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

July 26, 2012

In response refer to:
2011/06500

Captain Cynthia L. Stowe
U.S. Coast Guard
Sector San Francisco
Yerba Buena Island
San Francisco, California 94130-9309

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

Frank Dean
National Park Service
Golden Gate National Recreational Area
Fort Mason Building 201
San Francisco, California 94123-0022

Dear Captain Stowe, Colonel Baker, and Mr. Dean:

Thank you for the U.S. Coast Guard's (USCG) letter of November 23, 2011, requesting initiation of formal consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 *et seq.*), and the Essential Fish Habitat (EFH) provisions of the Magnuson Stevens Fishery Conservation and Management Act (MSA) for the 34th America's Cup (AC34), James R. Herman Cruise Terminal, and Northeast Wharf Plaza projects (Project) located on San Francisco Bay in the City and County of San Francisco, California. The proposed Project involves actions and permits by three Federal Agencies: the USCG; the National Park Service (NPS); and the U.S. Army Corps of Engineers (Corps). The USCG has been designated as the federal lead agency for the purpose of conducting the Project's section 7 consultation with NMFS. Non-federal Project sponsors and applicants include the America's Cup Event Authority (ACEA), America's Cup Race Management (ACRM), America's Cup Organizing Committee (ACOC), City and County of San Francisco (City), and Port of San Francisco (Port), collectively referred to as, Applicants.

The enclosed biological opinion is based on our review of the Applicants' proposal to construct AC34 facilities and venues, host a series of AC34 yacht races, and construct the new Cruise Terminal. The biological opinion describes NMFS' analysis of the Project's potential effects on Central California Coast (CCC) steelhead (*Oncorhynchus mykiss*), threatened Central Valley (CV) steelhead (*O. mykiss*), threatened CV spring-run Chinook salmon (*O. tshawytscha*), endangered Sacramento River winter-run Chinook salmon (*O. tshawytscha*), threatened southern distinct population segment (DPS) of North American green sturgeon (*Acipenser medirostris*), and designated critical habitat for green sturgeon, CCC steelhead, and winter-run Chinook salmon in accordance with section 7 of the ESA. In the enclosed biological opinion, NMFS concludes the project is not likely to jeopardize the continued existence of these listed salmonid species or green sturgeon. NMFS has also concluded the proposed project is not likely to result in the destruction or adverse modification of the critical habitats described above. However, NMFS anticipates take of green sturgeon and listed salmonids will occur during project construction from sound pressure waves associated with pile driving and exposure to contaminants associated with dredging An incidental take statement which applies to this project with non-discretionary terms and conditions is included with the enclosed biological opinion.

Although ESA-listed marine mammals, such as the humpback whale (*Megaptera novaeangliae*) and Steller sea lion (*Eumetopias jubatus*) do inhabit the project area, take for ESA-listed marine mammals has not been requested as the intent of the proposed monitoring and mitigation measures is expected to avoid take of ESA-listed marine mammals. The Applicants have applied for an Incidental Harassment Authorization under the Marine Mammal Protection Act for take of non-ESA listed marine mammals. Should take of an ESA-listed marine mammal occur, the Applicants should cease activities and contact Monica DeAngelis at (562) 980-4032 or Monica.Deangelis@noaa.gov at NMFS' Southwest Regional Office immediately.

This letter also transmits NMFS' Essential Fish Habitat (EFH) Conservation Recommendations (Enclosure 2) as required by the Magnuson-Stevens Fisheries Conservation and Management Act (MSA) (16 U.S.C. 1801 *et seq.*). NMFS has reviewed the proposed project for potential effects on EFH and determined that the proposed project would adversely affect EFH for various federally managed fish species under the Pacific Salmon, Coastal Pelagic, and Pacific Groundfish Fishery Management Plans (FMPs).

Section 305(b)(4)(B) of the MSA requires the federal action agency to provide NMFS with a detailed written response within 30 days to these EFH Conservation Recommendations, including a description of the measures adopted by the USCG for avoiding, minimizing, or mitigating the impact of the project on EFH (50 CFR 600.920(j)). In the case of a response that is inconsistent with NMFS' recommendations, the federal action agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the proposed action and the measures needed to avoid, minimize, or mitigate such effects.

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

Sincerely,

for Rodney R. McInnis
Regional Administrator

Enclosure

cc: Chris Yates, NMFS, Long Beach, CA
Bryant Chesney, NMFS, Long Beach, CA
Aaron Lubrano, USCG, San Francisco, CA
Rob Lawrence, U.S. Army Corps of Engineers, San Francisco, CA
Michael Savidge, National Park Service, San Francisco, CA
Kelley Capone, Port of San Francisco, CA
Copy to Administrative File: 151422SWR2012SR00103

Enclosure 1

BIOLOGICAL OPINION

ACTION AGENCY: U.S. Coast Guard, San Francisco
National Park Service, San Francisco
U.S. Army Corps of Engineers, San Francisco

ACTION: 34th America's Cup, James R. Herman Cruise Terminal, and Northeast Wharf Plaza projects, San Francisco, California.

CONSULTATION CONDUCTED BY: National Marine Fisheries Service, Southwest Region

TRACKING NUMBER: 2011/06500

DATE ISSUED: **July 26, 2012**

I. CONSULTATION HISTORY

On December 31, 2010, San Francisco was selected as the host city for the 34th America's Cup (AC34). Mayor Gavin Newsom and the Board of Supervisors for the City and County of San Francisco (City) approved a 34th America's Cup Host and Venue Agreement with the America's Cup Event Authority (ACEA), in association with America's Cup Race Management (ACRM), and America's Cup Organizing Committee (ACOC). The U.S. Coast Guard (USCG), U.S. Army Corps of Engineers (Corps), and National Park Service (NPS) (collectively referred to as the Action Agencies) have jurisdiction over different components of the AC34. Based on USCG authority over the in-water portion of the race event, NPS and Corps have designated USCG to be the lead federal agency for the purpose of conducting the Endangered Species Act (ESA) section 7 consultation with NOAA's National Marine Fisheries Service (NMFS).

Between March and November 2011, NMFS provided Endangered Species Act (ESA) and Magnuson Stevens Act (MSA) technical and procedural assistance to the project Sponsors, USCG, NPS, and the Corps that resulted in completion of a Biological Assessment and Essential Fish Habitat (EFH) Assessment in November 2011. During this time, at least 10 meetings were held among NMFS, the Applicants, and the Action Agencies.

By letter dated November 23, 2011, the USCG requested initiation of formal consultation with NMFS pursuant to section 7 of the ESA regarding the proposed 34th America's Cup, James R. Herman Cruise Terminal, and Northeast Wharf Plaza projects (Project) in San Francisco, California. With the USCG's November 23, 2011, letter requesting consultation, the USCG

provided NMFS a Biological Assessment and EFH Assessment (BA) prepared by the Applicants' consultants, Applied Marine Sciences, Inc., Boudreau Associates LLC, and Environmental Science Associates, dated November 2011.

NMFS provided comments on the BA to the USCG via email dated December 20, 2011, requesting clarification of project elements and additional project information.

By email message on February 10, 2012, Boudreau Associates provided NMFS and the USCG with information requested in the December 20, 2011, email and a revised project description with attachments dated, February 6, 2012.

By email message on April 27, 2012, Boudreau Associates provided NMFS and the Corps with a revised project description. Project changes included reductions in the amount of proposed dredging, number of floating docks, amount of permanent on deck and in-water improvements, the amount of venue programming for the race events, and revisions to the race schedule

On May 1, 2012, NMFS participated in a conference call with representatives from Boudreau Associates and the Port. During the meeting NMFS asked several questions to clarify project elements and requested additional information for assessment of potential project impacts to ESA listed species and EFH.

By email messages on May 9 and May 14, 2012, the Port provided NMFS, the Corps, and the USCG with information requested during the May 1, 2012, meeting.

By email to the Corps, Port, Boudreau Associates on May 15, 2012, NMFS requested additional information related to sediment samples taken at the proposed dredge sites to determine whether additional data on chemical components in sediments could be obtained from archived sediment samples.

By email message on May 23, 2012, the Port provided NMFS, the Corps, and the USCG responses to the questions NMFS asked in the May 15, 2012, email.

On June 4, 2012, NMFS participated in a conference call with representatives from Boudreau Associates and the Port. During the meeting NMFS requested additional information on the proposed AC34 dredging activities and sedimentation rates at the dredge sites. By email dated, June 11, 2012, Boudreau and Associates provided additional information on dredging activities. Additional information on sedimentation rates at the dredge sites was not provided to NMFS. Boudreau and Associates explained in their June 11, 2012, email that time would not be spent to prepare this information.

II. DESCRIPTION OF PROPOSED ACTION

The USCG proposes to issue a Marine Event Permit authorizing AC34 on water activities, as

well as a Special Local Regulation to safely and securely manage marine traffic during events. The Corps proposes to issue a permit for in-water construction and dredging components of the Project pursuant to section 10 of the Rivers and Harbors Act. The NPS proposes to accommodate additional visitors during AC34 events by temporarily installing self-contained portable toilets on NPS lands.

The purpose of Phase 1 of the project is to host the 34th America's Cup in San Francisco Bay. The America's Cup is a series of yacht sailing races hosted at changing locations around the world. The City of San Francisco will be hosting the 34th America's Cup event. The proposed AC34 consists of race events in Central San Francisco Bay that will take place in mid-August and early October in 2012, and from early July to late September in 2013. Project Applicants propose to make improvements at the James R. Herman Cruise Terminal and the Northeast Wharf Plaza at Piers 27-29 (referred to as "Phase 1" of Cruise Terminal Improvements) which will create a hub of hospitality, entertainment, exhibitions, merchandising, and spectator viewing for AC34. In addition to work at Piers 27-29, the Project proposes to make repairs at other existing piers and install temporary floating docks along the San Francisco waterfront to facilitate spectator viewing and race operations. Repairs are proposed at Piers 19, and 30-32. The installation of temporary floating docks is proposed at the Marina Green, and at Piers 9, 14, 23, 27-29, 30-32, and 80. These improvements, repairs, and temporary installations will occur between July 2012 and December 2013.

The purpose of Phase 2 of the project is to complete improvements to the Cruise Terminal in order to meet current cruise ship and operational requirements, energy efficiency standards, create new special event opportunities, and improve public open space and access along the San Francisco waterfront. These additional improvements to modernize and reconfigure the James R. Herman Cruise Terminal and Northeast Wharf Plaza will commence following the completion of the AC34 events in 2013. In-water construction for Phase 2 of the Cruise Terminal will occur between November 2013 and December 2014.

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

A. Description of Project Elements and Construction Activities

1. Races

Two America's Cup (AC) World Series events are planned for 2012. The first event will take place from August 18 through August 26 with four days of racing with 45-foot yachts (referred to as "AC45"). The second event will take place from September 30 through October 7 with three days of racing with 72-foot yachts (referred to as "AC72"). The second event will also include exhibition racing and four additional days of AC45 racing.

The 2012 AC World Series races will be followed in 2013 by the Louis Vuitton America's Cup Challenger Series (CSS) to determine which of the challenger teams advances to compete with

the defender in the final Match. The overall timeframe for the CSS races and the Match will occur over approximately 81 days between July 4 and September 22, 2013. During this period, there will be approximately five days of fleet racing and 39 days of AC72 racing for a total of 44 race days in 2013.

The Applicants estimate 800 spectator boats (e.g., recreational boaters, commercial charter, large private yachts) will observe AC34 race activities, of which 10% (80 boats) are expected to come to San Francisco Bay from elsewhere. All of these vessels would be able to use existing marina facilities in the greater Bay-Delta to dock. However, some boaters may elect to anchor in approved open water anchorages in Central San Francisco Bay. During race events, many of these visiting boaters are expected to observe the races from their boats in the northern and western portions of Central San Francisco Bay.

2. <u>In-Water Construction</u>

a. Repair of Existing Piers

The Project proposes to make repairs at Piers 19, 27-29, and 30-32. Piers will be repaired by wrapping piles with a Poly Vinyl Chloride (PVC) jackets. It is anticipated that a jacket would primarily be placed on the piles in the wave zone (Elevation 0 to +3 mean lower low water [MLLW]) and not extend to the seabed. However, a small number of jacket repairs would extend to the seabed. PVC jackets will be installed by divers. A number of piles at Piers 27-29 and 30-32 would also receive crack repairs such as epoxy injection or concrete patching at the top near their connection to the beam and slab deck. Piles will be inspected to determine if cracks need to be repaired. Repairs will be performed from a boat under the piers at low tide when the cracks are above water and dry. Piles that are beyond repair would be replaced. At Pier 19, pier repairs will include the associated apron. The apron at Pier 19 is a 15- to 30-foot wide area on the edge of the pier where vessels are moored. The apron is supported with pilings and the surface is typically wood deck and beams. Fender pilings and mooring cleats are provided along the edges for the docking of vessels. Table 1 below presents a summary of the repairs anticipated to occur at Piers 19, 27-29, and 30-32.

