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

JUL 17 2012

In response reply to:
2012/02694

Lieutenant Colonel John K. Baker
U.S. Department of the Army
San Francisco District Corps of Engineers
1455 Market Street, 16th Floor
San Francisco, California 94103-1398

Dear Colonel Baker:

Thank you for your staff's electronic mail (e-mail) message to NOAA's National Marine Fisheries Service (NMFS) requesting reinitiation of consultation pursuant to section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 *et seq.*) for the U.S. Army Corps of Engineers' (Corps) and San Francisco Port's (Port) proposed Pier 36 Demolition/Brannan Street Wharf Project (Corps File No. 320786). The Corps is requesting re-initiation of consultation on the Pier 36/Brannan Street Wharf project to address modifications to the project from what was described in the September 16, 2011, biological opinion (File No. 2011/00608). That September 16, 2011, biological opinion indicated that a bubble curtain will be used for all pile driving; however, in its May 12, 2012, e-mail message, the Corps clarified the project description to restrict the use of a bubble curtain to the driving of steel shell piles (24- and 36-inch diameter). A bubble curtain will not be used during the driving of the 24-inch diameter octagonal concrete piles. In addition, the Corps modified the project description to include the installation of 5 more 24-inch diameter concrete piles and 1800 cubic yards of riprap along a concrete seawall adjacent to the Brannon Street Wharf.

The majority of demolition activities described in the September 16, 2011, biological opinion has been completed by the Corps. The Corps did not observe any adverse effects of the project on listed species from the demolition work that was completed. The remaining work needed to complete the project includes demolition of a section of the existing marginal wharf and construction of the new Brannon Street wharf. The Corps is proposing to authorize the Port to construct the new Brannon Street Wharf under the Nationwide Permit provisions of Section 404 of the Clean Water Act.

The enclosed biological opinion is based on our review of the Corps' and Port's project and describes NMFS' analysis of potential effects on the threatened Central California Coast (CCC) steelhead (*Oncorhynchus mykiss*) distinct population segment (DPS), the threatened Southern

DPS of threatened North American green sturgeon (*Acipenser medirostris*), and designated critical habitat for these two species in accordance with section 7 of the ESA. Threatened CCC steelhead and threatened North American green sturgeon are present within the project's action area and Central San Francisco Bay is designated critical habitat for both species. In the enclosed biological opinion, NMFS concludes that the project is not likely to jeopardize the continued existence of CCC steelhead or southern DPS green sturgeon. NMFS has also concluded the proposed project is not likely to result in the destruction or adverse modification of critical habitat for CCC steelhead or green sturgeon. However, NMFS anticipates take of CCC steelhead and southern DPS green sturgeon may occur as a result of project construction. An incidental take statement with non-discretionary terms and conditions is included with the enclosed draft biological opinion.

Please contact Amanda Morrison at (707) 575-6083 if you have any questions concerning this section 7 consultation, or if you require additional information.

Sincerely,

Mark Helvey

for Rodney R. McInnis
Regional Administrator

Enclosure

cc: Chris Yates, NMFS, Long Beach, California
Tessa Bernhardt, Corps, Environmental Section A, San Francisco, California
Chuck Armor, California Department of Fish and Game, Bay Delta Region, Napa, California
Ryan Olah, FWS, Sacramento, California
Copy to File 151422SWR2011SR00130

Enclosure

BIOLOGICAL OPINION

ACTION AGENCY:	U.S. Army Corps of Engineers, Environmental Planning Section A, San Francisco District
ACTION:	Completion of Pier 36 Demolition/Brannan Street Wharf Project in San Francisco, California.
CONSULTATION CONDUCTED BY:	National Marine Fisheries Service, Southwest Region
FILE NUMBER:	2012/02694
DATE ISSUED:	**July 17, 2012**

I. CONSULTATION HISTORY

The U.S. Army Corps of Engineers (Corps) contacted the North Central Coast Office of NOAA's National Marine Fisheries Service (NMFS) in Santa Rosa by telephone on November 30, 2009, regarding the Pier 36 Demolition and Brannan Street Wharf Project. They asked about the Section 7 consultation process and who would be the NMFS contact for Essential Fish Habitat (EFH) related questions.

On December 11, 2009, the Port of San Francisco (Port) hosted a conference call with NMFS and the Corps to discuss the Corps and Port's draft project description. NMFS provided information on the potential impacts to species and what information the Corps should provide in their Biological Assessment to ensure they submit a complete consultation package. NMFS also provided the Corps and the Port information on the federally listed species that occur in the action area; however, the Corps requested a formal species list from NMFS in January 2011.

On June 24, 2010, the Port hosted a conference call with NMFS and the Corps to discuss what information the Corps should include in their biological assessment. Specific topics discussed were related to what resources are available to assist the Corps in preparing their pile driving impact analysis, the marine mammal take permit process, what types of figures would be helpful in illustrating the project's area of cumulative impacts, and whether there were pile driving work windows in the Bay to avoid impacts to green sturgeon.

By letter dated January 5, 2011, to NMFS the Corps requested a list of federally-listed species and critical habitat that may be affected by the proposed project. By letter dated January 13, 2011, NMFS provided the Corps a list of federally listed threatened or endangered species or critical habitat that may be affected by the Pier 36/Brannan Street Wharf Project.
On January 24, 2011, the Port hosted a conference call with NMFS and the Corps to discuss the

project timeline, pile driving sound analysis, contaminants in the action area, revisions to the project description, and useful information to include in the Biological Assessment, such as aerial photographs of the action area.

By letter dated February 16, 2011, the Corps requested initiation of formal section 7 consultation with NMFS regarding the Corps' proposed demolition of Pier 36 and construction of the new Brannon Street Wharf. The Corps' initiation request included the *Biological Assessment/ Essential Fish Habitat Assessment* prepared by the Corps, dated January 2011, with appendices. The Corps determined the proposed project is likely to adversely affect Central California Coast (CCC) steelhead, but is not likely to adversely affect green sturgeon. The Corps also determined that the project is not likely to adversely modify critical habitat for CCC steelhead or green sturgeon.

NMFS received the Corps' February 16, 2011, letter on February 25, 2011. Upon review of the Corps' initiation package, NMFS determined that it contained the information necessary to initiate consultation on February 28, 2011.
NMFS issued a draft biological opinion to the Corps on August 11, 2011. By letter dated September 12, 2011, the Corps informed NMFS that they had no comments on the draft biological opinion.

On September 16, 2011, NMFS issued a final biological to the Corps for the project.

On April 20, 2012, the Corps informed NMFS by electronic mail message (e-mail) that the project description in the Biological Assessment for the project did not include bubble curtains for the concrete piles. The Corps explained that the Port had never planned on using bubble curtains to attenuate sound during pile driving of the 24-inch diameter concrete piles because it would be too costly to operate a curtain during the installation of these piles.

On April 30, 2012, the Corps and NMFS discussed over the phone that the September 16, 2011, biological opinion included the use of a bubble curtain as a minimization measure to reduce the sound produced by pile driving the concrete piles by 5 decibels (dB). NMFS informed the Corps that by not using a bubble curtain to install the concrete piles, the area in which sound levels would exceed injury thresholds for fish would increase from 87 m to 178 m. The Corps and NMFS both agreed that this change to the project may cause an effect to listed species or critical habitat that was not considered in the biological opinion.

By e-mail dated May 12, 2012, the Corps requested reinitiation of consultation for the Pier 36/Brannon Street Wharf to assess changes to the project.

On June 7, 2012, the Corps informed NMFS that the Port was also proposing to add 1800 cubic yards of riprap along the seawall adjacent to the Brannon Street Wharf.

II. DESCRIPTION OF THE PROPOSED ACTION

The Corps proposes to issue a permit under Section 404 of the Clean Water Act to the Port to construct a new Brannon Street Wharf along San Francisco's waterfront where the recently demolished Pier 36 and marginal wharf were located (Corps File No. 320786). Pier 36 is located along the Embarcadero (waterfront street) between Piers 30-32 and Pier 38, adjacent to Central San Francisco Bay, south of the San Francisco Bay Bridge, in San Francisco, California (Figure 1). Pier 36, along with the existing marginal wharf structure between Piers 30-32 and Pier 38, were condemned in 2004 due to the severely deteriorated deck structure and deteriorated pilings. The Corps demolished the Pier 36 and the majority of the marginal wharf between March and July 2012; this demolition was described and evaluated in the September, 16, 2011, biological opinion. The goal of the proposed project is to demolish the remaining section of the marginal wharf and construct a new, open-space park along the San Francisco waterfront. The construction component of the project and demolition of a small section of the marginal wharf by the Port will begin in July of 2012 and conclude in June of 2013. NMFS does not anticipate any interdependent or interrelated actions associated with the proposed action.

Figure 1. Location of Pier 36, San Francisco Bay, California.

A. Description of Proposed Project Design and Construction Activities

1. <u>Demolition of the Marginal Wharf</u>

Demolition of Pier 36 and the marginal wharf was commenced by the Corps in March 2012. The Corps completed demolition of Pier 36 and most of the marginal wharf in May 2012. The Port proposes to begin demolition of the remaining portion of the marginal wharf in July 2012.

The demolition work areas will include a 3560 square feet section of the marginal wharf. Demolition of the remaining portion of marginal wharf will be conducted from land using a crawler crane. Barge mounted excavators may also be used to supplement land based excavators. Rotating debris baskets attached to excavators will be used to catch debris, and dump trucks will be used to transport materials off site to an authorized upland disposal site. Demolition of the remaining portion of the marginal wharf is scheduled to be completed December 2012. Demolition activities will be conducted during daylight hours.

2. Construction of the Brannon Street Wharf

The new Brannon Street Wharf will include 57,000 square feet of new public open space over San Francisco Bay on a pile-supported deck. It will be generally oriented in a north-south configuration, and connected to the Embarcadero Promenade. The northern end of the park would begin south of Piers 30-32, extending south for about 830 feet to a point south of Pier 36. The wharf will have a wedge shape, starting from an approximately 10 feet width at its narrowest point and widening to approximately 140 feet at the southern end. An approximately 2400 square foot floating dock structure would extend outward into the Bay from the southern end of the wharf. This structure would provide a launch site for kayaks and other small, unpowered crafts.

