 CFR 600.920k to implement the EFH provisions of the MSA require your office to provide a written response to this programmatic consultation within 30 days of its receipt and prior to its use. A preliminary response indicating the anticipated submission date of the final response is acceptable if a final response cannot be completed within 30 days. Your final response must include a description of how the EFH Conservation Recommendations will be implemented and any other measures that will be required to avoid, mitigate, or offset the adverse impacts of the activity. If your response is inconsistent with any of our EFH Conservation Recommendations, you must provide an explanation for not implementing the recommendations at least 10 days prior to final approval of the action. This explanation must include 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.

Supplemental Consultation

Pursuant to 50 CFR 600.920(l), the FTA 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.

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