Table 1. Location and type of permanent pier repairs and structures.

Location	Type of Repair
Pier 19 - Pile Replacement for Pier and Apron Repair	224 12-inch diameter wood piles replaced
	20 piles repaired with 1-inch thick wrap or 6-inch thick pile jackets
Cruise Terminal at Pier 29 - Substructure Pile Repair (Phase 1)	10 42-inch diameter concrete piles replaced
	15 piles repaired with 6-inch thick jacket
Cruise Terminal at Pier 27 – Pile Replacement for Apron, Marginal Wharf, and Fender Repairs (Phase 2)	52 18-inch diameter concrete piles repaired with 6-inch thick jacket
	60 14-inch steel H-beams replaced
	3 48-inch steel pipe piles replaced
	8 18-inch diameter concrete piles replaced
Piers 30-32 - Pile Jacket Repair	12 piles repaired with 6-inch thick jacket

b. Installing Temporary Floating Docks, Gangways, and Anchor.

Temporary floating docks, gangways, block anchors, and helical anchors will be installed to provide berthing and anchoring facilities to AC34 spectator, team, and official boats. The locations and number of these structures are listed in Table 2.

Table 2. Location, size, and type of temporary structures.

Location	Floating Docks		Gangways		18-inch diameter Steel Piles		Block Anchors		Helical Anchors	
	No.	Sq. Ft.	No.	Sq. Ft.	No.	Sq. Ft.	No.	Sq. Ft.	No.	Sq. Ft.
Marina Green 2012/2013	1	8,000	1	480	14	25	28[a]	700	0	0
Pier 29 N 2013/ 27-29 E 2013	2	9,960	3	720	26	46	0	0	50	350
Pier 27 S 2013	2	26,944	2	960	55	98	124	3,100	0	0
Pier 23 N 2013	1	9,120	2	720	21	37	6	150	0	0
Pier 23 S 2013	1	4,800	2	480	16	28	0	0	0	0
Pier 9 S 2013	1	6,600	1	240	15	27	0	0	44	308
Pier 14 N 2013	1	5,424	1	480	44	78	0	0	48	336
Pier 32 S 2012/2013	1	14,640	2	720	27	48	28	700	0	0
Pier 80 2012/2013	1	12,000	2	480	26	46	8	200	0	0
Totals	**11**	**97,488**	**16**	**5,280**	**244**	**433**	**194**	**4,850**	**142**	**994**

[a] During 2013, anchor blocks will be reduced from 28 to 8 at Marina Green.

Floating docks would be made of concrete, aluminum, or lighter-duty timber pre-cast sections. The dock modules would be fabricated off site, placed on a barge and towed to the specific location. The sections would then be assembled and located in the correct positions. To fix the dock system in place, 18-inch diameter steel guide piles would be driven through pile guides. Gangways will be installed to access the floating docks from the landside. The gangways would likely be placed into position and attached with the aid of a barge mounted crane.

Temporary mooring facilities for vessels will be installed at Piers 9, 14, 23, 27-29, 30-32, 80 and Marina Green for the duration of AC34 events. Either helical or concrete block anchoring systems are proposed for the temporary moorings (see Table 2). The helical anchors consist of a long screw like threaded metal bar with plate and o-ring comprising the top portion of the anchor system. The concrete anchors are a cube of concrete (5 by 5 by 5 feet or 25 square feet) with a steel fitting for transportation of the blocks and for anchor connection. These anchors would be

lowered to the seafloor and positioned as per the designs. Typically, two cubes or helical anchors are sufficient for vessels up to 100 feet. For larger vessels, multiple anchors would be connected together to provide greater resistance. Installation would be via derrick barge or other platform. The concrete anchor would be either placed through gravity drop or through diver assistance or from a vessel with an "A" frame with powered device. The helical anchor would be installed with "A" frame powered device or with diver assistance to screw it into the sediment floor. Temporary moorings and their associated anchors will be removed no later than November 30, 2013, following the conclusion of AC34 events.

c. Removing Temporary Floating Docks, Gangways, and Anchors

Although the support piles will remain in place, temporary floating docks would be removed between the 2012 and 2013 AC34 events. The piles will remain in place to reinstall the floating docks prior to 2013 events. At the conclusion of all AC34 events in October 2013, the dock systems, gangways, and supporting piles would be dismantled and removed. The processes described above would be completed in reverse order. Piles would typically be pulled out of the seafloor using the same barge mounted crane type that would be used for installation.

d. Construction of a Bird Platform

The Project proposes to remove approximately 42,500 square feet of creosote piles from the Bay at two dilapidated piers, Piers 64 and ½, as a conservation measure. Currently, the dilapidated Pier 64 is commonly used by birds. The Project proposes to build a new bird platform near Pier 64 to compensate for this loss of structure for perching birds. The replacement platform may be up to 1,500 square feet and supported by eight 16-inch diameter steel piles. Pier 64 would be demolished and the new platform would be rebuilt between September 2013 and December 2014.

e. Pile Installation

Pier repairs, install the temporary floating docks, and construct the replacement bird platform all require piles of various sizes and materials to be installed in San Francisco Bay along the waterfront. In total, the Project proposes to install 557 piles. Of those, 244 are temporary and would be removed from the Bay by November 30, 2013.

Three different methods will be used to install new piles in San Francisco Bay: (1) vibratory hammer installation; (2) impact hammer installation; and (3) pour-in-place installation of concrete piles. Pour-in-place installation of concrete piles is accomplished with barges and divers in the water. Rebar is installed along the entire length of the pile column from the overwater pier to a concrete block placed on the Bay floor. Divers will install a fiberglass form consisting of two semi circles that form a watertight seal around the new rebar. A small hole at the top of the fiberglass form will allow an aggregate mix to be pumped into the form displacing seawater. Concrete will be prevented from entering the Bay by the fiberglass form. The fiberglass forms are translucent allowing the process to be monitored by a diver. The concrete

cures in approximately five days and the fiberglass forms are removed. Piles will be installed using a pour-in-place technique at Piers 27 and 29. Table 3 presents pile types, sizes, and installation methods.

Table 3. Summary of piles that will be installed as part of the Project (temporary and permanent).

Locations	Pile Diameter (inches)	Pile Type	Number of Piles	Installation Method	Attenuation Device(s)
Pier 19	12	Wood	224	Impact Hammer	None
Pier 27-Cruise Terminal (Phase 2)	14	Steel H-beam	60	Vibratory Driver*	None
	48	Steel pipe	3	Vibratory Driver*	Bubble curtain
	18	Concrete	8	Pour-in-Place	NA
Pier 29-Cruise Terminal (Phase 1)	42	Concrete	10	Pour-in-place	NA
Floating docks at Marina Green and Piers 27-29, 23, 9, 14, 32, and 80	18	Steel pipe	244	Vibratory Driver	None
Pier 64-Bird Platform	16	Steel	8	Vibratory Driver	None

*An impact hammer may be used to drive the last 15-25 feet of the piles.

Pier 19 - 12-inch diameter wood piles. An impact hammer will be used to permanently install 12-inch wood piles at Pier 19 between August 2012 and February 2013. Piles will be installed from the existing deck structure using land based pile driving equipment or from a marine derrick barge depending on the location of the pile. Once piles are driven, divers will install a PVC wrap around each pile. The PVC material will be wrapped around each pile for the entire length of the pile to the mudline. In total, 224 12-inch wood piles will be permanently installed for repair of the pier and its associated apron.

Pier 27 – 14-and 48-inch steel piles, and 18-inch concrete piles. A vibratory hammer will be used for permanently installing 14-inch H-Beams and 48-inch diameter pipe piles at Pier 27 unless difficult driving conditions are encountered, in which case an impact hammer will be used to complete the last 15-25 feet of each drive. Piles will be installed from the existing deck structure using land based pile driving equipment or from a marine derrick barge between November 2013 and December 2014. Construction of the permanent 18-inch concrete piles at Pier 27 will be done using the pour-in-place technique between November 2013 and December 2014.

Pier 29 - 42-inch concrete piles. Pour-in-place installation of the permanent 42-inch diameter concrete piles will be done using barges and divers in the water between July 2012 and October 2012.

Temporary Floating docks - 18-inch steel piles. 18-inch diameter steel piles will be temporarily installed for floating docks at the Marina Green, Piers 9, 14, 23, 27-29, 30-32, and 80. These steel piles will be installed by a vibratory pile driver operated from barge mounted cranes. Pile installation for temporary floating docks may occur year-round extending from July 2012 through November 2014.

Pier 64 - 16-inch steel piles. Permanent 16-inch diameter steel piles will be installed to support the replacement bird platform near Pier 64. Piles will be installed using vibratory pile driver operated from barge mounted cranes. Pile installation may occur year-round extending from September 2013 through November 2014.

f. Dredging

The project proposes to remove accumulated sediments along the San Francisco waterfront to accommodate anchored mooring of AC racing boats, and other AC34 support and spectator vessels. Dredging of approximately 13,500 cubic yards (cy) is proposed within the basin between Piers 32 and 36 (referred to as "32-36 Over Water Basin"). The 32-36 Over Water Basin will be dredged to a depth of -10 feet MLLW plus 1 foot overdepth. If needed, dredging will also be performed at Piers 9 and 14. An estimated 10,000 cy of accumulated sediments would be removed at Pier 9, and 10,000 cy at Pier 14 North. Pier 9 may be dredged in two areas; one area to a depth of -9 feet MLLW plus 1 foot overdepth and a second area to a depth of -11 feet MLLW plus 1 foot overdepth. The basin at Pier 14 North may be dredged to a depth of -11 feet MLLW plus 1 foot of overdepth. Dredging would be accomplished with a 10 cy clamshell bucket in October 2013 at the 32-36 Over Water Basin. Dredging at Piers 9 and 14 would be conducted between June 1 and November 30 in 2013. Dredged materials will be barged to the San Francisco Deep Ocean Disposal Site (SF-DODS) for disposal, or, alternatively, may be barged to Suisun Bay for disposal at an upland location in the Montezuma Wetlands Restoration Project.

Post-dredging, sediments on the exposed Bay floor will be sampled within 15 days of the completion of dredging in accordance with procedures established by the Dredged Material Management Office (DMMO). Post-dredge sampling results will be submitted to NMFS and DMMO agencies. The Applicants will discuss the sampling results and the need for possible next actions with NMFS and the DMMO agencies, and if deemed necessary, develop measures for managing sediment contaminants at the project site, as appropriate. These measures will be developed in coordination with NMFS and the DMMO agencies and provided to DMMO within 60-days of the Applicants' receiving post-dredge sampling results.

3. Conservation Actions

The Project proposes the following conservation actions:

- **Removal of Creosote Piles and Dilapidated Piers.** The Project propose to remove between 350 and 400 existing creosote piles from the Bay at two dilapidated piers, Piers 64 and ½. Pier 64 consists of approximately 14,454 square feet of creosote piles and is located near Mission Rock along the San Francisco waterfront. This pier consists of a collection of remnant creosote piles and a dilapidated pier structure, which is commonly used by birds. As presented above, a new bird platform will be built to compensate for removal of the bird perching sites at Pier 64. Pier ½ consists of approximately 21,000 square feet of creosote, concrete, and steel piles and is located between the Ferry Building and Pier 1. Pile removal at both Pier 64 and Pier ½ is planned to take place between July 2012 and December 2014. Piles will be removed through vibratory extraction, followed by direct pull, or by clamshell removal and cutting, as necessary based on site specific investigations.

- **Benthic Study Funding.** A total of $100,000 will be distributed by the Applicants to contribute to a benthic study design program. Funds will be provided to the Science Committee associated with the Long-Term Management Strategy (LTMS) for dredged material from the San Francisco Bay Area. The LTMS identified several studies that would be valuable to assessing effects of dredging to benthic organisms and their habitat in San Francisco Bay. Field collection methods for this type of study could include periodic sampling of the benthos using Eckman bottom grabs, Ponar dredges, or similar equipment, with grab areas of approximately 0.1-10 square inches. The specific study has not been defined at this time but will be addressed in upcoming LTMS Management and Science Committee meetings in the next year.

- **Replacing Moorings.** Ten existing mooring buoys/anchors in North San Francisco Bay will be replaced with new mooring configurations. Locations are four anchors in the vicinity of Sausalito, one anchor at Angel Island, three anchors at Brooks Island near Richmond, and two anchors at Marina Bay Yacht Harbor near Richmond. New moorings include a buoy system to lift the chain off the surface of the bottom which avoids damage to eelgrass habitats through chain and anchor drag. The new moorings will be installed before the 2013 AC34 races begin.