To construct the new Brannon Street Wharf, the Port proposes to repair the existing seawall on site and install 266 steel and concrete piles and 57,000 square feet of new decking. Seawall repair will involve sealing cracks and patching spalls (chips) in the concrete wall, and placing riprap (1800 cubic yards) along 170 linear feet of the wall. Riprap will be placed in the tidal zone from 7ft to -7ft MLLW, with the toe excavated to -12ft MLLW, approximately 5 feet into mud. The wharf structure will be supported by approximately 262 piles (116 24-inch diameter steel pipe piles and 146 24-inch diameter octagonal concrete piles) and the floating dock gangway will be supported by four 36-inch diameter steel piles. All piles will be driven to depths of more than 60 feet below the mudline in water depths ranging approximately -2 to -15 feet at mean low lower water (MLLW) and will be installed using a combination of impact and vibratory hammer driving methods. Pile driving will be done from the water using a barge-mounted marine crane and other construction activities will be primarily done from land. Riprap placement will be done with marine equipment. Seawall repair is within tidal zones and will be done within tidal work windows using floating skiffs. Construction of the new wharf is scheduled to begin in July 2012, and be completed in June 2013. In–water work will not extend beyond December 2012. Construction will be conducted during daylight hours, except for a section of the wharf near Pier 32, which will require double shifts to minimize impacts to traffic on the Embarcadero.

a. 24-inch octagonal concrete piles

Approximately 146 24-inch octagonal concrete piles will be driven by impact hammer into the Bay to support the new Brannon Street Wharf. The total time of pile driving for each pile is estimated to be 20 minutes in duration. During one work day, five to eight of the 24-inch octagonal concrete piles may be installed. If necessary, a water jet may be used to increase driving efficiency. Up to 800 blows from an impact hammer will occur for each pile, using a DelMag D46-32 diesel hammer,

producing approximately 122,000 foot-pounds (ft-lbs) maximum energy per blow, at a rate of 1.5 seconds per blow (sec/blow) average.

b. 24-inch steel shell piles

Approximately 116 24-inch steel shell piles will be installed nearest the shoreline as support piles. During a work day, three to five piles may be installed. Each pile will be driven for 20 to 30 minutes. Installation will begin with approximately 8 minutes of vibratory pile driving, and finish with up to 300 blows from an impact hammer using a DelMag D46-32 diesel hammer, producing approximately 122,000 ft-lbs maximum energy per blow, at a rate of 1.5 sec/blow average.

c. 36-inch steel shell piles

Installation of the floating dock will require the placement of four 36-inch steel shell piles. It is estimated that each pile will be driven in 20 to 30 minutes. All four of these piles will be installed in one work day. Installation will begin with 5 to 15 minutes of vibratory driving, and finish with approximately 600 blows from a DelMag D62-22 diesel hammer, producing approximately 165,000 ft-lbs maximum energy, at a rate of 1.5 sec/blow.

3. <u>Measures to Protect Listed Species and Critical Habitat</u>

The Corps has proposed best management practices applicable to the control of sediment, hydrocarbon, and turbidity during construction. In addition to the general avoidance and minimization measures, measures specific to pile driving activities have been developed to reduce potential project effects on fish. The most pertinent of these measures are listed below. Additional measures not listed below, may be found in detail on Pages 24-26 and Appendix E of the project's biological assessment (2011).

- To reduce peak noise levels during pile driving, vibratory hammers will be used to install all steel piles for the majority of the pile driving (e.g., up to the last 10 feet), then an impact hammer will need to be used to achieve the final required depth.

- Pile driving with an impact hammer will employ a "soft start" technique. The soft start technique requires that the initial strikes of a piling with an impact hammer are not performed at full force, but a significantly reduced force and slowly build to full force over several strikes.

- Unconfined bubble curtains will be used in deeper water for steel piles to reduce noise levels.

- Prior to the start of construction, the Port will develop a NMFS-approved sound attenuation and monitoring plan. This plan will provide details on the sound attenuation system and the methods used to monitor and verify sound levels during pile driving activities. The sound monitoring results will be made available to NMFS.

- During demolition, the barges performing the work will be moored in a position to capture and contain the debris generated during the dismantlement of the building and wharf. In the event that debris does reach the Bay, personnel in work boats will immediate retrieve the debris for proper handling and disposal. All demolition debris will be disposed of at an authorized upland disposal site.

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 proposed project is located in San Francisco City and County, California, in and along the western shore of the Central San Francisco Bay, just south of the Bay Bridge. Approximate site coordinates are 37.7834 degrees north latitude and 122.3878 degrees west longitude (WGS 84). The action area is approximately 70 acres and includes the area outside the project footprint that will be affected by noise and turbidity during pile removal, pile driving, and pier installation, and the areas that will be shaded by the new wharf structure. The potentially lethal effects of noise produced by the project are expected to extend up to approximately 355 meters (1,171 feet) radial distance from where the floating dock will be located, which is near the shoreline at Pier 36 (Figure 2).

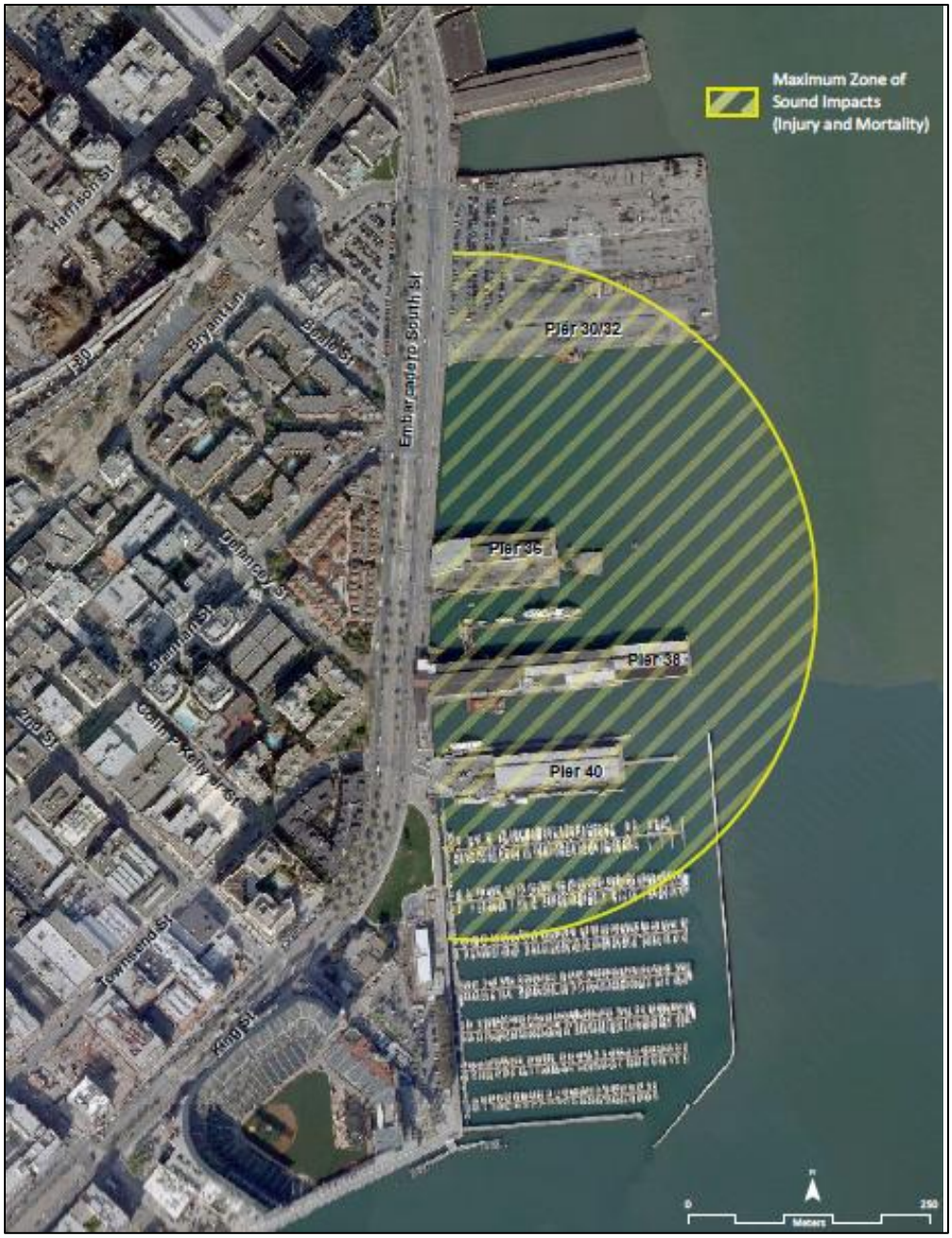

Figure 2. Area where potentially lethal effects to fish may be experienced (approximately 355 meter radius from the shoreline).

III. ANALYTICAL FRAMEWORK

A. Jeopardy Analysis

In accordance with policy and regulation, the jeopardy analysis in this biological opinion relies on four components: (1) the Status of the Species, which evaluates the CCC steelhead Distinct Population Segment's (DPS) and the North American green sturgeon southern DPS's 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 the 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 the 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 the species in the action area; and (4) Cumulative Effects, which evaluates the effects of future, non-Federal activities in the action area on the species.

The jeopardy determination is made by adding the effects of the proposed Federal action and any Cumulative Effects to the Environmental Baseline and then determining if the resulting changes in species status in the action area are likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the 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 the listed species and the role of the action area in the survival and recovery of the 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 steelhead and green sturgeon in the action area will impact their respective population. If the populations will be impacted, we assess whether this impact is likely to affect the ability of the populations to support the survival and recovery of the DPS.

B. Adverse Modification Determination

This biological opinion does not rely on the regulatory definition of destruction or adverse modification of critical habitat at 50 CPR 402.02, which was invalidated by the 9th Circuit Court of Appeals in 2004. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.

The adverse modification analysis in this biological opinion relies on four components: (1) the Status of Critical Habitat, which evaluates the range-wide and watershed-wide condition of critical habitat for the CCC steelhead DPS and North American green sturgeon southern DPS 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 the 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 and 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 (sites for spawning, rearing, and migration) 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, the biological assessment for this project, and project meeting notes if applicable. Information was also provided in e-mail messages, site visits, and telephone conversations between February 2011 and June 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 151422SWR2011SR00130).

IV. STATUS OF THE SPECIES AND CRITICAL HABITAT

This biological opinion analyzes the effects of the Corps' Pier 36 Demolition/Brannan Street Wharf Project on the following Federally-listed species and designated critical habitat:

Central California Coast steelhead DPS (*Oncorhynchus mykiss*)
threatened (January 5, 2006, 71 FR 834)
critical habitat (September 2, 2005, 70 FR 52488)
North American green sturgeon southern DPS (*Acipenser medirostris*)
threatened (April 7, 2006, 71 FR 17757)
critical habitat (October 9, 2009, 74 FR 52300)

Salmonids that use Central Valley streams as their spawning grounds and freshwater rearing areas migrate through the Bay and occasionally stray into the Central Bay south of the Bay Bridge (Jahn 2004, Klimley et al. 2009). However, they generally show fidelity to deepwater migration corridors in the North Bay (Jahn 2004). NMFS expects that no salmonids belonging to Central Valley Evolutionary Significant Units (ESUs) or DPSs occur in the action area.