- **Invasive Species Prevention.** The Applicants have established an Invasive Species Task Force (ISTF) specifically for the America's Cup Project with interested parties and resource agencies (Coastal Commission, CDFG, Regional Water Quality Control Board, San Francisco Estuary Project, State Lands Commission, CA Department of Boating and Waterways, and USCG). The ISTF also includes representatives from the Smithsonian Environmental Research Center. For the AC34 events, the ISTF has created a list of Best Management Practices (BMPs) that will be distributed to boaters. These BMPs will

educate boaters planning to attend the AC34 events about the importance of cleaning their hulls before they leave home port. A 'boater pledge' program will offer incentive flags to boat owners who pledge to comply with the BMP guidelines to avoid the spread of invasive species.

4. On-land Activities

The AC34 project involves many activities on land or piers that do not involve in-water activities. These include the operation and construction of exhibitions, hospitality, merchandising, concessions, entertainment, media support, spectator venues, office space and bases for staff, volunteers, and race teams. The AC Village will be located at Marina Green in 2012 and will include exhibitions, hospitality, merchandising, entertainment, and a media center. Proposed outdoor bleacher-style seating will accommodate approximately 700 spectators for public viewing of the 2012 races. In 2013, the AC Village will be located at Piers 27-29, which will serve as a hub for hospitality, entertainment, exhibitions, merchandising, and spectator viewing of the sailing races.

At Piers 30-32, bases for up to 10 teams for the 2012 events and up to 6 teams for the 2013 events will be constructed. Bases for teams will include space for boat work, boat washing, storage and maintenance facilities, as well as office space and ancillary team parking. Temporary tents (up to 40 feet in height) will be installed to house team base operations and hospitality uses.

Construction of the new Cruise terminal and wharf plaza will be phased to allow for its use in the 2013 AC34 events. As currently planned, Phase 1 permanent improvements will be completed by December 2012, and will include demolition of pier sheds, construction of the Cruise Terminal core building and shell, providing Americans with Disabilities Act access, relocating shoreside power, base level paving and lighting for the Northeast Wharf plaza, and installing stormwater management features. Post-construction stormwater management actions will include a rainwater harvesting and distribution system, biofiltration planters, impervious surface replacement with pervious landscaping, and media filters containing dual media cartridges designed to remove metals, hydrocarbons, and sediment. If the construction of the Cruise Terminal is deferred until after 2013, a temporary tent structure will be installed within the same footprint of the Cruise Terminal building for AC34 events.

Pier 80 will serve either as an ancillary location for AC34 2012 race events or the primary location for up to 10 team bases, depending whether Piers 30-32 can be made available in time to be the primary team base location for 2012. It will also serve as an ancillary location for team bases for AC34 2013 race events.

Phase 2 of the Cruise Terminal portion of the project will be initiated after the 2013 AC34 events have concluded, and will be completed by December 2014. On-land Phase 2 improvements consist of completing the interior of the new Cruise Terminal building, reinstalling shore-side power, completing the Northeast Wharf Plaza, and installing stormwater management features consistent with the San Francisco Stormwater Management Guidelines.

B. Measures to Protect Listed Species and Critical Habitat

The Project proposes to implement several measures related to the control of invasive species, lighting impacts, and containment of construction-related contaminants, noise, sound, and turbidity. The following measures are proposed during construction activities, and during all AC34 events:

- A Spill Prevention Control and Countermeasure (SPCC) Plan and Materials Management Disposal Plan (MMDP) will be prepared and implemented to prevent and clean up accidental discharges of debris, rubbish, creosote-wood, soil, silt, sand, fuel, oil, and other petroleum products, cement, concrete, or washings thereof, or other construction-related materials and waste.

- Fueling of equipment will use proper fuel transfer procedures as per USCG regulations (USCG 33 CFR 156.120 and 33 CFR 155.320), including spill containment. Fueling locations will be inspected after fueling to document that no spills have occurred. Any spills will be cleaned up immediately using spill response equipment as identified in the SPCC Plan.

- Hydroacoustic monitoring will be performed during impact hammer pile driving. The monitoring program will be used to record sound levels during pile driving activities. The monitoring plan will be developed in advance of construction and submitted to NMFS for review. The sound monitoring results will be made available to NMFS.

- Impact hammers will be cushioned using a 12-inch thick wood cushion block.

- Only a single impact hammer will be operated at one time.

- Shielded, low elevation, and low intensity lighting will be installed on all temporary floating docks to minimize artificial illumination of Bay waters.

- Information will be provided to visiting boaters that identifies sensitive habitats and species in the Bay and measures to avoid impacts to marine resources.

- Piles will be removed by direct pull or vibratory hammer. Broken and damaged pilings that cannot be removed by either the vibratory hammer or direct pull will be removed with either a clamshell bucket or environmental clamshell. If the entire pile cannot be removed, the pile will be cut at the mudline.

- Piles will be cut off at lowest practical tide condition and at slack water to reduce turbidity.

C. 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 action area for the Project encompasses the western shore of Central San Francisco Bay in the City and County of San Francisco from Pier 80 north to the Marina Green, nearshore areas for mooring buoys along the shoreline of Sausalito, Angel Island and Richmond, open water areas in Central San Francisco Bay for AC34 sailing races, and the deepwater ocean disposal site for dredged materials (SF-DODS) (Figure 1). The action area includes areas that will be affected by noise and turbidity during construction, dredging, sailing races, and implementation of conservation actions.

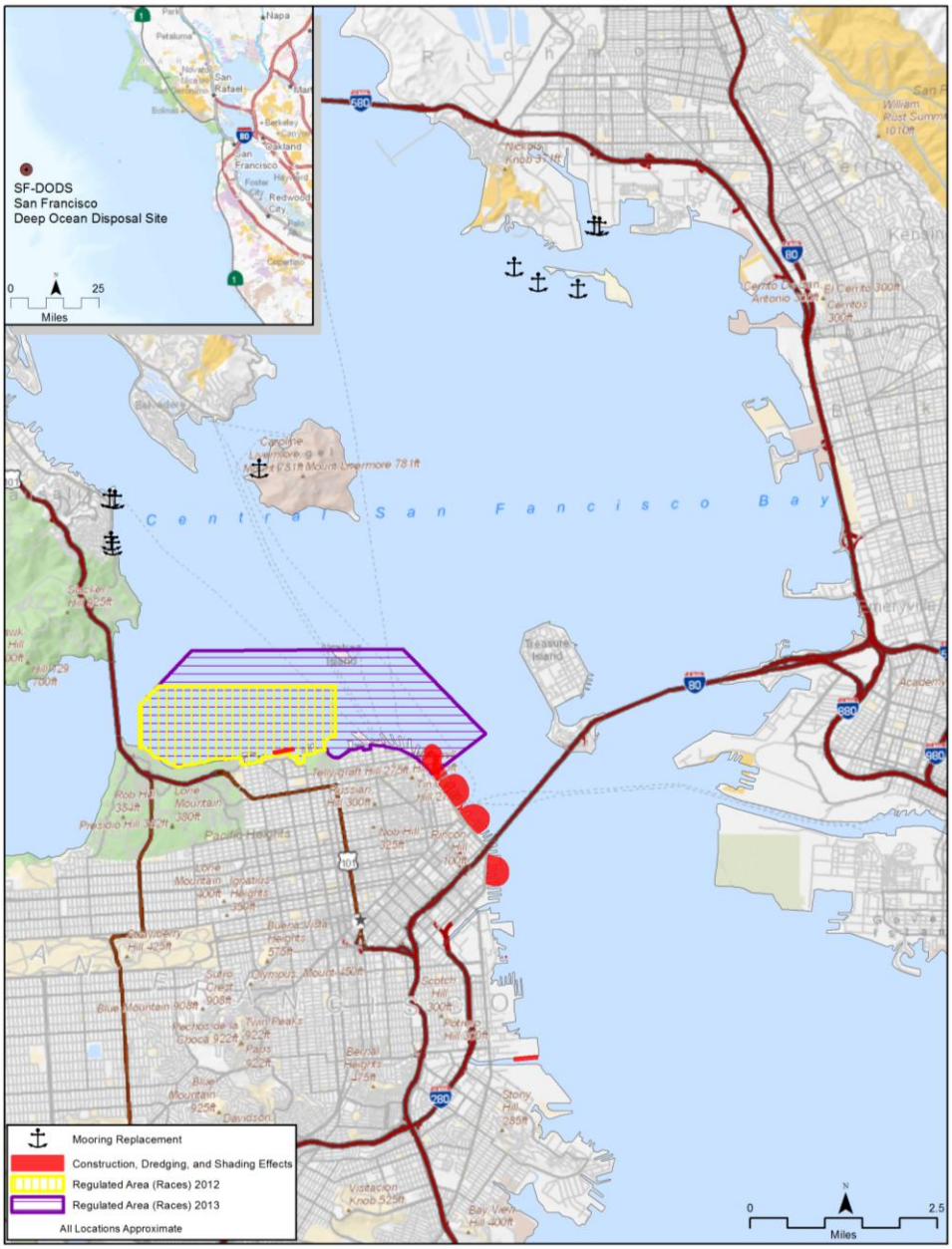

Figure 1. Areas affected by the Project.

III. ANALYTICAL FRAMEWORK

In accordance with policy and regulation, the jeopardy analysis in this biological opinion relies on four components: (1) the Status of the Species, which evaluates the California Central Coast (CCC) steelhead distinct population segment (DPS), Central Valley (CV) steelhead DPS, CV spring-run Chinook salmon evolutionarily significant unit (ESU), Sacramento River winter-run Chinook salmon ESU, and southern DPS of North American green sturgeon range-wide conditions, the factors responsible for that condition, and the species' likelihood of both survival

and recovery; (2) the Environmental Baseline, which evaluates the condition of this listed species in the action area, the factors responsible for that condition, and the relationship of the action area to the likelihood of both survival and recovery of this listed species; (3) the Effects of the Action, which determines the direct and indirect effects of the proposed Federal action and the effects of any interrelated or interdependent activities on this species in the action area; and (4) Cumulative Effects, which evaluates the effects of future, non-Federal activities in the action area on this species.

A. Jeopardy Analysis

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

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

B. Adverse Modification Analysis

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

The adverse modification analysis in this biological opinion relies on four components: (1) the Status of Critical Habitat, which evaluates the range-wide and watershed-wide condition of critical habitat for the CCC steelhead DPS, Sacramento River winter-run Chinook salmon ESU, and southern DPS of North American green sturgeon ESU in terms of primary constituent elements (PCEs – sites for spawning, rearing, and migration), the factors responsible for that condition, and the resulting conservation value of the critical habitat overall; (2) the Environmental Baseline, which evaluates the condition of critical habitat in the action area, the factors responsible for that condition, and the conservation value of critical habitat in the action area; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the PCEs in the action area and how that will influence the conservation value of affected critical habitat units; and (4) Cumulative Effects, which evaluates the effects of future, non-Federal

activities in the action area on the PCEs and how that will influence the conservation value of affected critical habitat units.

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

C. Use of Best Available Scientific and Commercial Information

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

- Invasive Species Control Plan for the 34th America's Cup and James R. Herman Cruise Terminal and Northeast Wharf Plaza Project, dated November 2, 2011.
- 34th America's Cup Water and Air Traffic Plan, dated December 2011.
- 34th America's Cup Zero Waste Plan, dated December 2011.
- Biological and Essential Fish Habitat Assessment for the 34th America's Cup and James R. Herman Cruise Terminal and Northeast Wharf Plaza, dated December 2011.
- 34th America's Cup/James R. Herman Cruise Terminal Project Description and Fill Removal Mitigation Proposal, dated December 2011.
- Additional project information provided by the Port of San Francisco, dated February 8, 2012.
- Characterization of Port of San Francisco Piers 32-36, 28 South, 14 North and South, and 9 Sediments in Support of the 34th America's Cup: Dredge Materials Sampling and Analysis Results, dated February 2012.
- Revised AC34 Project Description, dated April 2012.

- Additional project information provided by the Port of San Francisco, dated May 9 and 14, 2012.

Information was also provided in emails messages, site visits, and telephone conversations between March 2010 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 151422SWR2012SR00103).