A. CCC Steelhead

1. General Description and Life History

Steelhead are anadromous forms of *O. mykiss*, spending some time in both fresh- and saltwater. The older juvenile and adult life stages occur in the ocean, until the adults ascend freshwater streams to spawn. Unlike Pacific salmon, steelhead are iteroparous, or capable of spawning more than once before death (Busby et al. 1996). Although one-time spawners are the great majority, Shapovalov and Taft (1954) reported that repeat spawners are relatively numerous

(17.2 percent) in California streams. Eggs (laid in gravel nests called redds), alevins (gravel dwelling hatchlings), fry (juveniles newly emerged from stream gravels), and young juveniles all rear in freshwater until they become large enough to migrate to the ocean to finish rearing and maturing to adults. General reviews for steelhead in California document much variation in life history (Shapovalov and Taft 1954, Barnhart 1986, Busby et al. 1996, McEwan 2001). Although variation occurs, in coastal California steelhead usually live in freshwater for 1 to 2 years, then spend 1 to 3 years in the ocean before returning to their natal stream to spawn. Steelhead may spawn 1 to 4 times over their life. 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 April and May (Fukushima and Lesh 1998).

Steelhead fry rear in freshwater edgewater habitats and move gradually into pools and riffles as they grow larger. Cover is an important habitat component for juvenile steelhead, both as a velocity refuge and as a means of avoiding predation (Shirvell 1990, Meehan and Bjornn 1991). Steelhead, however, tend to use riffles and other habitats not strongly associated with cover during summer rearing more than other salmonids. Young steelhead feed on a wide variety of aquatic and terrestrial insects, and emerging fry are sometimes preyed upon by older juveniles. Rearing steelhead juveniles prefer water temperatures of 7.2-14.4 degree Celsius (°C) and have an upper lethal limit of about 25°C (Barnhart 1986, Bjornn and Reiser 1991). However, they can survive in water up to 27°C with saturated dissolved oxygen conditions and a plentiful food supply. Fluctuating diurnal water temperatures also aid in survivability of salmonids (Busby et al. 1996).

Emigrating CCC steelhead use San Francisco Bay as a migration corridor to the ocean. Adult CCC steelhead migrate from the ocean to South San Francisco Bay tributary streams from December through April. Juvenile steelhead emigration from their South Bay natal streams occurs episodically during fall, winter, and spring months, and generally occurs during high flow events. Barnhart (1986) reported that steelhead smolts in California typically range in size from 140 to 210 millimeter (mm) (fork length). It is believed that the majority of juvenile steelhead transiting through the Bay migrate mainly within deeper areas of dredged ship channels opposed to the surrounding shallows (Klimley et al. 2009).

2. Status of CCC Steelhead DPS and Critical Habitat

In this opinion, NMFS assesses four population viability parameters to help us understand the status of CCC steelhead and the population's ability to survive and recover. These population viability parameters are: abundance, population growth rate, spatial structure, and diversity (McElhany et al. 2000). While there is insufficient information to evaluate these population viability parameters in a thorough quantitative sense, 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 402.20). For example, the first three parameters are used as surrogates for numbers, reproduction, and distribution. We relate the fourth parameter, diversity, to all three regulatory criteria. Numbers,

reproduction, and distribution are all affected when genetic or life history variability is lost or constrained resulting in reduced population resilience to environmental variation at local or landscape-level scales.

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

While historical and present data on abundance are limited, CCC steelhead numbers are substantially reduced from historical levels. A total of 94,000 adult steelhead were estimated to spawn in the rivers of this DPS in the mid-1960s, including 50,000 fish in the Russian River - the largest population within the DPS (Busby et al. 1996). Recent estimates for the Russian River are on the order of 4,000 fish (NMFS 1997). Abundance estimates for smaller coastal streams in the DPS indicate low but stable levels with recent estimates for several streams (Lagunitas, Waddell, Scott, San Vincente, Soquel, and Aptos creeks) of individual run sizes of 500 fish or less (62 FR 43937). Some loss of genetic diversity has been documented and attributed to previous among-basin transfers of stock and local hatchery production in interior populations in the Russian River (Bjorkstedt et al. 2005). Similar losses in genetic diversity in the Napa River may have resulted from out-of-basin and out-of-ESU releases of steelhead in the Napa River basin in the 1970s and 80s. These transfers included fish from the South Fork Eel River, San Lorenzo River, Mad River, Russian River, and the Sacramento River. In San Francisco Bay streams, reduced population sizes and fragmentation of habitat has likely also led to loss of genetic diversity in these populations. For more detailed information on trends in CCC steelhead abundance, see: Busby et al. 1996, NMFS 1997, Good et al. 2005, Spence et al. 2008, and Williams et al. 2011.

CCC steelhead have experienced serious declines in abundance and long-term population trends suggest a negative growth rate. This indicates the DPS may not be viable in the long term. DPS populations that historically provided enough steelhead immigrants to support dependent populations may no longer be able to do so, placing dependent populations at increased risk of extirpation. However, because CCC steelhead remain present in most streams throughout the DPS, roughly approximating the known historical range, CCC steelhead likely possess a resilience that is likely to slow their decline relative to other salmonid DPS or ESUs in worse condition. The 2005 status review concluded that steelhead in the CCC steelhead DPS remain "likely to become endangered in the foreseeable future" (Good et al. 2005). On January 5, 2006, NMFS issued a final determination that the CCC steelhead DPS is a threatened species, as previously listed (71 FR 834).

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

A more recent viability assessment of CCC steelhead concluded that populations in watersheds that drain to San Francisco Bay are highly unlikely to be viable, and that the limited information available did not indicate that any other CCC steelhead populations could be demonstrated to be viable[2] (Spence et al. 2008). Although there were average returns (based on the last ten years of data) of adult CCC steelhead during 2007/08, research monitoring data from the 2008/09 and 2009/10 adult CCC steelhead returns shows a decline in returning adults across their range compared to the last ten years (Jeffrey Jahn, personal communication, 2011). The most recent status review 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).

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[3]: logging, agricultural and mining activities, urbanization, stream channelization, dams, wetland loss, and water withdrawals, including unscreened diversions for irrigation. Impacts of concern include alteration of 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.

B. Green Sturgeon

1. General Description and Life History

North American green sturgeon are the most widely distributed, and most marine-oriented of sturgeon species belonging to the family Acipenseridae. Like all sturgeon, North American green sturgeon are anadromous, long-lived, and a slow growing species (Adams et al. 2002). Along the Pacific Coast, North American green sturgeon have been documented offshore from Ensenada, Mexico to the Bering Sea, Alaska and found in freshwater rivers from the Sacramento River to British Columbia (Moyle 2002).

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

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

Adult green sturgeon are believed to spawn every 3 to 5 years and generally exhibit fidelity to their spawning site. Green sturgeon reach sexual maturity only after several years of growth; first spawning generally occurs at 15 years of age for males, and 17 years for females. Southern DPS green sturgeon spawn in the deep turbulent sections of the upper reaches of the Sacramento River. The California Department of Fish and Game (CDFG) (2002) report southern DPS green sturgeon spawning occurs above Hamilton City and possibly as far upstream as Keswick Dam. Adults typically begin their upstream spawning migrations into the San Francisco Bay by late February to early March, reach Knights Landing by April, and spawn between March and July (Heublein et al. 2009). Peak spawning is believed to occur between mid-April to mid-June. Green sturgeon in the Sacramento River can display two outmigration strategies. Monitoring data reveals that post-spawned green sturgeon can leave the Sacramento River prior to September 1, or remain in the river for several additional months (Heublein et al. 2009).

Adult female green sturgeon produce between 60,000 and 140,000 eggs, depending on body size, with a mean egg diameter of 4.3 mm (Moyle et al. 1992, Van Eenennaam et al. 2001). Eggs are likely broadcast spawned over large cobble substrate where they settle into the spaces between the cobbles, but substrate can range from clean sand to bedrock (USFWS 2002). Like salmonids, green sturgeon require cool water temperatures for egg and larval development, with optimal temperatures ranging from 11 to 18˚C.

Juvenile green sturgeon spend from one to three years in freshwater before they enter the ocean (Nakamoto et al. 1995, Adams et al. 2002). Based on Klamath River age distribution work by Nakamoto et al. (1995), the majority of fish entering the ocean are between 200 and 600 mm in length which suggests they are 2 to 3 years of age. The low abundance of juveniles smaller than 200 mm in the Delta indicates juvenile southern DPS green sturgeon likely hold in the mainstem Sacramento River, as suggested by Kyndard et al. (2005). Laboratory studies, conducted by Allen and Cech, Jr. (2007), also indicated juveniles spend approximately the first six months in fresh to brackish water and then transition into salt water at about 1.5 years of age.

Both adult and juvenile green sturgeon are benthic feeders (Moyle 2002). Adult green sturgeon are believed to feed primarily upon benthic invertebrates such as clams, mysid and grass shrimp, and amphipods (Radtke 1966, Adams et al. 2002), and to some extent on fish. Adults captured in the Sacramento-San Joaquin Delta are known to feed on invertebrates such as shrimp, mollusks, amphipods, and additionally upon small fish (Adams et al. 2002). Juvenile green sturgeon in the San Francisco Bay have been shown to feed on opossum shrimp (*Neomysis mercedie*) and amphipods (*Corophium spp.*) (Moyle 2002).

Southern DPS green sturgeon are also known to inhabit nearshore marine waters, and are commonly observed in bays and estuaries. Kelly et al. (2007) studied the movement of six green sturgeon (one adult and five sub-adults) in the San Francisco Estuary (tagged in San Pablo Bay) and discovered while adults and sub-adults occupied shallow water depths, there were distinct directional movements. In contrast, when the fish exhibited non-directional movements, they remained close to the bottom. The movements were not found to be related to salinity, current, or temperature and the authors surmised they are related to food resource availability.

2. Status of Southern DPS Green Sturgeon and Critical Habitat

The southern DPS green sturgeon is considered vulnerable to catastrophic events due in part to a small estimated spawning population and drastic reductions in historically accessible spawning habitat. The precise population size of southern DPS green sturgeon is unknown, but it is likely to be much smaller than the northern DPS. Population abundance information concerning the southern DPS green sturgeon is described in the NMFS status reviews (Adams *et al*. 2002, NMFS 2005). Abundance information is limited, coming mainly from three 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, and 3) fish salvage operations at the water export facilities on the Sacramento-San Joaquin Delta. These data are insufficient in a variety of ways (short time series, non-target species, *etc*.) and do not support more than a qualitative evaluation of changes in green sturgeon abundance.

Some population abundance information comes from incidental captures of southern DPS green sturgeon from the white sturgeon monitoring program by the CDFG sturgeon tagging program (CDFG 2002). CDFG (2002) utilizes a multiple-census or Peterson mark-recapture method to estimate the legal population of white sturgeon captures in trammel nets. By comparing ratios of white sturgeon to green sturgeon captures, CDFG provides estimates of adult and sub-adult southern DPS green sturgeon abundance. Estimated abundance 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. Fish monitoring efforts at the Red Bluff Diversion Dam (RBDD) and Glenn-Colusa Irrigation District (GCID) on the upper Sacramento River have captured between 0 and 2,068 juvenile southern DPS green sturgeon per year (Adams et al. 2002).

Green sturgeon salvage numbers are recorded at California State (1968-present) and Federal (1980-present) water export facilities on the Sacramento-San Joaquin Delta. The average number of southern DPS green sturgeon taken per year at the state facility prior to 1986 was 732; from 1986 to 2001, the average per year was 47 (70 FR 17386). For the Federal facility, the average number prior to 1986 was 889; from 1986 to 2001 the average was 32 (70 FR 17386). Additional analysis of southern DPS green sturgeon indicate a downward trend in the number of green sturgeon per acre-foot of exported water at state and Federal facilities since 1974 and 1983 respectively. Direct capture in salvage operations 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 exotic predators, disruption in migratory behavior, and poor habitat quality. Delta water exports have likely contributed to negative trends in the abundance of migratory fish that utilize the delta, including the southern DPS green sturgeon. Catches of sub-adult and adult southern DPS green sturgeon by the Interagency Ecological Program (IEP) between 1996 and 2004 ranged from 1 to 212 green sturgeon per year (212 occurred in 2001), however, the portion of these captures consisting of southern DPS green sturgeon is unknown as the fish were primarily captured in San Pablo Bay which is known to consist of a mixture of northern and southern DPS green sturgeon.

Recent spawning population estimates using sibling based genetics by Israel (2004) indicates a maximum spawning population of 32 spawners in 2002, 64 in 2003, 44 in 2004, 92 in 2005, and 124 in 2006 above RBDD (with an average of 71). Based on the length and estimated age of post-larvae captured at RBDD (approximately two weeks of age) and GCID (downstream; approximately three weeks of age), it appears the majority of southern DPS green sturgeon are spawning above RBDD.[4]

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 United States marine waters within 60 fathoms depth from, and including, Monterey Bay, California, north to Cape Flattery, Washington, including the Strait of Juan de Fuca, Washington, to its United States boundary. The project's action area (i.e., Central San Francisco Bay) is located within designated critical habitat for southern DPS green sturgeon. Primary constituent elements of designated critical habitat in the action area include adequate food resources and foraging habitat; and the estuarine water column, which includes suitable depth, sediment, and water quality.

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 particular, passage 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 the delta and estuary. Loss of individuals during this phase of the life history of green sturgeon represents losses to multiple year classes rearing in the Delta, which can ultimately impact the potential population structure for decades to come.

C. Global Climate Change

Global climate change presents an additional potential threat to CCC steelhead, southern DPS green sturgeon, and their respective critical habitat. Modeling of climate change impacts in California suggests that average summer air temperatures are expected to increase (Lindley et al. 2007). Heat waves are expected to occur more often, and heat wave temperatures are likely to be higher (Hayhoe et al. 2004). Total precipitation in California may decline; critically dry years may increase (Lindley et al. 2007, Schneider 2007). The Sierra Nevada snow pack is likely to decrease by as much as 70 to 90 percent by the end of this century under the highest emission

[4] There are many assumptions with this interpretation (*i.e.*, equal sampling efficiency and distribution of post-larvae across channels) and this information should be considered cautiously.

scenarios modeled (Luers et al. 2006). Wildfires are expected to increase in frequency and magnitude, by as much as 55 percent under the medium emissions scenarios modeled (Luers et al. 2006). Vegetative cover may also change, with decreases in evergreen conifer forest and increases in grasslands and mixed evergreen forests. The likely change in amount of rainfall in Northern and Central Coastal streams under various warming scenarios is less certain, although as noted above, total rainfall across the state is expected to decline. For the California North Coast, some models show large increases (75 percent to 200 percent) in rainfall amounts while other models show decreases of 15 percent to 30 percent (Hayhoe et al. 2004). Many of these changes are likely to further degrade CCC steelhead and southern DPS green sturgeon 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 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). 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 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 impact of State or private actions which are contemporaneous with the consultation in process (50 CFR §402.02).

The action area is in Central San Francisco Bay, just south of the Bay Bridge. 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.

The action area consists of 1.5 acres of developed upland areas and 70 acres of open water areas in San Francisco Bay. Open water areas include the collapsed wharf extension area (1.08 acres) and 17 acres of Bay that are covered and shaded underneath Piers 30, 36, 38, and 40. Water within the action area varies in depth, ranging between 5 feet and, at the eastern edge, as deep as 55 feet (ft) at MLLW. Within the project footprint, water depths are shallow, around 7 ft MLLW on average. Benthic habitat in the action area includes Bay sand and mud. There is no rocky shoreline habitat within the action area. The transition zone between the upland areas to the

subtidal zone consists of riprap and retaining walls.

A. Status of Listed Species and Critical Habitat in the Action Area

1. CCC Steelhead

Data on steelhead presence in Central San Francisco Bay is limited. CDFG has sampled fish presence/absence at fixed stations in the Bay and Delta for over 25 years (IEP 2011). Data is comprised of otter trawl, midwater trawl, beach seine, and other gear catches at the various stations. The beach seine data cover only the years 1980 – 1986, and certain stations were added for other gear types. Very few steelhead were captured throughout these surveys, with less than 100 fish caught during all years sampled (Jahn 2004). All of the steelhead were caught in the northern and central portions of the Bay. The small number of captures of steelhead in during CDFG surveys is likely due to the small populations of CCC steelhead in south Bay streams (Jahn 2004). Based on this information, very few CCC steelhead are expected to be present in the action area. Those that do occur are expected to be actively migrating.

Available information suggests that salmonids depend very little on the Bay for rearing and migrate quickly through the estuary. Historically, the tidal marshes within San Francisco Bay provided a highly productive estuarine environment for juvenile steelhead. 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. McFarlane and Norton (2002) found that fall-run Chinook experienced little growth, depleted condition, and no accumulation of lipid energy reserves during the relatively limited time the fish spent transiting the 65-km length of the estuary.

Adults steelhead potentially occurring in the action area will be those fish that are transiting the Bay to their spawning grounds in Guadalupe River, Stevens Creek, San Francisquito Creek, Coyote Creek, Alameda Creek, and possibly San Leandro Creek,. Adult steelhead migrations occur in the action between December and April. Similarly, juvenile CCC steelhead may occur within the action area during their migration through the Bay (en route from their natal streams to the Pacific Ocean), and are expected to occur during late winter and spring months.

San Francisco Bay in the action area is designated as critical habitat for CCC steelhead (70 FR 52488). Essential features of critical habitat in the action area include the estuarine water column, foraging habitat, and food resources used by steelhead as part of their juvenile downstream migration or adult spawning upstream migration (58 FR 33212). PCEs of designated critical habitat for steelhead in the action area include estuarine areas free of obstruction and excessive predation with: 1) water quality, water quantity and salinity conditions supporting juvenile and adult physiological transitions between freshwater 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 (69 FR 71880).
PCEs within the action area are degraded mainly due to the high degree of development in the action area and surrounding areas that have reduced natural cover and forage items for steelhead. Natural cover for CCC steelhead in the action area does not exist. The action area includes a developed wharf area surrounded by urban development. The transition area between upland

areas and the intertidal zone consists of riprap and retaining walls. Benthic habitat in the action area consists of Bay sand and mud. There are no eelgrass beds in the action area. The submerged portion of Pier 36 may provide cover to CCC steelhead rearing or migrating in San Francisco Bay, but no evidence exists to support this.

Water quality and quantity, and salinity in the action area appear to be intact. Suspended sediment concentrations in San Francisco Bay tend to be extremely variable and strongly correlated to season and water depth (Buchanan and Ganju 2005, McKee et al. 2006). Salinity in the action area ranges from 18-30 percent and temperatures generally range from 10-18 C, depending on season and water year type (i.e., wet or dry). Within the project footprint under the pier and wharf, water depths are shallow, around 7 ft MLLW on average. Suspended sediment concentrations in the Bay can range from 1000 milligrams (mg) per liter (mg/L) near the bottom, to as little as 10 mg/L in near surface measurements (SFEI 2008). Suspended sediment near the action area ranges from 300 mg/L near the bottom, to approximately 10 mg/L near the surface (USGS gage at Pier 24).

Sediment within the project site has been tested for contaminant toxicity. Sediment testing conducted by the Port of San Francisco in 1998 found high concentrations of organic pollutants such as, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and the inorganic pollutant, selenium, throughout the action area (Corps 2011). These contaminants were above the Effects Response Low (ER-L)[5] threshold for sediments and ambient levels in the Bay. However, PAHs, PCBs, and selenium concentrations were below the Effects Response Median (ER-M)[6] threshold for sediment. Total concentrations of dichlorodiphenyltrichloroethane (DDT) in the action area were well above ambient concentrations in the bay and the ER-M threshold. DDT is considered a legacy insecticide that was once at the top of the list of contaminants of concern for San Francisco Bay, but is now declining due to restrictions on DDT applications and use 20 years ago. However, in some areas, DDT persists in the sediment and continues to enter the Bay from its tributaries (Connor et al. 2004). Chemical concentrations within the water column were below toxicity thresholds.

2. Green Sturgeon

Subadult and adult green sturgeon are oceanic, but enter the Bay during the spring and remain through fall. Juvenile green sturgeon move into estuaries early in their first year, where they may remain for approximately three years before migrating to the ocean. (Allen and Cech, Jr. 2007, Kelly et al. 2007). Between 1980 and 1995, the San Francisco Bay Study sampled several stations each month using midwater and bottom trawls (Baxter et al. 1999). The data show that most green sturgeon collected by trawls in the estuary range from about 200 to 1200 mm in length. Little is known about green sturgeon distribution within the San Francisco Bay or what, if any, physical parameters influence their movements (Kelly et al. 2007). Heublein et al. (2009) found that of 90 green sturgeon tagged in San Francisco Bay, only 11 moved up into the Sacramento River, suggesting that many green sturgeon enter the bay for purposes other than

[5] The ER-L threshold is the lower tenth percentile concentration of screened water toxicity data at which toxicity to benthic organisms may begin (Long et al. 1995).