IV. STATUS OF THE SPECIES AND CRITICAL HABITAT

This biological opinion analyzes the effects of the proposed 34th America's Cup, James R. Herman Cruise Terminal, and Northeast Wharf Plaza projects on the following Federally-listed species (Distinct Population Segments [DPS] or Evolutionarily Significant Units [ESU]) and designated critical habitats:

Central California Coast steelhead (*Oncorhynchus mykiss*) DPS
Threatened (71 FR 834; January 5, 2006)
Critical habitat (70 FR 52488; September 2, 2005)
Central Valley steelhead (*O. mykiss*) DPS
Threatened (71 FR 834; January 5, 2006)
Central Valley Spring-run Chinook salmon (*O. tshawytscha*) ESU
Threatened (70 FR 37160; June 28, 2005)
Sacramento River Winter-run Chinook salmon (*O. tshawytscha*) ESU
Endangered (70 FR 37160; June 28, 2005;)
Critical habitat (58 FR 33212; June 16, 1993)
North American Green Sturgeon (*Acipenser medirostris*) southern DPS
Threatened (71 FR 17757; April 7, 2006)
Critical habitat (74 FR 52300; September 8, 2008)

Critical habitat for CV steelhead and CV spring-run Chinook salmon is not present in the action area.

A. Species Description, Life History, and Status

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

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

1. CV and CCC Steelhead

a. General Life History

Steelhead are anadromous forms of *O. mykiss*, spending some time in both freshwater and saltwater. Unlike Pacific salmon, steelhead are iteroparous, or capable of spawning more than once before death (Busby et al. 1996). Although one-time spawners are the great majority, Shapovalov and Taft (1954) reported that repeat spawners are relatively numerous (17.2 percent) in California streams. Steelhead young usually rear in freshwater for 1 to 3 years before migrating to the ocean as smolts, but rearing periods of up to 7 years have been reported. Migration to the ocean usually occurs in the spring. Steelhead may remain in the ocean for 1 to 5 years (2 to 3 years is most common) before returning to their natal streams to spawn (Busby et al. 1996). The distribution of steelhead in the ocean is not well known. Coded wire tag recoveries indicate that most steelhead tend to migrate north and south along the continental shelf (Barnhart 1986). Adult steelhead typically migrate from the ocean to freshwater between December and April, peaking in January and February (Fukushima and Lesh 1998).

Juvenile steelhead migrate as smolts to the ocean from January through May, with peak migration occurring in April and May (Fukushima and Lesh 1998). Barnhart (1986) reported that peak smolt migration occurs in March and April, and steelhead smolts in California typically range in size from 140 to 210 millimeter (mm) (fork length). Steelhead of this size can withstand higher salinities than smaller fish (McCormick 1994), and are more likely to occur for longer periods in tidally influenced estuaries, such as San Francisco Bay. Smolts primarily use estuaries for rearing prior to seawater entry. Smaller steelhead juveniles are likely to avoid salt water and brackish environments, and while they can be acclimated to brackish water, their growth is likely hindered.

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

turbid conditions had lower growth rates than fish kept in clear water for the same amount of time.

b. Status of CCC Steelhead DPS and Critical Habitat

Historically, approximately 70 populations[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 1997a). Abundance estimates for smaller coastal streams in the DPS indicate low but stable levels with recent estimates for several streams (Lagunitas, Waddell, Scott, San Vincente, Soquel, and Aptos creeks) of individual run sizes of 500 fish or less (62 FR 43937). Some loss of genetic diversity has been documented and attributed to previous among-basin transfers of stock and local hatchery production in interior populations in the Russian River (Bjorkstedt et al. 2005). Similar losses in genetic diversity in the Napa River may have resulted from out-of-basin and out-of-DPS releases of steelhead in the Napa River basin in the 1970s and 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 1997a, Good et al. 2005, Spence et al. 2008.

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

[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).

NMFS issued a final determination that the CCC steelhead DPS is a threatened species, as previously listed (71 FR 834).

A more recent viability assessment of CCC steelhead concluded that populations in watersheds that drain to San Francisco Bay are highly unlikely to be viable, and that the limited information available did not indicate that any other CCC steelhead populations could be demonstrated to be viable[2] (Spence et al. 2008). Research monitoring data from 2008/09 and 2009/10 of adult CCC steelhead returns shows a decline in adults across the range of the DPS compared to the last ten years (Jeffrey Jahn, personal communication, 2010). The most recent status update found that the status of the CCC steelhead DPS remains "likely to become endangered in the foreseeable future" (Williams et al. 2011), as new and additional information available since Good et al. (2005), does not appear to suggest a change in extinction risk. On December 7, 2011, NMFS chose to maintain the threatened status of the CCC steelhead (76 FR 76386).

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.

c. Status of the CV Steelhead DPS

Central Valley steelhead historically were well-distributed throughout the Sacramento and San Joaquin rivers (Busby et al. 1996). Although it appears Central Valley steelhead remain widely distributed in Sacramento River tributaries, the vast majority of historical spawning areas are currently above impassable dams. At present, all Central Valley steelhead are considered winter-run steelhead (McEwan and Jackson 1996), although there are indications that summer steelhead

[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.

were present in the Sacramento River system prior to the commencement of large-scale dam construction in the 1940s (IEP Steelhead Project Work Team 1999). McEwan and Jackson (1996) reported that wild steelhead stocks appear to be mostly confined to upper Sacramento River tributaries such as Antelope, Deer, and Mill creeks and the Yuba River. However, naturally spawning populations are also known to occur in Butte Creek, and the upper Sacramento mainstem, Feather, American, Mokelumne, and Stanislaus rivers (CALFED 2000). It is possible that other small populations of naturally spawning steelhead exist in Central Valley streams, but are undetected due to lack of sufficient monitoring and research programs; increases in fisheries monitoring efforts led to the discovery of steelhead populations in streams such as Auburn Ravine and Dry Creek (IEP Steelhead Project Work Team 1999).

Small self-sustaining populations of CV steelhead exist in the Stanislaus, Mokelumne, Calaveras, and other tributaries of the San Joaqiun River (McEwan 2001). On the Stanislaus River, steelhead smolts have been captured in rotary screw traps at Caswell State Park and Oakdale each year since 1995 (Demko et al. 2000). Incidental catches and observations of steelhead juveniles also have occurred on the Tuolumne and Merced Rivers during fall-run Chinook salmon monitoring activities, indicating that steelhead are widespread, if not abundant, throughout accessible streams and rivers in the Central Valley (Good et al. 2005).

Steelhead counts at the Red Bluff Diversion Dam (RBDD) have declined from an average annual count of 11,187 adults for the ten-year period beginning in 1967, to an average annual count 2,202 adults in the 1990's (McEwan and Jackson 1996). Estimates of the adult steelhead population composition in the Sacramento River (natural origin versus hatchery origin) have also changed over this time period; through most of the 1950's, Hallock et al. (1961) estimated that 88 percent of returning adults were of natural origin, and this estimate declined to 10-30 percent in the 1990's (McEwan and Jackson 1996). Furthermore, the California Fish and Wildlife Plan estimated a total run size of about 40,000 adults for the entire Central Valley, including San Francisco Bay, in the early 1960s (CDFG 1965). In 1991-92, this run was probably less than 10,000 fish based on dam counts, hatchery returns and past spawning surveys (McEwan and Jackson 1996).

The status of Central Valley steelhead appears to have worsened since the 2005 status review (Good et al. 2005), when the biological review team concluded that the DPS was in danger of extinction. New information available since Good et al. (2005) indicates an increased extinction risk (Williams et al. 2011). Steelhead have been extirpated from most of their historical range in this region. Habitat concerns in this DPS focus on the widespread degradation, destruction, and blockage of freshwater habitat within the region, and water allocation problems. Widespread hatchery production of introduced steelhead within this DPS also raises concerns about the potential ecological interactions between introduced and native stocks. Because the Central Valley steelhead population has been fragmented into smaller isolated tributaries without any large source population, and the remaining habitat continues to be degraded by water diversions, the population remains at an elevated risk for future population declines. Based on this information, NMFS chose to maintain the threatened listing for this species (76 FR 50447), but

recommends reviewing Central Valley steelhead status again in 2-3 years, (instead of the normal 5 years) if species numbers do not improve (NMFS 2011a).

2. CV Spring-run and Sacramento River Winter-run Chinook Salmon

a. General Life History

Chinook salmon return to freshwater to spawn when they are 3 to 8 years old (Healy 1991). Runs are designated on the basis of adult migration timing; however, distinct runs also differ in the degree of maturation at the time of river entry, thermal regime and flow characteristics of their spawning site, and actual time of spawning (Myers et al. 1998). Both winter-run and spring-run Chinook salmon tend to enter freshwater as immature fish, migrate far upriver, and delay spawning for weeks or months. For comparison, fall-run Chinook salmon enter freshwater at an advanced stage of maturity, move rapidly to their spawning areas on the mainstem or lower tributaries of rivers, and spawn within a few days or weeks of freshwater entry (Healey 1991). Adult endangered Sacramento River winter-run Chinook salmon enter San Francisco Bay from November through June (Hallock and Fisher 1985), and delay spawning until spring or early summer. Adult threatened Central Valley spring-run Chinook salmon enter the Sacramento-San Joaquin Delta (Delta) beginning in January and enter natal streams from March to July (Myers et al. 1998). Central Valley spring-run Chinook salmon adults hold in freshwater over summer and spawn in the fall. Central Valley spring-run Chinook salmon juveniles typically spend a year or more in freshwater before migrating toward the ocean. Adequate instream flows and cool water temperatures are more critical for the survival of Central Valley spring-run Chinook salmon due to over summering by adults and/or juveniles.

Sacramento River winter-run Chinook salmon spawn primarily from mid-April to mid-August, peaking in May and June, in the Sacramento River reach between Keswick Dam and the Red Bluff Diversion Dam. Central Valley spring-run Chinook salmon typically spawn between September and October depending on water temperatures. Chinook salmon generally spawn in waters with moderate gradient and gravel and cobble substrates. Eggs are deposited within the gravel where incubation, hatching, and subsequent emergence take place. The upper preferred water temperature for spawning adult Chinook salmon is 55 ^{o}F (Chambers 1956) to 57 ^{o}F (Reiser and Bjornn 1979). The length of time required for eggs to develop and hatch is dependent on water temperature, and quite variable.

Sacramento River winter-run Chinook salmon fry begin to emerge from the gravel in late June to early July and continue through October (Fisher 1994). Juvenile winter-run Chinook salmon spend 4 to 7 months in freshwater prior to migrating to the ocean as smolts. Central Valley spring-run Chinook salmon fry emerge from November to March and spend about 3 to 15 months in freshwater prior to migrating towards the ocean (Keljson et al. 1981). Post-emergent fry seek out shallow, nearshore areas with slow current and good cover, and begin feeding on small terrestrial and aquatic insects and crustaceans. Chinook fry and parr may spend time rearing within riverine and/or estuarine habitats including natal tributaries, the Sacramento River, non-natal tributaries to the Sacramento River, and the Delta.

Within estuarine habitat, juvenile rearing Chinook salmon movements are generally dictated by tidal cycles, following the rising tide into shallow water habitats from the deeper main channels, and returning to the main channels when the tide recedes (Levy and Northcote 1982; Levings 1982; Healey 1991). Juvenile Chinook salmon forage in shallow areas with protective cover, such as intertidal and subtidal mudflats, marshes, channels and sloughs (McDonald 1960, Dunford 1975). As juvenile Chinook salmon increase in length, they tend to school in the surface waters of the main and secondary channels and sloughs, following the tides into shallow water habitats to feed (Allen and Hassler 1986). Keljson *et al*. (1981) reported that juvenile Chinook salmon demonstrated a diel migration pattern, orienting themselves to nearshore cover and structure during the day, but moving into more open, offshore waters at night. The fish also distributed themselves vertically in relation to ambient light. Juvenile Sacramento River winter-run Chinook salmon migrate to the sea after only rearing in freshwater for 4 to 7 months, and occur in the Delta from October through early May (CDFG 1998). Most Central Valley spring-run Chinook salmon smolts are present in the Delta from mid-March through mid-May depending on flow conditions (CDFG 2000).

b. Status of the CV Spring-run Chinook Salmon

Historically, the predominant salmon run in the Central Valley was the spring-run Chinook salmon. Extensive construction of dams throughout the Sacramento-San Joaquin basin has reduced the Central Valley spring-run Chinook salmon run to only a small portion of its historical distribution. The Central Valley drainage as a whole is estimated to have supported Central Valley spring-run Chinook salmon runs as large as 600,000 fish between the late 1880s and 1940s (CDFG 1998). The ESU has been reduced to only three naturally-spawning populations that are free of hatchery influence from an estimated 17 historic populations.4 These three populations (spawning in three tributaries to the Sacramento River - Deer, Mill, and Butte creeks), are in close geographic proximity, increasing the ESU's vulnerability to disease or catastrophic events.