[6] The ER-M threshold corresponds to the concentration in which adverse biological effects on benthic organisms were measured 50 percent of the time (Long et al. 1995)

spawning. This study also shows that post-spawning adults who have left their freshwater spawning grounds can spend months in the bay, generally in the fall, before returning to the ocean (Hublein et al. 2009). Other studies have shown that some sub-adult and adult green sturgeon use the Bay year-round (Lindley et al. 2011). Three tagged adult sturgeon were recorded near a monitor at Pier 30 in May and August 2007 and February 2009 (California Fish Tracking Database, unpublished data 2011). Two of these fish were recorded in the Sacramento River before and after they transited the Bay, suggesting that these were spawning adults (California Fish Tracking Database, unpublished data 2011). The third fish was only recorded in the Bay and is believed to be a summer resident not of spawning age yet (California Fish Tracking Database, unpublished data 2011). No juveniles have been tagged as part of these studies so less information is available on their distribution in the Bay or the action area. However, according to their life history strategy, they are likely present throughout the Bay during the first 2-3 years of their life. Not enough data exists to estimate abundances of green sturgeon in the Bay or the action area, however, based on the information above, juveniles, sub-adults, and adult green sturgeon are likely to occur in the action area.

San Francisco Bay in the action area is designated as critical habitat for North American green sturgeon Southern DPS (74 FR 52300). Essential features of critical habitat in the action area include the estuarine water column, foraging habitat, and food resources used by sturgeon as part of their adult spawning upstream migration and their residence in the Bay as juveniles and sub-adults. Primary constituent elements of designated critical habitat for sturgeon in the action area include estuarine habitats with: (i) Abundant prey items; (ii) Sufficient water flow; (iii) Water quality for normal behavior, growth, and viability of all life stages; (iv) Migratory pathways necessary for the safe and timely passage of Southern DPS fish within estuarine habitats and between estuarine and riverine or marine habitats; (v) A diversity of depths necessary for shelter, foraging, and migration of juvenile, subadult, and adult life stages; and (vi) Sediment quality (i.e., chemical characteristics) necessary for normal behavior, growth, and viability of all life stages.

San Francisco Bay serves as an important habitat for all lifestages of green sturgeon, as it supports rearing and serves as an important migratory/connectivity corridor between the Sacramento River system and nearshore coastal marine waters. Juveniles and subadults are believed to be present in the Bay, including the action area, throughout the year, and adults transiting to and from their freshwater spawning grounds in the Sacramento River are most likely to occur in early-spring to late-fall (Hublein et al. 2009), but could also be present at other times of the year (CDFG 2002, Hublein et al. 2009, Lindley et al. 2008, Kelly et al. 2007). These lifestages utilize the action area for rearing and foraging. The action area of this project is south of the San Francisco Bay Bridge and is outside of the direct migratory pathway between the ocean and the Sacramento River.

Water quality and quantity, and salinity in the action area appear to be suitable for green sturgeon. Green sturgeon rarely inhabit depths greater than 100 m (Lindley et al. 2008), and generally prefer depths of less than 10 m (Kelly et al. 2007). Tracking of five sub-adults in San Pablo and Suisun bays illustrated that green sturgeon movements were independent of physical gradients and that they actually inhabited areas of relatively low DO for extended periods of time because they occupy the bottom of the water column where DO is generally low (Kelly et al. 2007). Benthic habitat in the action area is believed to provide few prey items for green

sturgeon. Benthic invertebrates, characteristic of estuarine waters, were found in very low abundances in the Central Bay along the San Francisco shoreline (Hopkins 1986). The most common benthic species observed in this region of the bay, yet in low abundances, were three common species of bivalves (*Macoma nasuta, Macoma balthica, Tapes japonica)* and a common amphipod *(Ampelisca abdita*) (Hopkins 1986). Benthic invertebrates common to the San Francisco Bay are found in much higher abundances in many other parts of the South and Central Bay near the action area (Hopkins 1986). Habitat in the action area may provide other prey items such as grass shrimp (*Crangon* spp. and *Palaemon macrodactylus*), which have been observed in high abundances in the Central Bay (Baxter et al. 1999). Based on this information, PCEs for green sturgeon in the action area are believed to be degraded due to the low availability of benthic prey items.

B. Factors Affecting the Species Environment and Critical Habitat 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 Embarcadero, including commercial and high density residential development and high use streets. The hydrology of the action area is highly modified as a result. The terrestrial portions (developed wharf) of the action area receive water from direct precipitation, which flows into storm drains and into combined stormwater and sewage treatment system. An overflow structure with the San Francisco combined sewer system is located at the foot of Brannon Street at its intersection with the Embarcadero. Water and sediment quality within the action area is affected by stormwater runoff, industrial activities, and other urban influences. The high density of shipping traffic through the Bay renders the action area vulnerable to PAH contamination from oil spills. A recent example is the Cosco Busan Oil Spill in November 2007 in Central San Francisco Bay. Another source of PAHs in the action area is creosote-treated wood piles used in the construction of the piers that border the San Francisco waterfront. Legacy contaminants, such as, PCBs and DDT are still persistent in the action area, even though their sources have been eliminated or reduced significantly. These contaminants are present in Bay sediment and are periodically re-suspended by various activities (e.g., dredging, pile removal, etc.). Furthermore, the introduction and spread of non-native species throughout the San Francisco Bay-Delta estuary has affected many native species, including listed salmonids (Cohen and Carlton 1995), through predation and competition for food and habitat, and presumably green sturgeon through competition for food and habitat.

Demolition of Pier 36 and the majority of the marginal wharf were completed in July 2012. The September 16, 2012, biological opinion assumed that demolition activities would potentially result in behavioral (Sigler et al. 1984, Berg and Northcote 1985, Whitman et al. 1982, Gregory 1988) and sub-lethal impacts from exposure to increased turbidity (Sigler 1988, Sigler et al.

1984, Kirn et al. 1986, Emmett et al. 1988, Servizi 1988); exposure to contaminants that may be redistribution and/or released during demolition activities, with increased potential for chronic or acute toxicity; and exposure to toxic chemicals from construction equipment. NMFS did not anticipate these impacts to result in adverse effects to green sturgeon and steelhead or adversely modify critical habitat. Based on data provided by the Corps, already completed demolition activities did not result in any observable increases in turbidity, or fish mortalities or injuries.

The biological opinion also assumed that demolition of Pier 36 and the marginal wharf would have beneficial effects on steelhead and green sturgeon critical habitat by reducing areas shaded by overwater structure and removal of pilings treated with contaminants. Removal of Pier 36 reduced the amount of shadow fill in the action area by 1.1 acres and removed 350 to 400 creosote piles. No monitoring has been conducted since the removal of these structures, but NMFS assumes the removal of 350 to 400 creosote piles and reducing the amount of shadow fill by 1.1 acres in the action area will improve water quality conditions and forage items for fish over time.

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

Since 2001, pursuant to section 7 of the ESA, NMFS has conducted two interagency consultations that affected the action area of this project.

In August 2004, NMFS and the Corps completed consultation on the Port's placement of two floating fenders for ships docking at Pier 30/32. Project construction required the installation of twelve 16-inch diameter ACZA-treated wood piles (NMFS administrative record #151422-SWR2004SR9335 and Corps File No. 29059S). This consultation concluded the project was not likely to adversely affect Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, CCC steelhead, or Central Valley steelhead.

In September 2011, NMFS and the Corps completed consultation on the Pier 36/Brannon Street Wharf Project. The project included the demolition of Pier 36 and the marginal wharf and the construction of the new Brannon Street Wharf (NMFS administrative record #151422SWR2011SR00130 and Corps File No. 320786). This consultation concluded the project was not likely to adversely affect CCC steelhead, or green sturgeon or adversely modify CCC steelhead and green sturgeon critical habitat. Demolition work for this project was completed in July 2012. The remaining work to be completed for this project is described in this biological opinion, and supersedes the construction work described in the September 16, 2011, biological opinion.

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 2010, no research activities have occurred in the Central San Francisco Bay watershed.

VI. EFFECTS OF THE PROPOSED ACTION

The purpose of this section is to identify the direct and indirect effects of the proposed action, and any interrelated or interdependent activities, on threatened CCC steelhead, threatened southern DPS green sturgeon and their designated critical habitat. Data to quantitatively determine the precise effects of the proposed action on CCC steelhead and southern DPS green sturgeon are limited or not available; the assessment of effects therefore focuses mostly on qualitative identification. This approach was based on knowledge and review of the ecological literature concerning the effects of loss and alteration of habitat elements important to steelhead and green sturgeon, including the PCEs of critical habitat. This information was used 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 and their critical habitat are likely to be exposed to. Next, we evaluate the likely response of steelhead, sturgeon and critical habitat to these stressors in terms of changes to steelhead and sturgeon survival, growth and reproduction, and changes to the ability of PCEs to support the value of critical habitat. 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.

Construction activities associated with demolition of the remaining section of the marginal wharf are expected to affect steelhead and green sturgeon through degradation of water quality during demolition. The subsequent construction of the Brannon Street Wharf is expected to affect listed fish through underwater noise during pile driving and degradation of water quality. Demolition of the marginal wharf and construction of the new wharf is expected to be completed in 11 months. In-water work will occur year-round, with demolition of the marginal wharf and construction of the new wharf occurring from July 2012 to June 2013. Pile driving activities will be conducted between July and December 2012. Juvenile (smolts) and adult steelhead are anticipated to be in the action area during a portion of the project's in-water activities. Juvenile, sub-adult, and adult green sturgeon may be present year-round and exposed to all the project's in-water activities. Pile driving is expected to adversely affect the water column of San Francisco Bay within the action area. The potential effects of these activities are presented in detail below.

A. Species Effects

1. <u>Sound Pressure Impacts on Fish from Pile Driving</u>

a. Overview of Pile Driving Impacts

Pile driving activities may affect listed salmonids and green sturgeon through exposure to high underwater sound levels produced during pile driving and degradation of water quality during pile driving activities. The underwater sound pressure waves that have the potential to adversely affect CCC 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 proposed project, concrete and steel piles will be used for construction. Steel pipe piles produce more underwater sound than concrete piles of the same size.