Central Valley spring-run Chinook salmon from the Feather River Hatchery (FRH) were included in the ESU because they are believed by NMFS to be the only population in the ESU that displays early run timing. This early run timing is considered by NMFS to represent an important evolutionary legacy of the spring-run populations that once spawned above Oroville Dam (70 FR 37160). The FRH population is closely related genetically to the natural Feather River population. The FRH's goal is to release five million spring-run Chinook salmon per year. Recent releases have ranged from about one-and-a-half to five million fish, with most releases below five million fish (Good et al. 2005).

Several actions have been taken to improve habitat conditions for Central Valley spring-run Chinook salmon, including: habitat restoration efforts in the Central Valley; and changes in freshwater harvest management measures. Although protective measures likely have contributed

4 There has also been a small run in Big Chico Creek in recent years (Good et al. 2005).

to recent increases in Central Valley spring-run Chinook salmon abundance, the ESU is still well below levels observed from the 1960s. Threats from hatchery production (i.e., competition for food between naturally-spawned and hatchery fish, run hybridization and genomic homogenization), climatic variation, high temperatures, predation, and water diversions still persist. Because wild Central Valley spring-run Chinook salmon ESU populations are confined to relatively few remaining watersheds and continue to display broad fluctuations in abundance, the Biological Review Team concluded that the ESU is likely to become endangered within the foreseeable future. The most recent status review concludes the status of Central Valley spring-run Chinook salmon ESU has probably deteriorated since the 2005 status review (Williams et al. 2011). New information available since Good et al. (2005) indicates an increased extinction risk. Based on this information, NMFS has chosen to maintain the threatened listing for this species (76 FR 50447), but recommends reviewing Central Valley spring-run Chinook status again in 2-3 years, (instead of the normal 5 years) if species numbers do not improve (NMFS 2011b).

c. Status of the Sacramento River Winter-Run Chinook Salmon and Critical Habitat

The Sacramento River winter-run Chinook salmon ESU has been completely displaced from its historical spawning habitat by the construction of Shasta and Keswick dams. Approximately, 300 miles of tributary spawning habitat in the upper Sacramento River is now inaccessible to the ESU. Most components of the Sacramento River winter-run Chinook salmon life history (e.g., spawning, incubation, freshwater rearing) have been compromised by the habitat blockage in the upper Sacramento River. The remaining spawning habitat in the upper Sacramento River is artificially maintained by cool water releases from Shasta and Keswick Dams, and the spatial distribution of spawners is largely governed by the water year type and the ability of the Central Valley Project to manage water temperatures in the upper Sacramento River.

Between the time Shasta Dam was built and the Sacramento River winter-run Chinook salmon were listed as endangered, major impacts to the population occurred from warm water releases from Shasta Dam, juvenile and adult passage constraints at the RBDD, water exports in the southern Delta, and entrainment at a large number of unscreened or poorly-screened water diversions. The naturally spawning component of this ESU has exhibited marked improvements in abundance and productivity in the 2000s (CDFG 2008). These increases in abundance are encouraging, relative to the years of critically low abundance of the 1980s and early 1990s; however, returns of several West Coast Chinook salmon and coho salmon stocks were lower than expected in 2007 (NMFS 2008), and stocks remained low through 2009.

A captive broodstock artificial propagation program for Sacramento River winter-run Chinook salmon has operated since the early 1990s as part of recovery actions for this ESU. As many as 150,000 juvenile salmon have been released by this program, but in most cases the number of fish released was in the tens of thousands (Good et al. 2005). NMFS reviewed this hatchery program in 2004 and concluded that as much as 10 percent of the natural spawners may be attributable to the program's support of the population (69 FR 33102). The artificial propagation program has contributed to maintaining diversity through careful use of methods that ensure

genetic diversity. If improvements in natural production continue, the artificial propagation program may be discontinued (69 FR 33102).

Critical habitat was designated for the Sacramento River winter-run Chinook salmon on June 16, 1993. Physical and biological features that are essential for the conservation of Sacramento winter-run Chinook salmon, based on the best available information, include: (1) access from the Pacific Ocean to appropriate spawning areas in the upper Sacramento River; (2) the availability of clean gravel for spawning substrate; (3) adequate river flows for successful spawning, incubation of eggs, fry development and emergence, and downstream transport of juveniles; (4) water temperatures between 42.5 and 57.5˚F for successful spawning, egg incubation, and fry development; (5) habitat areas and adequate prey that are not contaminated; (6) riparian areas that provides for successful juvenile development and survival; and (7) access downstream so that juveniles can migrate from the spawning grounds to San Francisco Bay and the Pacific Ocean (58 FR 33212).

Designated critical habitat for Sacramento River winter-run Chinook salmon has been degraded from conditions known to support viable salmonid populations. It does not provide the full extent of conservation values necessary for the recovery of the species. In particular, adequate river flows and water temperatures have been impacted by human actions, substantially altering the historical river characteristics in which the Sacramento River winter-run Chinook salmon evolved. Depletion and storage of stream flows behind large dams on the Sacramento River and other tributary streams have drastically altered the natural hydrologic cycles of the Sacramento River and Delta. Alteration of flows results in migration delays, loss of suitable habitat due to dewatering and blockage; stranding of fish from rapid flow fluctuations; entrainment of juveniles into poorly screened or unscreened diversions, and increased water temperatures harmful to salmonids. Other impacts of concern include alteration of stream bank and channel morphology, loss of riparian vegetation, loss of spawning and rearing habitat, fragmentation of habitat, loss of downstream recruitment of spawning gravels, degradation of water quality, and loss of nutrient input.

Several actions have been taken to improve habitat conditions for Sacramento River winter-run Chinook salmon, including: changes in ocean and inland fishing harvest that to increase ocean survival and adult escapement, and implementation of habitat restoration efforts throughout the Central Valley. However, this population remains below established recovery goals and the naturally-spawned component of the ESU is dependent on one extant population in the Sacramento River. There is particular concern about risks to the ESU's genetic diversity (genetic diversity is probably limited because there is only one remaining population) life-history variability, local adaptation, and spatial structure (Good et al. 2005, 70 FR 37160). The status of Sacramento River winter-run Chinook salmon is little changed since the last status review, and new information available since Good et al. (2005) does not appear to suggest a change in extinction risk (Williams et al. 2011). On August 15, 2011, NMFS reaffirmed no change to the listing of endangered for the Sacramento River winter-run Chinook salmon ESU (76 FR 50447).

3. Green Sturgeon

a. General Life History

Green sturgeon is an anadromous, long-lived, and bottom-oriented fish species in the family Acipenseridae. Sturgeon have skeletons composed mostly of cartilage and lack scales, instead possessing five rows of characteristic bony plates on their body called "scutes." On the underside of their flattened snouts are sensory barbels and a siphon-shaped, protrusible, toothless mouth. Large adults may exceed 2 meters in length and 100 kilograms in weight (Moyle 1976). Based on genetic analyses and spawning site fidelity, NMFS determined that North American green sturgeon are comprised of at least two distinct population segments (DPS): a northern DPS consisting of populations originating from coastal watersheds northward of and including the Eel River ("northern DPS green sturgeon"), with spawning confirmed in the Klamath and Rogue river systems; and a southern DPS consisting of populations originating from coastal watersheds south of the Eel River ("southern DPS green sturgeon"), with spawning confirmed in the Sacramento River system (Adams et al. 2002).

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

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

Adult southern DPS green sturgeon spawn in the Sacramento River watershed during the spring and early summer months (Moyle et al. 1995). Eggs are laid in turbulent areas on the river bottom and settle into the interstitial spaces between cobble and gravel (Adams et al. 2007). Like salmonids, green sturgeon require cool water temperatures for egg and larval development, with optimal temperatures ranging from 11 to 17˚C (Van Eenennaam et al. 2005). Eggs hatch after 6–

8 days, and larval feeding begins 10–15 days post-hatch. Metamorphosis of larvae into juveniles typically occurs after a minimum of 45 days (post-hatch) when fish have reached 60–80 mm total length (TL). After hatching larvae migrate downstream and metamorphose into juveniles. Juveniles spend their first few years in the Sacramento-San Joaquin Delta (Delta) and San Francisco estuary before entering the marine environment as subadults. Juvenile green sturgeon salvaged at the State and Federal water export facilities in the southern Delta are generally between 200 mm and 400 mm TL (Adams et al. 2002) which suggests southern DPS green sturgeon spend several months to a year rearing in freshwater before entering the Delta and San Francisco estuary. Laboratory studies conducted by Allen and Cech (2007) indicated juveniles approximately 6-month old were tolerant of saltwater, but approximately 1.5-year old green sturgeon appeared more capable of successful osmoregulation in salt water.

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

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

Green sturgeon feed on benthic invertebrates and fish (Adams et al. 2002). Radtke (1966) analysed stomach contents of juvenile green sturgeon captured in the Sacramento-San Joaquin Delta and found the majority of their diet was benthic invertebrates, such as mysid shrimp and amphipods (Corophium spp). Manual tracking of acoustically-tagged green sturgeon in the San Francisco Bay estuary indicates they are generally bottom-oriented, but make occasional forays to surface waters, perhaps to assist their movement (Kelly et al. 2007). Dumbauld et al. (2008) report green sturgeon utilize soft substrate in estuaries, presumably feeding on benthic

invertebrates. Preliminary data from mapping surveys conducted in Willapa Bay, Washington, showed densities of "feeding pits" (depressions in the substrate believed to be formed when green sturgeon feed) were highest over shallow intertidal mud flats, while harder substrates (e.g., gravel) had no pits (M. Moser, unpublished data). Within the San Francisco estuary, green sturgeon are encountered by recreational anglers and during sampling by CDFG in the shallow waters of San Pablo Bay.

b. Status of Southern DPS Green Sturgeon and Critical Habitat

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

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

Juvenile green sturgeon are collected at water export facilities operated by the California Department of Water Resources (DWR) and the Federal Bureau of Reclamation (BOR) in the Sacramento-San Joaquin Delta. Fish collection records have been maintained by DWR from 1968 to present and by BOR from 1980 to present. The average number of southern DPS green

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

During the spring and summer spawning period, researchers with University of California Davis have utilized dual-frequency identification sonar to enumerated adult green sturgeon in the upper Sacramento River (i.e., DIDSON). These surveys estimated 175 to 250 sturgeon (±50) in the mainstem Sacramento River during the 2010 and 2011 spawning seasons (E. Mora, personal communication, January 2012). However, it is important to note that this estimate may include some white sturgeon, and movements of individuals in and out of the survey area confound these estimates. Given these uncertainties, caution must be taken in using these estimates to infer the spawning run size for the Sacramento River, until further analyses are completed.
The most recent status review update concluded the southern DPS green sturgeon is likely to become endangered in the foreseeable future due to the substantial loss of spawning habitat, the concentration of a single spawning population in one section of the Sacramento River, and multiple other risks to the species such as stream flow management, degraded water quality, and introduced species (NMFS 2005). Based on this information, the southern DPS green sturgeon was listed as threatened on April 7, 2006 (71 FR 17757).

Critical habitat was designated for the southern DPS of green sturgeon on October 9, 2009 (74 FR 52300) and includes coastal marine waters within 60 fathoms depth from Monterey Bay, California to Cape Flattery, Washington, including the Strait of Juan de Fuca to its United States boundary. Designated critical habitat also includes the Sacramento River, lower Feather River, lower Yuba River, Sacramento-San Joaquin Delta, Suisun Bay, San Pablo Bay, and San Francisco Bay in California. PCEs of designated critical habitat in estuarine areas are food resources, water flow, water quality, mitigation corridor, depth, and sediment quality. In freshwater riverine systems, PCEs of green sturgeon critical habitat are food resources, substrate type or size, water flow, water quality, migratory corridor, depth, and sediment quality. In nearshore coastal marine areas, PCEs are migratory corridor, water quality, and food resources. The current condition of critical habitat for the southern DPS of green sturgeon is degraded over its historical conditions. It does not provide the full extent of conservation values necessary for the recovery of the species, particularly in the upstream riverine habitat of the Sacramento River. In the Sacramento River, migration corridor and water flow PCEs have been impacted by human actions, substantially altering the historical river characteristics in which the southern DPS of green sturgeon evolved. In addition, the alterations to the Sacramento-San Joaquin River Delta may have a particularly strong impact on the survival and recruitment of juvenile green sturgeon due to their protracted rearing time in brackish and estuarine waters.

B. Factors Responsible for Steelhead, Chinook Salmon, and Green Sturgeon Stock Declines

NMFS cites many reasons (primarily anthropogenic) for the decline of steelhead (Busby *et al*. 1996), Chinook salmon (Myers et al. 1998), and southern DPS of green sturgeon (Adams et al. 2002, NMFS 2005). The foremost reason for the decline in these anadromous populations is the degradation and/or destruction of freshwater and estuarine habitat. Additional factors contributing to the decline of these populations include: commercial and recreational harvest, artificial propagation, natural stochastic events, marine mammal predation, reduced marine-derived nutrient transport, and ocean conditions.

1. Habitat Degradation and Destruction

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

2. Commercial and Recreational Harvest

Until recently, commercial and recreational harvest of southern DPS green sturgeon was allowed under State and Federal law. The majority of these fisheries have been closed (NMFS 2005). Ocean salmon fisheries off California are managed to meet the conservation objectives for certain stocks of salmon listed in the Pacific Coast Salmon Fishery Management Plan, including any stock that is listed as threatened or endangered under the ESA. Early records did not contain quantitative data by species until the early 1950's. In addition, the confounding effects of habitat deterioration, drought, and poor ocean conditions on salmonids make it difficult to assess the degree to which recreational and commercial harvest have contributed to the overall decline of salmonids and green sturgeon in West Coast rivers.

3. Artificial Propagation

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

4. Natural Stochastic Events

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

5. Marine Mammal Predation

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

In a peer reviewed study of harbor seal predation in the Alsea River Estuary of Oregon, the combined results of multiple methodologies led researchers to infer that seals consumed 21 percent (range = 3–63 percent) of the estimated prespawning population of coho salmon. The majority of the predation occurred upriver, at night, and was done by a relatively small proportion of the local seal population (Wright et al. 2007).

However, at the mouth of the Russian River, Hanson (1993) reported that the foraging behavior of California sea lions and harbor seals with respect to anadromous salmonids was minimal, and predation on salmonids appeared to be coincidental with the salmonid migrations rather than dependent upon them.

6. Reduced Marine-Derived Nutrient Transport

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

7. Ocean Conditions

Recent evidence suggests poor ocean conditions played a significant role in the low number of returning adult fall run Chinook salmon to the Sacramento River in 2007 and 2008 (Lindley et al. 2009). Changes in ocean conditions likely affect ocean survival of all west coast salmonid populations (Good et al. 2005, Spence et al. 2008).

C. Global Climate Change

Modeling of climate change impacts in California suggests average summer air temperatures are expected to increase (Lindley et al. 2007). Heat waves are expected to occur more often, and heat wave temperatures are likely to be higher (Hayhoe et al. 2004). Total precipitation in California may decline; critically dry years may increase (Lindley et al. 2007, Schneider 2007). The Sierra Nevada snow pack is likely to decrease by as much as 70 to 90 percent by the end of this century under the highest emission scenarios modeled (Luers et al. 2006). Wildfires are expected to increase in frequency and magnitude, by as much as 55 percent under the medium emissions scenarios modeled (Luers et al. 2006). Vegetative cover may also change, with decreases in evergreen conifer forest and increases in grasslands and mixed evergreen forests. The likely change in amount of rainfall in Northern and Central Coastal California streams under various warming scenarios is less certain, although as noted above, total rainfall across the state is expected to decline.

For the California North Coast, some models show large increases (75 to 200 percent) while other models show decreases of 15 to 30 percent (Hayhoe et al. 2004). Many of these changes are likely to further degrade salmonid habitat by, for example, reducing stream flows during the summer and raising summer water temperatures. Estuaries may also experience changes detrimental to salmonids and green sturgeon. Estuarine productivity is likely to change based on changes in freshwater flows, nutrient cycling, and sediment amounts (Scavia et al. 2002). In marine environments, ecosystems and habitats important to 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, its habitat (including designated critical habitat), and ecosystem in the action area. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impacts of State or private actions which are contemporaneous with the consultation in process (50 CFR §402.02).

A. Action Area Overview

The action area is located within Central San Francisco Bay and the offshore dredge material disposal site (SF-DODS). San Francisco Bay is the largest estuary on the west coast of North America. Located about halfway up the California coast from the Mexican border, it is the

natural exit point of 40 percent of California's freshwater outflow. The climate is Mediterranean; most precipitation falls in winter and spring as rain throughout the Central Valley and as snow in the Sierra Nevada and Cascades. The freshwater outflow pattern is seasonal; highest outflow occurs in winter and spring. Current and wave patterns in the action area are largely generated by the tides interacting with the bottom and shoreline configurations. It also receives inputs from stormwater runoff, and wastewater from municipal and industrial sources that vary in volume depending on the location and seasonal weather patterns. SF-DODs is a 9 square mile area located approximately 50 miles offshore from the City of San Francisco in the Pacific Ocean. SF-DODs is located in the open ocean in water depths of approximately 9,000 ft. The site is exposed to strong ocean currents.

The action area consists of densely developed San Francisco waterfront areas, nearshore and open water estuarine areas, and the offshore dredge material disposal site (SF-DODS). Proposed in-water construction activities occur in waters along and adjacent to the San Francisco waterfront from Pier 80 north to the Marina Green. Water depth at construction sites range from less than 5 feet to about 40 feet at MLLW. Water depths at the dredge sites range from 5 feet to 12 feet at MLLW. The transition zone between the upland areas to the subtidal zone primarily consists of rock rip rap and retaining walls. Racing will occur in open water areas within the western portion of Central San Francisco Bay flanked by the Golden Gate, Angel Island, the north shore of San Francisco, and south to Treasure Island and the San Francisco-Oakland Bay Bridge. The majority of benthic aquatic habitats within the project area are soft mud and/or sand sediments. Some hard bottom habitat is present around Angel Island and the Golden Gate. Eelgrass is present along the Marin County shoreline, at isolated locations around Angel Island and Treasure Island, and along the Richmond shoreline. For disposal of dredged materials, SF-DODS is located approximately 50 miles offshore from the Golden Gate in the Pacific Ocean in waters approximately 10,000 feet deep.

B. Status of Species and Critical Habitat in Action Area

1. CCC Steelhead, CV Steelhead, CV Spring-Run Chinook Salmon, and Sacramento River Winter-Run Chinook Salmon

The action area is used as a migration corridor by listed CCC steelhead, CV steelhead, CV spring-run Chinook salmon and Sacramento River winter-run Chinook salmon. Adult salmonids migrate from the Pacific Ocean through the San Francisco Bay estuary as they seek the upstream spawning grounds of their natal streams. CCC steelhead migration through San Francisco Bay to San Francisco Bay tributaries primarily occurs from December through March. Ocean maturing CV steelhead (winter steelhead) migration through the Bay typically begins in fall and winter and spawn within a few weeks to a few months from the time they enter fresh water (McEwan and Jackson 1996).

CV spring-run Chinook salmon and Sacramento River winter-run Chinook migrate through San Francisco Bay between December and May. Adult winter-run Chinook salmon return to their natal streams in the Central Valley during the winter but delay spawning until the spring and

summer. They typically enter San Francisco Bay from November through May. Based on time of entry to natal tributaries in the Central Valley, adult Sacramento River spring-run Chinook salmon enter the Bay from the ocean for their upstream migration in late January to early February.

Juvenile (smolt) salmonids migrate from their natal streams through San Francisco Bay estuary to the ocean. Emigration timing is highly variable among Sacramento River winter-run Chinook, CV spring-run Chinook, CCC steelhead and CV steelhead smolts, but peak migrations downstream typically occur through the Bay during the late winter and spring months. During the course of their downstream migration, juvenile salmon and steelhead utilize the estuary for seasonal rearing, and as a migration corridor to the sea. Historically, the tidal marshes of San Francisco Bay provided a highly productive estuarine environment for juvenile anadromous salmonids. However, loss of habitat, changes in prey communities, and water-flow alterations and reductions have degraded habitat and limit the ability of the Bay to support juvenile rearing. MacFarlane and Norton (2002) found that fall-run Chinook experienced little growth, depleted condition, and no accumulation of lipid energy reserves during the relatively limited time the fish spent transiting the 40-mile length of the estuary.

Recent studies conducted by the California Fish Tracking Consortium (CFTC) provide information regarding the length of residence time in San Francisco Bay by Central Valley salmonid smolts. Thousands of Central Valley late fall-run Chinook salmon and Central Valley steelhead smolts were tagged with acoustic transmitters and released in the Sacramento River from 2006 through 2010. Most of these fish migrate downstream relatively quickly having a mean transit time of 2.6 days for salmon and steelhead smolts to travel over 25 miles from the Carquinez Strait to the Golden Gate (California Fish Tracking Consortium, unpublished data 2009).

2. <u>CCC Steelhead and Sacramento River Winter-Run Chinook Salmon Critical Habitat</u>

The portion of the Project's action area north of the San Francisco-Oakland Bay Bridge is designated critical habitat for Sacramento winter-run Chinook salmon. Features of designated critical habitat for winter-run Chinook salmon in the action area essential for their conservation are habitat areas and adequate prey that are uncontaminated. These physical and biological features of designated critical habitat within the action area are partially degraded and limited. Habitat degradation in the action area is primarily due to altered and diminished freshwater inflow, shoreline development, shoreline stabilization, non-native invasive species, discharge and accumulation of contaminants, and periodic dredging for navigation.

Designated critical habitat for CCC steelhead includes all aquatic habitat within the Project's action area. PCE's essential for the conservation of CCC steelhead are estuarine areas free of obstruction and excessive predation with: (1) water quality, water quantity and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; (2) natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks

and boulders, and side channels; and (3) juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation (70 FR 52488). Within the action area, essential features of critical habitat include the estuarine water column, foraging habitat, and food resources used by steelhead as part of their juvenile downstream migration and adult upstream migration. These essential features of estuarine PCEs of designated critical habitat within the action area are partially degraded and limited due to altered and diminished freshwater inflow, shoreline development, shoreline stabilization, non-native invasive species, discharge and accumulation of contaminants, and periodic dredging for navigation.

3. Green Sturgeon

Green sturgeon are iteroparous[5], and adults pass through the San Francisco Bay estuary during spawning, and post-spawning migrations. Pre-spawn green sturgeon enter the Bay between late February and early May, as they migrate to spawning grounds in the Sacramento River (Heublein et al. 2009). Post-spawning adults may be present in the bay after spawning in the Sacramento River in the spring and early summer for months prior to emigrating into the ocean. Juvenile green sturgeon move into the Delta and San Francisco estuary early in their juvenile life history, where they may remain for 2-3 years before migrating to the ocean (Allen and Cech, Jr. 2007; Kelly et al. 2007). Sub-adult and non-spawning adult green sturgeon utilize both ocean and estuarine environments for rearing and foraging. Due to these life-history characteristics, juvenile, sub-adult and adult green sturgeon may be present in the San Francisco Bay portion of the action area during project activities.

4. Green Sturgeon Critical Habitat

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

C. Factors Affecting the Species Environment in the Action Area

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

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

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 of the action area receive water from direct precipitation, which flows into storm drains and into combined stormwater and sewage treatment system. Water and sediment quality within the action area is affected by stormwater runoff, industrial activities, and other urban influences. Results from testing of sediments for the past five years within the vicinity of the action area show that sediments along the San Francisco waterfront contain concentrations of mercury, PCBs, PAHs, and Dieldrin above thresholds where bioaccumulation occurs[6] (Applied Marine Sciences et al. 2012 [Appendix F]). 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. Other sources of PAHs in the action area are stormwater runoff from adjacent urban areas and 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 (Cohen and Carlton 1995) and presumably listed salmonids and green sturgeon through competition for food and habitat. Dredging is performed at several locations along the San Francisco waterfront within the action area. Dredging is primarily performed at marinas, wharfs and docks for vessel access. Dredged materials from several navigation channels and marinas in the Central San Francisco Bay are disposed in the action area near Alcatraz Island (referred to as SF-11). The Alcatraz disposal site is located at a depth of approximately -40 feet MLLW, and the site was selected for its dispersive currents. Since 2001, dredgers have disposed 700,000 to 1,800,000 cy of materials per year adjacent to Alcatraz Island.

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

From 2004 through 2012, pursuant to section 7 of the ESA, NMFS has conducted two to 12 interagency consultations per year within the action area of this project. The total number of consultations during this 8-year period was 54. Of these 54 consultations, 43 were with the Corps, five were with the USCG, two were internal NMFS consultations, one was with the U.S. Navy, one was with NPS, one was with the Bureau of Indian Affairs, and one was with the Federal Emergency Management Agency. These consultations were primarily related to

[6] Thresholds for mercury, total PCBs, and total PAHs are based on San Francisco Bay ambient sediment concentrations determined via the Regional Monitoring Program (RMP), and are recalculated and updated each year. Thresholds for Dieldrin are based on similar values in use in other parts of the country and generally remain the same year-to-year.

maintenance of existing infrastructure along the shoreline of Central San Francisco Bay (i.e. shoreline protection; repair of wharves, docks and piers; replacement of storm water outfalls; and repair of boat ramps). A small number of consultations have been conducted for dredging of navigation channels, fireworks displays, and clean-up of contaminated sediments. For most of these projects NMFS determined that they were not likely to adversely affect listed salmonids or green sturgeon or their critical habitat. For those projects with adverse effects on listed salmonids and green sturgeon and/or critical habitat, NMFS determined that they were not likely to jeopardize the continued existence of listed salmonids or adversely modify critical habitat. Adverse effects that resulted from these projects are not anticipated to affect the current population status of listed salmonids or green sturgeon.