Available information indicates that fish may be injured or killed when exposed to elevated underwater sound pressure waves generated by steel and concrete 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 results in reverberation of the swim bladder.

Exposure to sound for longer periods of time can also injure and kill fish (Hastings 1995). Hastings (1995) found death rates of 50 percent and 56 percent for gouramis (*Trichogaster* spp.) when exposed to continuous sounds at 192 dB re one micropascal squared-second (re: 1 μPa) at 400 Hz and 198 dB (re: 1 μPa) at 150 Hz, respectively, and 25 percent for goldfish (*Carassius auratus*) when exposed to sounds of 204 dB (re: 1 μPa) at 250 Hz for two 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, increasing risk of mortality by reducing predator avoidance capability, and interfering with communication necessary for navigation and reproduction (Scholik and Yan 2001, Shin 1995,Popper 1997).

In the *Compendium of Pile Driving Sound Data* (Illinworth & Rodkin 2007) the most recent pile driving case studies are compiled in order to provide information regarding the underwater sound pressure levels generated with the installation of steel and concrete piles by different hammer types. Several pile driving case studies conducted within the San Francisco Bay region are included in the compendium. From this data, a dual metric criteria of 206 dB re one micropascal peak sound pressure level for any single strike and an accumulated Sound Exposure Level (SEL) of 187 dB re one micropascal squared-second are currently used by NMFS and the California Department of Transportation (Caltrans) 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. 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. The results are not conclusive but there is a suggestion that pile-driving operations may result in a disruption in the normal migratory behavior of salmon. Since CCC steelhead, in general, are physiologically similar and share similar migration habits to those of pink and chum salmon, it is reasonable to assume that similar migratory disruption behavioral patterns would result from pile driving operations.

Currently, there is very little data available regarding effects of pile driving directly focused on green sturgeon. However, due to similarities in the use of estuarine environments for migration, it is reasonable to assume that similar migratory disruption behavioral patterns, as discussed above for salmonids resulting from pile driving operations, may occur for green sturgeon as well. Additionally, there is evidence of pile driving-related underwater sound pressures resulting in mortality of green sturgeon. During the construction of the Benicia-Martinez Bridge in 2002, unattenuated piles driven with a large impact hammer did result in the mortality of an 24-inch juvenile white sturgeon (Caltrans, unpublished data 2002). The piles for the bridge piers were 2.5-m diameter steel piles and were driven in water about 12 and 15 m deep in the main channel. Peak underwater sound pressure levels ranged from 227 dB (re 1 μPa) at approximately five meters from the pile to 178 dB at approximately 1,100 m from the pile (Illingworth and Rodkin 2007). There is uncertainty as to the behavioral response of fish to 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. Given the typical 15 decibel or so difference between peak SPL and RMS, a value of 150 dB RMS (re: 1 μPa) is approximately equivalent to 165 dB peak SPL (re: 1 μPa).

b. Project Specific Considerations

The results of the above pile driving projects and information available in the literature are helpful in assessment of the potential effects of pile driving associated with the proposed project, but considerable uncertainty remains. Effects on an individual fish during pile driving at Pier 36 and the Brannon Street Wharf will be dependent on a number of variables associated with environmental conditions at the project site and variables associated with the specific construction schedule.

As stated above, a dual metric criteria of 206 dB re one micropascal peak sound pressure levels (SPL) for any single strike and an accumulated SEL of 187 dB re one micropascal squared-second are currently used by NMFS and Caltrans 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.

Water depth at the pile driving site will also influence the rate of sound attenuation. In deep water areas high sound pressure waves are likely to travel further out into San Francisco Bay. Within shallow water (less than 15 meters), much of the acoustic energy is expected to be absorbed by the bottom and reflected off the surface back down to the bottom and even backwards towards the pile if an impediment is situated in a way that causes the reflection path to move back 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 approximately 2 to 15 feet at MLLW.

Methods may be used during construction to aide sound attenuation. Encapsulating the piles within an air bubble curtain, or conducting operations within a dewatered cofferdam, attenuates the sound, thereby decreasing the area in which the adverse sound-related impacts occur. Bubble curtains reduce the area of sound impedance from the pile and, therefore, reduce the area of noise impacts on fish. The Port proposes to use an unconfined bubble curtain to attenuate pile driving noise during construction. Unlike confined bubble curtains where the bubbles are confined along the length of the pile, an unconfined curtain has a larger diameter. Unconfined curtains are effective in areas where tidal currents are low, but in areas where tidal currents are high, confined curtains are more effective. Pile driving for the proposed project will occur in an area sheltered from strong tidal currents, where an unconfined bubble curtain is anticipated to effectively reduce sound levels by 5 to 15 dB (ICF Jones and Stokes 2009).

The timing and duration in which pile driving will occur will also greatly influence the level of potential impact on listed CCC steelhead and green sturgeon. Construction activities for the proposed project are expected to occur year-round, with pile driving activities limited to the period between July 2012 and December 2012. Between July and December, migrating juvenile and adult CCC steelhead and juvenile and subadult green sturgeon are expected to be present in San Francisco Bay. Juvenile steelhead migration from South Bay streams is typically completed by June, with the majority of fish migrating by May, and does not resume until February of the next year. Adult CCC steelhead migration to natal stream from the ocean typically begins in December and peaks in February and March. Migrating adult, juvenile, and sub-adult green sturgeon may be present in the action area year-round. Therefore, juvenile and adult CCC steelhead and juvenile, sub-adult, and adult (spawning and non-spawning) green sturgeon are likely to occur in the action area during pile driving activities, and may be subject to harmful sound levels during pile driving. Due to the timing of pile driving, few adult and juvenile CCC steelhead are expected to overlap with the period of elevated underwater sound levels from pile installations.

c. Assessment of Pile Driving Effects

Sound monitoring data collected from pile driving projects throughout the Bay indicate that sound pressure levels resulting from the proposed project's pile driving activities will in some instances exceed the dual metric criteria and therefore likely result in injury to CCC steelhead and green sturgeon. With the use of a bubble curtain, none of the proposed pile driving will exceed the 206 dB peak threshold. However, all of the proposed pile driving is anticipated to exceed the 187 dB SEL threshold for physical injury and the 150 dB RMS threshold for behavioral responses. The use of a bubble curtain to attenuate sound levels will reduce the distance in which the fish will be affected by these elevated sound levels.

36-inch diameter steel shell piles. The 36-inch diameter shell piles will produce the highest sound levels and have the largest area of impact, but will only persist for a short period of time (one day). With a bubble curtain these piles will result in a maximum peak of 205 dB peak re one micropascal, 178 dB SEL, and 190 RMS dB per single strike. A total of 2400 strikes per day will be required to install all four of these piles which results in an accumulated SEL of 212 dB. Based upon this data, the distance in meters to the threshold for physical injury to fish resulted in a radial distance of 355 meters (0.22 miles) and the distance to the threshold for behavioral effect resulted in a radial distance of 3162 meters (1.98 miles). The impacts associated with driving these four piles will persist for 2 hours over one day.

24-inch diameter steel shell piles. With a bubble curtain the 24-inch diameter steel shell piles will result in a maximum peak of 200 dB peak re one micropascal, 173 dB SEL, and 185 RMS dB per single strike. A maximum of 1500 strikes per day, for up to 39 days will be required to install all 116 of these piles which results in a daily accumulated SEL of 205 dB. Based upon this data, the distance in meters to the threshold for physical injury to fish resulted in a radial distance of 129 meters (0.08 miles) and the distance of meters to the threshold for behavioral effects to fish resulted in a radial distance of 1540 meters (0.96 miles).

24-inch diameter octagonal concrete piles. The 24-inch diameter concrete piles will result in a maximum peak of 185 dB peak re one micropascal, 170 dB SEL, and 170 RMS dB per single strike. A maximum of 6400 strikes per day, for up to 18 days will be required to install all 146 of these piles which results in a daily accumulated SEL of 208 dB. Based upon this data, the distance in meters to the threshold for physical injury and behavioral effects to fish resulted in a radial distance of 178 meters (0.05 miles). No bubble curtains will be used during the installation of these piles.

The pile driving sound assessment (memo to NMFS file #151422SWR2011SR00130, May 13 2012) resulted in a zone of physical injury (sound levels above the 187 dB SEL) with radial distances of 129, 178, and 355 meters from the pile driving activities (Figure 3). Since the proposed project is located adjacent to the Embarcadero, sound will mainly travel outwards towards the Bay, and only travel a short distance in the opposite direction before it hits land. For the purposes of this analysis, the zone of potential impact is defined as the area where there may be injury or mortality to listed CCC steelhead and green sturgeon. Within this zone, CCC steelhead and southern DPS green sturgeon could experience a range of barotraumas, including the damage to the inner ear, eyes, blood, nervous system, kidney, and liver. These injuries are expected to result in the mortality of many of these fish either immediately or later in time. Beyond this range, NMFS estimates fish will generally survive during pile driving and not sustain permanent harm or injury. Fish within the range of 150 dB RMS and 187 db SEL or 206 dB peak may demonstrate temporary abnormal behavior indicative of stress or exhibit a startle response. As described previously, a fish that exhibits a startle response is not 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.

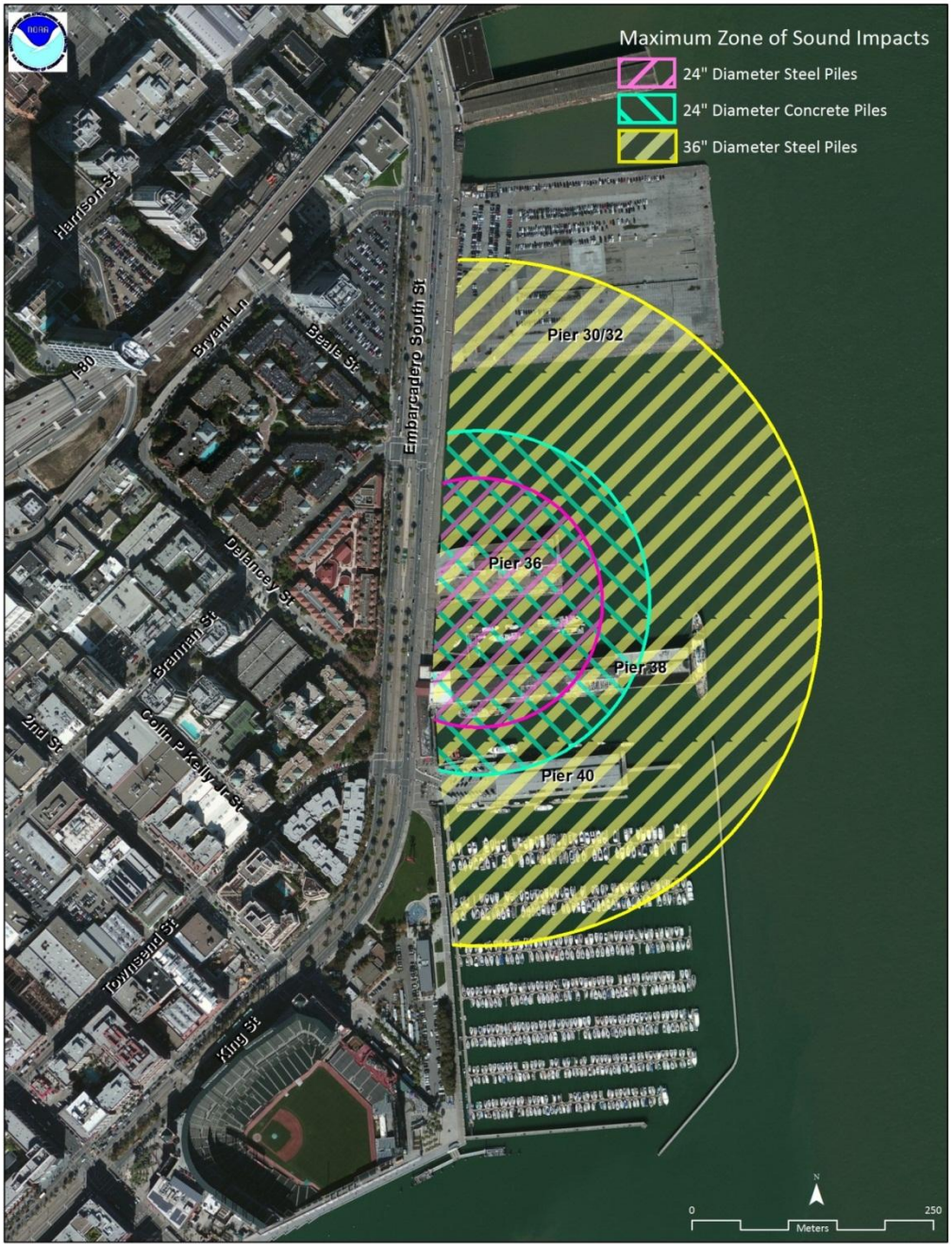

Figure 3. Areas where lethal effects to fish are expected to occur from sound produced by different types of piles.

NMFS estimates that a small number of CCC steelhead and southern DPS green sturgeon are likely to be injured or killed by the proposed pile driving. Using data from the California Fish Tracking Consortium Database (unpublished data, 2011) and CDFG (Jahn 2004 and 2006), and the condition of habitat in the action area (degraded), NMFS concludes the action area supports a small number of fish. This data shows that tagged salmonids and sturgeon that enter the action area generally spend short periods of time (less than 2 hours) at the site, suggesting that fish entering the action area are likely straying from nearby migration routes or forage grounds in

search of shelter or forage. Since the site provides little forage or shelter, fish do not stay in the action area. The number of fish entering the action area is probably a small proportion of each cohort. Thus, the number of fish entering the action area will vary from year to year in response to variations in cohort strength. Cohort strength is influenced by variations in precipitation and temperature, variations in predator or prey abundance, restoration actions, and other factors. Thus, NMFS expects the number of fish in the action area to be a very small proportion of the steelhead and sturgeon cohort due to the degraded condition of habitat in the action area. Pile driving activities will be limited to the period between May and December; thus, elevated sound levels will only affect a small percentage of migrating steelhead, but could affect juvenile, subadult, and adult southern DPS green sturgeon. Using the survey results from CDFG (Jahn 2004 and Jahn 2006) and tracking data from the California Fish Tracking Database (unpublished data 2011) and taking into consideration the habitat characteristics of the action area and interannual variation in fish numbers, NMFS estimates a low number of CCC steelhead (adult and juvenile) and green sturgeon (adult, sub-adult, and juvenile) will be present in the action area when pile driving activities occur.

Adult salmonids, due to their large size, can usually tolerate higher sound pressure levels (Hubbs and Rechnitzer 1952) and immediate mortality rates of adults are expected to be less than that experienced by juvenile salmonids. Given that adult green sturgeon are on average significantly larger than salmon, they could, presumably, tolerate higher levels of sound pressure and be less affected by pile driving activities. Similarly, juvenile green sturgeon are typically around 600 mm in length by the time they inhabit the estuary, close in size to some adult salmonids, therefore it is anticipated that they will also be more resilient and capable of recovering quickly from temporary disturbances associated with pile driving. However, they are vulnerable to injury or death from pile driving (especially if within close proximity), as demonstrated by SPLs that resulted in the death of an adult green sturgeon documented during the construction of the Benicia-Martinez Bridge installation.

2. Demolition and Construction Impacts on Fish

The existing Pier 36 platform, supporting caissons, and the majority of the marginal wharf have already been demolished by the Corps to make way for the new Brannon Street Wharf. Demolition of the remaining section of marginal wharf (3560 square feet) will be conducted from both land and water. For the new Brannon Street Wharf, construction activities consist of installing new piles, constructing a new cast in place concrete deck, and repairing the existing seawall. Construction of the new wharf will be primarily done from land. Concrete and other materials will be delivered to the site by land. Pile driving will be conducted from the water using a barge-mounted crane. Repair of the seawall will include sealing cracks and patching spalls in the concrete wall, and placing 1800 cubic yards of riprap along the toe of the seawall. The potential impacts of demolition and construction activities include behavioral (Sigler et al. 1984, Berg and Northcote 1985, Whitman et al. 1982, Gregory 1988) and sub-lethal impacts from exposure to increased turbidity (Sigler 1988, Sigler et al. 1984, Kirn et al. 1986, Emmett et al. 1988, Servizi 1988, Sigler 1988); redistribution and/or release of contaminants, with increased potential for chronic or acute toxicity; reduced contaminant sources from the removal of creosote-treated piles; introduction of toxic chemicals from construction equipment; and noise impacts from pile driving (discussed above).

a. Turbidity.

Construction and demolition activities are expected to create temporary increases in turbidity in the adjacent water column. There is little direct information available to assess the effects of turbidity in San Francisco Bay on juvenile or adult green sturgeon. Review of the literature regarding the effects of turbidity associated with dredging operations on anadromous salmonids indicates turbidity may interfere with visual foraging, increase susceptibility to predation, and interfere with migratory behavior. NMFS assumes that green sturgeon would also be affected by turbidity through interference with foraging and migratory behavior. Because they forage in bottom sediments, green sturgeon may be less affected by turbidity than salmonids during foraging. The extent of turbidity plumes resulting from the proposed project will depend on the tide, currents, and wind conditions during these activities. Tidal flow is low in the location of the proposed project. Accordingly, NMFS expects turbidity plumes to be minor and localized. Because fish tend to avoid areas of high turbidity and return when concentrations of suspended solids are lower, impacts to steelhead and sturgeon are expected to be temporary. These minor and localized elevated levels of turbidity will disperse from the project area with tidal circulation. CCC steelhead and southern DPS 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 of other aquatic organisms. Therefore, the minor and localized areas of turbidity associated with this project's in-water construction is not expected to impair or harm CCC steelhead or green sturgeon.

b. Contaminants.

In the aquatic environment, most anthropogenic chemicals and waste materials, including toxic organic and inorganic chemicals, eventually accumulate in the sediment. Contaminated sediments may be directly toxic to aquatic life or can be a source of contaminants for bioaccumulation in the food chain (Ingersoll 1995). Fine sediments in the project areas increase the likelihood of a problem with contaminants, because this fraction consists of particles with relatively large ratios of surface area to volume, which increase the sorptive capacity (the likelihood of taking up) of sediments for contaminants.

Dillon and Moore (1990) reported that major pollutant sources for San Francisco Bay include the freshwater flow from the Sacramento-San Joaquin River systems, over 50 waste treatment plants, and about 200 industries which are permitted to discharge directly into the bay (citing Luoma and Phillips 1988). Environmental contaminants discharged into aqueous systems tend to associate with particulate material in the water column and with consolidated bedded sediments.

The Corps performed sampling, chemical analyses and acute toxicity bioassays of Bay sediments from the project area to determine the chemical constituents of the sediments that may be re-suspended during demolition or construction. Chemical analyses were performed for priority pollutant inorganics; organotins; pesticides; PAHs; PCBs; and total organic carbon (TOC). Biological analyses were conducted for solid-phase bioassay and elutriate bioassays. The results of these studies showed a general absence of significant contamination, with low or non-detectable concentrations of chemical contaminants of concern (USACOE Biological Assessment dated February 2011). Therefore, NMFS expects there is little risk to listed fish from exposure to contaminants during construction of the proposed project.

c. Toxic Chemicals

Equipment refueling, fluid leakage, equipment maintenance, and construction activities near the Bay pose some risk of contamination of aquatic habitat and subsequent injury or death to CCC steelhead and green sturgeon. Oils and similar substances from construction equipment can contain a wide variety of polynuclear aromatic hydrocarbons (PAHs), and metals. Both can result in adverse impacts to salmonids. PAHs can alter salmonid egg hatching rates and reduce egg survival as well as 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).

Fueling of marine-based equipment will occur at designated safe locations adjacent to the proposed project. Fueling of land-based equipment will occur in a staging area or over pavement. Spill containment and remediation material will be nearby, and spills will be cleaned up immediately. Fresh cement or concrete will not be allowed to enter the Bay. Due to these measures, NMFS expects that accidents will be minimized and toxic chemical contamination of the action area will be minimized to levels which are unlikely to adversely affect fish.

d. Increased Boat Traffic

Upon completion of project construction, the new floating dock will serve as a boat launching site for kayaks and other small, unpowered crafts. These recreational boats will have easy access to the Bay from the dock. Since no launching site is currently present, the new dock is expected to increase the number of unpowered crafts in the Bay. Although noise associated with recreational boat traffic may startle fish, these boats are small in size and they will be human-powered (no motor or propeller). Adequate water depths in the project vicinity and the open-water nature of the Bay adjacent to the dock will provide startled fish sufficient area to escape and boat traffic is expected to result in insignificant disturbance.

B. Impacts to Critical Habitat

The action area is located within the Central Bay, south of the Bay Bridge, and is designated critical habitat CCC steelhead and the southern DPS of green sturgeon. The potential effects of this project to designated critical habitat associated with demolition and construction include temporary impacts on water quality, temporary reduction in foraging areas from noise and turbidity during construction and demolition activities, and a permanent reduction in the quality of critical habitat where riprap will be installed along the seawall. The temporary impacts on water quality and forage from construction activities are not expected to adversely affect PCEs of CCC steelhead and green sturgeon critical habitat, because water quality and forage in the action area is expected to improve once the project is completed and forage resources are available elsewhere in the Bay (Baxter et al. 1999).