Research and enhancement projects resulting from NMFS' Section 10(a)(1)(A) research and enhancement permits and section 4(d) limits or exceptions could potentially occur in the Central San Francisco Bay watershed. Salmonid and sturgeon monitoring approved under these programs includes juvenile and adult net surveys and tagging studies. In general, these activities are closely monitored and require measures to minimize take during the research activities. Through early summer 2012, no research or enhancement activities have occurred in the Central San Francisco Bay.

VI. EFFECTS OF THE ACTION

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

Construction activities associated with the proposed project are expected to temporarily affect threatened green sturgeon and salmonids through elevated levels of underwater sound during pile driving and degradation of water quality during construction and dredging. The Project's construction activities are expected to be completed in approximately 29 months, occurring

intermittently between July 2012 and December 2014. In-water work for the 2012 and 2013 AC34 race events and Phase 1 of the Cruise Terminal is expected to occur between July 2012 and November 30, 2013. In-water work for Phase 2 of the Cruise Terminal is expected to occur between November 2013 and December 2014. Operation of the Cruise Terminal will not change following completion of renovations to the terminal. Any future changes to maintenance dredging at the Cruise Terminal will be reviewed through a separate section 7 consultation with NMFS.

Listed salmonids and green sturgeon are anticipated to be in the action area during in-water construction activities and during AC34 races. The potential effects of the action are presented in detail below. NMFS does not anticipate any adverse effects to listed species or critical habitat from the on-land portion of the proposed project, because the Project will implement measures (i.e., proper storage and handling of fuels and other contaminants, accidental spill plan, and storm water management plan) that prevent the runoff and discharge of pollutants from landside activities to the waters of San Francisco Bay; these measures will render any potential effects on listed species or critical habitat discountable.

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

Construction activities by the proposed Project include repairs to existing piers, installation and removal of temporary floating docks, installation and removal of temporary moorings for vessels, removal of two dilapidated piers, and construction of a bird platform. These activities will likely result in temporary impacts to water quality and elevated underwater sound levels during pile driving. The potential effects of in-water construction are presented below.

1. Sound Pressure Impacts on Fish from Pile Driving

a. Overview of Pile Driving Impacts.

Pile driving activities may affect listed salmonids and green sturgeon through exposure to high underwater sound levels and degradation of water quality. The underwater sound pressure waves that have the potential to adversely affect to listed salmonids 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 AC34 Project, the Applicants propose to use an impact hammer to install wood and steel piles. The Project's concrete piles will be constructed by pour-in-place; thus, no pile driving

hammer will be used for their installation.

Available information indicates that fish may be injured or killed when exposed to elevated underwater sound pressure waves generated by steel piles installed with impact hammers. Pathologies associated with very high sound levels are collectively known as *barotraumas*. Barotraumas are pathologies associated with exposure to drastic changes in pressure. These include hemorrhage and rupture of internal organs, including the swim bladder and kidneys in fish. Death can be instantaneous, occur within minutes after exposure, or occur several days later. An important characteristic of the underwater sound that causes injury is the frequency. During pile installation, most energy is contained within the frequency range (100-1,000 Hertz) which 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 sp*.) when exposed to continuous sounds at 192 dB referenced to one micropascal squared second (dB re: 1μPa^2-s) at 400 Hz and 198 dB re: 1μPa^2-s at 150 Hz, respectively, and 25 percent for goldfish (*Carassius auratus*) when exposed to sounds of 204 dB re: 1μPa^2-s at 250 Hz for 2 hours or less. Hastings (1995) also reported that acoustic "stunning," a potentially lethal effect resulting in a physiological shutdown of body functions, immobilized gourami within eight to thirty minutes of exposure to the aforementioned sounds. These sound pressure levels can also result in hearing damage to fish (Enger 1981; Hastings et al. 1995, 1996). Additional detrimental effects on fish from sound levels such as those noted above include stress, 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*, Illingworth and Rodkin (2007) present pile driving case studies to provide information regarding the underwater sound pressure levels generated with the installation of steel and concrete piles by different hammer types. Several of the case studies presented in the *Compendium of Pile Driving Sound Data* (Illingworth and Rodkin 2007) were conducted within the San Francisco Bay region. Based on the best information currently available, a dual metric criteria of 206 dB referenced to one micropascal (re: 1μPa) peak sound pressure level (SPL) for any single strike and an accumulated sound exposure level (SEL) of 187 dB re: 1μPa^2-s are used by NMFS to correlate physical injury to fish greater than 2 grams in size from underwater sound produced during the installation of piles with impact hammers. As distance from the pile increases, sound attenuation from transmission loss reduces sound pressure levels and the potential harmful effects to fish also decrease. Disturbance and noise associated with construction at the pile driving site may also startle fish and result in dispersion from the action area.

A study in Puget Sound, Washington suggests that pile driving operations disrupt juvenile pink and chum salmon (*Oncorhynchus spp.*) behavior (Feist et al. 1992). Though no underwater sound measurements are available from that study, comparisons between juvenile salmon schooling behavior in areas subjected to pile driving/construction and other areas where there

was no pile driving/construction indicate that there were fewer schools of fish in the pile-driving areas than in the non-pile driving areas. Based on these observations, pile-driving operations may disrupt normal foraging, schooling, and migratory behaviors of juvenile anadromous salmonids.

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

The degree to which an individual fish exposed to underwater sound will be affected (ranging from a startle response to immediate mortality) is dependent on a number of variables such as the species of fish, size of the fish, presence of a swimbladder, sound pressure intensity and frequency, shape of the sound wave (rise time), depth of the water around the pile and the bottom substrate composition and texture. Both salmonids and sturgeon possess physostomous swimbladders (Smith 1982). As indicated by Keevin and Hempen (1997), fish with swimbladders are more susceptible to injury than fish which lack swimbladders. Sturgeon are known to have large swimbladders (Nelson 1994). In addition, both salmonids and sturgeon are hearing generalists[7] (ICF Jones and Stokes, and Illingworth and Rodkin, Inc., 2009; Popper 2005). Based on the above information, there is likely a similar behavioral response by listed anadromous salmonids and green sturgeon to elevated levels of underwater sound produced when driving piles in or near water. Until new information indicates otherwise, NMFS believes a 150 dB root-mean-square pressure (RMS) threshold for behavioral responses for salmonids and green sturgeon is appropriate.

b. Project Specific Considerations.

Several site-specific conditions should be considered when conducting an assessment of the potential effects of pile driving associated with construction projects. Effects on an individual fish during pile driving are dependent on variables such as environmental conditions at the project site, specific construction techniques, and the construction schedule. As stated above, a

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

dual metric criteria of 206 dB re: 1μPa peak SPL for any single strike and an accumulated SEL of 187 dB re: 1μPa^2-s are currently used by NMFS as thresholds to correlate physical injury to fish greater than 2 grams in size from underwater sound produced during the installation of piles with impact hammers. As distance from the pile increases, sound attenuation reduces sound pressure levels and the potential harmful effects to fish also decrease. Behavioral effects may extend radially from the pile to the sound level threshold of 150 dB RMS.

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

Sound attenuation devices are commonly used to reduce the level of elevated sound pressure levels during pile driving. Cofferdams can be used to completely dewater the area around the pile and will effectively reduce the level of SPLs transmitted into the water column. However, cofferdams can be expensive and create additional impacts to fish during construction and dewatering. Creating a curtain of air around the sound source (i.e. pile being driven) has proven to be a very effective means of reducing underwater SPLs. Encapsulating the piles with an air bubble curtain does not require dewatering of the site. Bubble curtains reduce the radiation of sound from the pile into the water by making the sound pass through a "curtain" of low-density air bubbles. Hydroacoustic monitoring has shown that air bubble curtains can decrease the overall level of SPLs in the adjacent water column and decrease the extent to which the adverse sound-related impacts occur. ICF Jones and Stokes, and Illingworth and Rodkin, Inc. (2009) report the use of a bubble curtain is capable of providing up to 20 dB of attenuation during impact hammer driving depending on the size of the pile. In general, sound attention rates increase with more bubbles and (to a point) a thicker curtain (ICF Jones and Stokes, and Illingworth and Rodkin Inc. 2009).

For the AC34 Project, the Applicants propose to use a bubble curtain to attenuate underwater sound levels during installation of the Project's largest steel piles, 48-inch diameter piles at Pier 27. The majority of the 48-inch diameter piles at Pier 27 will be installed by vibratory hammer, but an impact hammer may be used for the final seating (i.e. last 15-25 feet of pile). Based on the type of bubble curtain and pile sizes proposed by the applicant, the assessment of acoustic impacts presented in this biological opinion assumes an estimated reduction of 10 dB in sound pressure. As a general rule, sound reductions of greater than 10 dB with attenuation systems cannot be reliably predicted (ICF Jones and Stokes, and Illingworth and Rodkin, Inc., 2009).

The timing and duration of pile driving influences the level of potential impact on fish. Some species of fish occur seasonally in Central San Francisco Bay and in-water construction activities can be scheduled to avoid periods when the target fish species is mostly likely to be present. The

duration of pile driving also influences the level of risk to fish. If pile driving extends continuously for hours or days, the chance of encounters with fish in the vicinity increases, accordingly. If pile driving is occurring near shore at low tide, fewer large fish are likely to be present due to shallow water depths.

For the proposed project, pile driving with an impact hammer would occur over a period of approximately 9 days at Pier 27 for Phase 2 construction of the Cruise Terminal. Due to uncertainties in the construction schedule, the installation of these piles may occur at any time between November 2013 and December 2014. Although only 9 days of pile driving is required for the impact hammer, it may occur at any time of year and listed anadromous salmonids may be present. Juvenile, sub-adult, and adult green sturgeon are found in San Francisco Bay year-round and could be present during pile driving by this project.

c. Assessment of Pile Driving Effects.

As presented above, steel pipe piles struck with an impact hammer are the most likely to produce high sound pressure waves that can injure or kill fish. The Project proposes to use an impact hammer at Pier 27 for the final seating of 48-inch diameter steel pipe piles and for the final seating of 14-inch steel H-beam piles. The majority of the 48-inch steel pipe piles and 14-inch steel H-beam piles will be installed by vibratory hammer. A vibratory hammer will also be used to install all of the Project's temporary floating docks and the bird platform. Wood piles will be installed by impact hammer at Pier 19.

Sound pressure waves resulting from the impact driving of wood piles are different than those of steel piles. In comparison to steel, pressure levels produced from wood piles hit with an impact hammer are lesser extremes in overpressure and underpressure in the sound waveform. These extremes in pressure changes are what produce the harmful sound waveforms exhibited during impact driving of steel piles. Injuries or mortalities of fish from impact driving wood piles have never been observed. Based on measured SPLs during the installation of wood piles by impact hammers (ICF Jones and Stokes, and Illingworth and Rodkin, Inc., 2009), installation of the 224 wood piles (12-inch diameter) at Pier 19 with an impact hammer is not expected to produce sound that would result in injury or mortality of individual salmonids or green sturgeon.

Vibratory hammers will be used by the Project to install 244 steel piles (18-inches in diameter) at the temporary floating docks and 8 steel piles (16-inches in diameter) at the bird platform. Hydroacoustic data collected from projects using vibratory hammers and similar piles (Illingworth and Rodkin Inc. 2007) indicates that sound pressure levels created during installation of these piles should not present a risk of physical injury or mortality to listed fish. Vibratory hammers produce SPLs which are considerably lower than impact hammers.

For the installation of the Project's 48-inch steel pipe piles and the 14-inch steel H-beam piles vibratory hammers will be used except for the final seating of the last 15-25 feet of pile. The Project proposes to use an impact hammer for this final seating. Sound monitoring data collected

from recent pile driving projects indicates the Project's use of an impact hammer will, at times, exceed the dual metric criteria and therefore potentially injury listed fish in the project's action area (Table 6).

Table 4. Sound levels associated with impact hammer pile driving of steel piles (peak and RMS sound levels are referenced to one micropascal and SEL levels are referenced to one micropascal squared-second).