Placing riprap in the tidal zone will permanently cover a small portion of tidal mudflats along the seawall. Mudflats comprise the largest area of tidal flat areas in the Bay and generally support an extensive community of invertebrate aquatic organisms, such as diatoms, worms and shellfish, as

well as fish that feed during higher tides, and plants such as algae and eelgrass. Installing riprap over mudflats that occur in the action area would reduce the amount of forage available to CCC steelhead and green sturgeon in the action area. The riprap would still provide some forage for CCC steelhead and green sturgeon since some prey species would persist in the crevices of the riprap. Approximately 0.2 acres of tidal mudflat will be covered with riprap by the Project. This is a small proportion of the approximately 30,000 acres of tidal mudflats that exist in the Bay (Goals Project 1999). Considering the small size of the riprap footprint and its ability to continue to support some prey species, the riprap should not decrease primary productivity, alter predator-prey interactions, change invertebrate assemblages, or reduce the density of benthic invertebrates in a manner that will reduce forage opportunities for salmonids or green sturgeon to the extent that their fitness would be reduced. The effects of placing 1800 cy of riprap in tidal areas of the Bay adjacent to the San Francisco waterfront will not impair or degrade the value of PCEs of designated critical habitat for CCC steelhead or southern DPS of green sturgeon within the action area.

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". Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

NMFS does not anticipate any cumulative effects in the action area other than the increased boat traffic described above, those ongoing actions already described in the Environmental Baseline and 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 affecting the Bay. In the long term, climate change may produce temperature and precipitation changes that may adversely affect steelhead and green sturgeon habitat in the action area.

VIII. INTEGRATION AND SYNTHESIS OF EFFECTS

CCC steelhead and 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 action area, the effects of shoreline development, agricultural, past mining activities, industrialization, and urbanization are evident. These activities have eliminated tidal marsh habitats, introduced non-native species, degraded water quality, and altered the hydrology and fish habitat of the action area. As a result, forage species that CCC steelhead and southern DPS green sturgeon depend on have been reduced, periodic sources of contaminants are introduced from Port activities and stormwater runoff, and natural shoreline habitat areas have been eliminated.

Due to the degraded condition of the habitat in the action area, NMFS concludes few CCC steelhead and green sturgeon occur in the action area. The number of impacted CCC steelhead and green sturgeon by construction of this project will be very small. Turbidity, sediment, and contaminant effects will likely result in minor and temporary changes to fish behavior, and are not expected to injure or kill CCC steelhead or southern DPS green sturgeon. Tidal currents in the action area will disperse turbidity plumes quickly.

Pile driving activities are expected to continue for a period of approximately 60 days and adverse effects from elevated underwater sound levels are anticipated during this period. The noise produced from pile driving will exceed the 187 SEL threshold during installation of all of the piles. The radial distance in which effects to fish may occur will vary according to the type of pile being installed each day. The radial distance in which adverse effects to fish will be 355 meters for one day, 129 meters for a maximum of 39 days, and 178 meters for 18 days. NMFS expects the amount of fish occurring within the impact zone during pile driving activities to be small.

NMFS does not believe the project will appreciably diminish the numbers, reproduction, or distribution of the South San Francisco Bay populations of CCC steelhead returning to spawn or emigrating to the ocean during the time the project will be implemented or in subsequent years. Any steelhead present in the action area during the construction window likely make up a small proportion from these populations or the CCC steelhead DPS; and will only affect one cohort. It is unlikely that the potential loss of very small numbers of juveniles or adults for one year as a result of the project will impact future adult returns, due to the relatively large number of juveniles produced by each spawning pair and the relatively large juvenile steelhead population in south Bay watersheds unaffected by the project compared to the small number of juveniles likely in the action area.

NMFS does not believe the project will appreciably diminish the numbers, reproduction, or distribution of the North American green sturgeon Southern DPS. Any green sturgeon present in the action area during the construction window likely make up a small proportion of the southern DPS of green sturgeon. It is unlikely that the small potential loss of juveniles, sub-adults, or adults for one year 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 in the action area.

The project will impact CCC steelhead and North American green sturgeon Southern DPS critical habitat at the project site temporarily through turbidity and noise during construction, and permanently by covering a portion of submerged benthic habitat with riprap. However, these areas represent a very small portion of the overall Central San Francisco Bay watershed, and habitat impacted temporarily will become available to CCC steelhead and green sturgeon again once the project is complete. NMFS expects that the temporary and permanent loss of estuarine habitat in the action area from the project will have insignificant impacts on the value of migration and rearing PCEs in the action area. These impacts are unlikely to appreciably diminish the value of designated CCC steelhead and southern DPS green sturgeon critical habitat.

IX. CONCLUSION

After reviewing the best available scientific and commercial data, the current status of CCC steelhead and North American green sturgeon southern DPS, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is NMFS' biological opinion that the proposed Pier 36 Demolition/Brannan Street Wharf Project in San Francisco, California is not likely to jeopardize the continued existence of threatened CCC steelhead or threatened green sturgeon.

After reviewing the best available scientific and commercial data, the current status of critical habitat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is NMFS' biological opinion that the proposed Pier 36 Demolition/Brannan Street Wharf Project in San Francisco, California is not likely to adversely modify or destroy designated critical habitat for CCC steelhead or 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 Corps or the City for the exemption in section 7(o)(2) to apply. The Corps has continuing duty to regulate the activity covered by this incidental take statement. If the Corps: (1) fails to assume and implement the terms and conditions, or (2) fails to require its designees to adhere to the terms and conditions of the incidental take statement, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps or the Port 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 CCC steelhead and southern DPS green sturgeon associated with the Pier 36 Demolition and Brannon Street Wharf Construction Project will be in the form of mortality, injury, harassment, and disturbance through temporary impacts from construction activities associated with pile driving. The number of threatened steelhead and green sturgeon that may be incidentally taken during activities at the Pier 36 Demolition/Brannan Street Wharf

project is expected to be small. Because 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 the Bay due to depth and the presence of predators and scavengers such as birds, 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 that will be taken. As described above, take is expected to occur in areas where sound levels exceed 206 dB peak or 187 dB SEL. This was determined to be a distance of 355 meters from the shoreline during the installation of the 36-inch diameter steel piles (1 day), 129 meters within the shoreline during the installation of 24-inch diameter steel piles (39 days), and 178 meters from the shoreline during the installation of 24-inch diameter concrete piles (18 days) between May and December. If the 206 dB peak or 187 dB SEL sound thresholds are exceeded beyond these distances, more fish may be injured or killed than what was analyzed above. The Corps will monitor the areas just beyond the distances where lethal effects are expected to occur to ensure that more take does not occur. In areas where sound levels below 206 dB peak and 187 dB SEL, but above 150 RMS, southern DPS green sturgeon and CCC steelhead may exhibit behavioral responses such as agitation or rapid bursts in swimming speeds. These behavioral responses are not expected to result in take.

B. Effect of the Take

In the accompanying biological opinion, NMFS has determined that the anticipated take is not likely to jeopardize the continued existence of CCC steelhead or green sturgeon.

C. Reasonable and Prudent Measures

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

1. undertake measures to minimize harm to steelhead and green sturgeon from demolition, construction, and degradation of aquatic habitat;

2. ensure the fisheries and hydroacoustic monitoring program minimizes harm and mortality of steelhead and green sturgeon, and assists in the evaluation of project effects on salmonids and green sturgeon; and

3. prepare and submit reports regarding the construction of the proposed project and the results of the fisheries and hydroacoustic monitoring program.

D. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Corps and the Port must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are nondiscretionary.

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

   a. Treated wood may not be used in any structure that comes in contact with the waters of San Francisco Bay.

   b. The permittees 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.

   c. Once construction is completed, all construction related material must be removed, leaving the area as it was before construction. Excess materials will be disposed of at an appropriate disposal site.

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

   a. A fisheries and hydroacoustic monitoring plan shall be implemented that includes the following:

      i. underwater sound measurements at various distances and depths within and outside the area where lethal sound impacts are expected to occur (this must include monitoring at the boundary of lethal and non-lethal sound impacts);

      ii. evaluation of fish mortality and injury rates through the use of visual observations and collections during pile driving events; and

      iii. observations of bird predation and behavior.

   b. The permittees shall prepare and submit to NMFS for review and approval the hydroacoustic monitoring plans for pile driving at least 60 days prior to construction. Monitoring shall be designed to determine if underwater sound pressure levels exceed what has been analyzed in this biological opinion. If sound pressure levels exceed what has been analyzed, NMFS must be contacted within 24 hours to determine whether reinitiation of formal consultation is necessary.

   c. Data from the monitoring program shall be made available to NMFS on a real-time basis.

   d. If any salmonids or sturgeon are found dead or injured during visual observations, the biologist shall contact NMFS biologist Amanda Morrison by phone immediately at (707) 575-6083 or the NMFS Santa Rosa Area Office at (707) 575-6050. All salmonid and 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 Santa Rosa Area Office without obtaining prior written approval from the NMFS Santa Rosa Area Office, Supervisor of the Protected Resources Division. Any such transfer will be subject to such conditions as NMFS deems appropriate.

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

a. The Corps or permittee 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 Santa Rosa Area Office, Attention: Supervisor of Protected Resources Division, 777 Sonoma Avenue, Room 325, Santa Rosa, California, 95404-6528. The reports shall contain, at a minimum, the following information:

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

ii. Hydroacoustic and fisheries 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, the interval between strikes, the peak/SPL, RMS and SEL per strike, and accumulated SEL per day for each hydroacoustic monitor deployed; a discussion of any unanticipated effects or unanticipated levels of effects on steelhead and green sturgeon; the number of fish killed or injured during the pile driving; and a discussion of any observed bird predation and behavior.

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. The Corps and Port should provide support and funding for salmonid and sturgeon tagging and monitoring in the San Francisco Bay (California Fish Tracking Database).

b. The Corps and Port should remove or provide funding for the removal of abandoned creosote-treated piles from San Francisco Bay.

XII. REINITIATION NOTICE

This concludes formal consultation on the Pier 36 Demolition/Brannan Street Wharf Project in San Francisco, 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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Jeffrey Jahn, National Marine Fisheries Service (NMFS) Biologist; conversation with Amanda Morrison, NMFS Biologist; March 2011.