Pile type and size	Max single strike peak at 33 ft (10 m)	Accumulated SEL at 33 ft (10 m)	Single strike RMS at 33 ft (10 m)	Distance (ft) to 206 dB peak	Distance (ft) to 187 dB accumulated SEL/day	Distance (ft) to 150 dB RMS	Duration of Pile Driving Induced Sound
14-inch steel H Beams (60) (Pier 27)	196	170	181	7	433	3,824	8 days at 8 piles per day
48-inch steel pipe (3) (Pier 27)	195	175	180	6	485	3,280	1 day at 3 piles per day

Potential injury and mortality of listed fish could occur within a radial distance up to 485 feet when sound pressure levels exceed the 187 dB SEL cumulative threshold. Behavioral effects could occur within a radial distance up to 3,824 feet when sound pressure levels exceed the 150 dB RMS threshold for behavioral responses. For the single strike threshold for injury and mortality, NMFS predicts sound pressure levels of 206 dB peak could within 7 feet from the 14-inch H-beam piles and 6 feet from the 48-inch steel pipe piles.

For the purposes of this analysis, we have used the maximum distances peak SPLs and accumulated SELs could travel as a reasonable worst case scenario. The project description does not indicate the days on which the 48-inch pipe piles and 14-inch H-beam piles will be driven. Therefore, this effects analysis assumes that all 48-inch pipe piles and 14-inch H-beam piles will have a 7-foot, 206 dB peak range and a 485-foot, 187 dB accumulated SEL range.

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

Several factors make it unlikely that sturgeon or salmonids would be present or injured in the area immediately adjacent to a pile being driven by this project. First, the placement of an air bubble curtain at the 48-inch pipe piles will occupy 5-10 feet of the radial distance immediately

outward from the pile. Air bubble curtains are constructed by the placement of one or more horizontal concentric rings of perforated tubing (such as PVC) around the pile. Air is pumped through the tubes and into the rings to emit a curtain of bubbles that encapsulate the pile. To optimize the sound attenuation capability of the curtain, the amount of bubbles and thickness of the curtain are maximized by adjusting the flow of compressed air delivered to the perforated tubing. Thus, equipment and the air bubble curtain itself will physically take up 5-10 feet immediately outward of the pile. Secondly, activation of the air bubble curtain immediately prior to the initiation of pile driving is expected to startle fish adjacent to the pile and likely result in a flight response. Additional noise will be created by the air compressors operating the bubble curtain.

For the 14-inch H-beam piles, boats and barges containing the pile driving equipment and crew will be operating immediately overhead and a vibratory hammer will initially be used to install the majority of the pile. This noise will likely startle fish from the immediate area, so sturgeon and salmonids are not expected to remain in the area directly adjacent to a pile (over a 7-foot radial distance from the pile) during driving. Sonalyist (1997) report a variety of fish species demonstrate an avoidance reaction in the near-field (i.e. immediately adjacent to the sound source) to underwater sounds. Sonalyist (1996) did not define "near-field" as a specific distance, but ICF Jones and Stokes and Illingworth and Rodkin Inc. (2009) use 33 feet (10 meters) for near-field effects and to estimate the area of acoustic impact. Additionally, the short duration of the pile driving actions (approximately 9 days) to install the 48-inch pipe pilings and 14-inch beam pilings for the project will also limit the amount of exposure incurred by green sturgeon and salmonids in the action area.

Accumulated SEL are expected to extend a distance up to 485 feet from the 48-inch steel pipe piles and the 14-inch H-beam piles. In general, the effects of accumulated SEL generated by this project's pile driving are expected to be less severe than that for the smaller 2-gram size fish protected by the NMFS dual-metric criteria. However, due to their smaller size, juvenile and sub-adult green sturgeon and salmonid smolts are, in comparison to adult green sturgeon and salmonids, more vulnerable to barotramas. Juvenile green sturgeon are typically around 18 inches in length at the time they enter the estuary. Juvenile salmonids range from approximately 4 to 11 inches when they enter the estuary from freshwater areas. Larger fish are, presumably, more tolerant of high levels of sound pressure and would be less affected by pile driving activities. Yelverton et al. (1975) reported injury and mortality rates differed significantly depending on fish size in response to an underwater blast. Mortality rates decreased as fish size increased when exposed to the impulse of an underwater blast (Yelverton et al. 1975). Since adult sturgeon can be very large (up to 7 feet in length), they are likely to be more resilient to injury and capable of recovering more quickly from temporary disturbances associated with pile driving. Similarly, adult salmonids are likely more resilient to pile driving sounds due to their larger body size. The vulnerability of smaller fish to injury or death from pile driving (especially if within close proximity), was demonstrated by high SPLs at the construction site of the Benicia-Martinez Bridge that resulted in the death of a juvenile sturgeon, approximately 24-inches in length.

Although salmonids and green sturgeon could be in the vicinity of Pier 27 during the driving of 48-inch and 14-inch steel piles, the likelihood of injury or mortality is proportionate to the low likelihood of presence. Few green sturgeon and listed salmonids are anticipated to be injured or killed by elevated sound levels, because the duration of impact hammer driving by the project is only a small portion (i.e. final seating) of the 9 days of pile driving at Pier 27 and the area of physical injury associated with accumulated SEL during pile driving is relatively small in comparison to the size of Central San Francisco Bay. To date, tagging studies provide little information on juvenile green sturgeon, but sampling has indicated juveniles mostly occur in small groups in the San Pablo Bay and Delta (Adams et al. 2002) and are unlikely to occur in more than small numbers along the San Francisco waterfront. Listed anadromous salmonids are primarily migrating in deeper channels towards the center of the Bay. Since the area around Pier 27 provides little forage or shelter, habitat conditions would not be expected to attract or support listed salmonids and green sturgeon.

To experience injuries or mortality from accumulated SELs, exposed green sturgeon and salmonids would need to remain within a distance of 485 feet of a pile being driven by an impact hammer. Research conducted in Puget Sound suggests individual fish are likely to disperse from the immediate vicinity of pile driving. Feist et al. (1992) reported juvenile salmon schools in Puget Sound were fewer in areas subjected to pile driving and likely avoiding the area of elevated sound; thus, it is likely that many other species of fish would also avoid areas with elevated noise levels during pile driving. Although no data are available to quantify the risk of exposure to the accumulated SEL threshold of 187 dB, NMFS believes that, for the reasons stated herein the potential risk of injury and mortality to green sturgeon and salmonids is low. The noise and SPLs generated by pile driving will be detected by green sturgeon and salmonids. Most fish in the vicinity of Pier 27 would be expected to temporarily disperse with this intrusion, or move with tidal currents, behavioral movements, and migratory movements. Adjacent portions of San Francisco Bay exist outside the action area. These portions of the Bay provide fish sufficient area with habitat of similar or higher quality to avoid harm from increased sound levels in the action area and provide adequate carrying capacity to support individual sturgeon and salmonids that are temporarily displaced during pile driving.

The Project's use of a vibratory hammer for steel piles and the installation of wood piles by an impact hammer will also generate elevated sound levels with potential behavioral effects. NMFS estimates fish may demonstrate temporary abnormal behavior indicative of stress or exhibit a startle response extending out to the 150 dB RMS distance. As described previously, a fish that exhibits a startle response may not be injured, but it is exhibiting behavior that suggests it perceives a stimulus indicating potential danger in its immediate environment. Startle responses are likely to extinguish after a few pile strikes, or diminish as fish leave the area. Shin (1995) described the behavioral response of snakehead (*Channa argus*) to the noise of pile driving as "agitation" and these fish exhibited a change in swimming behavior. Fewtrell (2003) described the behavioral response of finfish to seismic survey noise as "alarm". Given the water conditions experienced at a pile driving site and in light of their anticipated behavioral action (to

leave the area of higher sound pressures for an area with lower sound pressures) green sturgeon and salmonids are expected to react to the sound produced by pile driving by swimming away from pile driving site. Adequate water depths and the open water area of Central San Francisco Bay adjacent to the action area will provide startled fish sufficient area to escape and elevated sound levels should not result in significant effects on these individuals. Areas adjacent to pile driving sites provide habitat of similar or higher quality and provide adequate carrying capacity to support individual salmonids and sturgeon that are temporarily displaced during the pile driving.

2. Impacts to Water Quality

Water quality in the action area may be degraded during Project construction activities. Disturbance of soft bottom sediments during the installation and removal of piles, and during the installation and removal of mooring anchors are likely to result in temporary increased levels of turbidity and release of contaminants from sediments in the substrate.

a. Turbidity

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

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

Threatened green sturgeon and listed anadromous salmonids in the 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. Fish generally react by avoiding areas of high turbidity and return when concentrations of suspended solids are lower. The minor and localized areas of turbidity associated with this project's in-water construction is not expected to result in harm or injury, or behavioral responses that impair migration, foraging, or make listed fish more susceptible to predation. If sturgeon or salmonids temporarily relocate from areas of increased

turbidity, areas of similar value are available in Central San Francisco Bay adjacent to the work sites which offer habitat of equal or better value for displaced individuals. Adjacent habitat areas also provide adequate carrying capacity to support individual sturgeon and salmonids that are temporarily displaced during the Project's construction activities.

b. Contaminants

As described above in the *Environmental Baseline*, water and sediment quality within the action area is affected by stormwater runoff, industrial activities, and other urban influences. Results from testing of sediments for the past five years within the vicinity of the action area show that sediments along the San Francisco waterfront contain concentrations of mercury, PCBs, PAHs, and Dieldrin above thresholds where bioaccumulation occurs (Applied Marine Sciences et al. 2012 [Appendix F]).

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

B. Effects of Dredging on Listed Species and Critical Habitat

The Project proposes to remove accumulated sediments along the San Francisco waterfront to accommodate anchored mooring of AC34 racing boats, and other AC34 support and spectator vessels. A clamshell dredge with a 10 cy bucket will be used to remove approximately 13,500 cy of material at the 32-36 Over Water Basin in October 2013. If needed, dredging would also be conducted at Pier 9 (10,000 cy) and Pier 14 North (10,000 cy). All dredged materials will be transported by barge for disposal at SF-DODS approximately 50 miles outside the Golden Gate in water depths of approximately 10,000 feet. Dredging has the potential to affect listed fish through degradation of water quality, re-suspension of contaminants, and entrainment.

1. <u>Impacts to Water Quality</u>

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

a. Turbidity

As discussed above for construction activities, high levels of turbidity may affect fish by disrupting normal feeding behavior, reducing growth rates, increasing stress levels, and reducing respiratory functions (Benfield and Minello 1996; Nightingale and Simenstad 2001). The extent of turbidity plumes resulting from dredging operations will depend on the tide, currents, and wind conditions during these activities. Although dredging may result in higher levels of turbidity for longer periods of time than the Project's other in-water activities, dredging operations will be restricted to the period between June 1 and November 30. This period avoids the migration seasons of both adult and juvenile ESA-listed anadromous salmonids; thus, no direct effects to CCC steelhead, CV steelhead, Sacramento River winter-run Chinook salmon, and CV spring-run Chinook are expected to occur. Threatened green sturgeon may be in San Francisco Bay year-round and may be exposed to the direct effects of dredging operations by the Project.

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

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

Elevated levels of turbidity from the Project's dredging activities along the San Francisco waterfront are expected to result in similar levels as those described above for the Oakland Harbor. The durations of such turbidity plumes will largely depend upon the currents at dredge sites. Central San Francisco Bay is the deepest sub-embayment in the San Francisco Bay estuary, and has the strongest tidal currents within the estuary (Chin et al. 2010). Tidal currents are strongest over the west-central part of the Central Bay (Chin et al. 2010), near Piers 9, 14, and the 32-36 Over Water Basin. Due to the location of the action area, currents are expected to be

strong and dissipate turbidity plumes within hours, if not faster. Thus, NMFS anticipates green sturgeon to be exposed to turbidity plumes within approximately 750 radial feet from dredge sites for short durations.

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

b. Contaminants

As discussed above for construction activities, Central San Francisco Bay in the action area has been subject to loading by anthropogenic contaminants from both point and non-point sources (Perkowski and Beckvar 1997). Dredging can cause contaminated sediments to be suspended in the water column and re-deposited to areas where they become bio-available to listed fish after dredging is completed. Contaminated sediments re-suspended during dredging are expected to follow the same patterns as those described above for turbidity and extend approximately 750 feet from the proposed dredge sites at Piers 9, 14, and the 32-36 Over Water Basin. Contaminated sediment released during dredging and deposited in areas outside the dredge footprint will be diluted as they travel through the water column.

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

The SAR presents the results of the conventional and chemical analyses with comparisons to two reference sources: Bay ambient sediment concentrations (SFRWQCB 1998) and the SF-DODs reference site database. Additionally, NMFS staff compared the sediment test results with a third

reference source, the 2012 Dredged Material Testing Thresholds for San Francisco Bay Area Sediments[8] (SFEI 2012). The Dredged Material Thresholds (SFEI 2012) are the thresholds that the DMMO uses to determine whether additional analysis of the dredge material may be warranted. This approach was developed through coordination among NMFS, the Corps, and the US Environmental Protection Agency (EPA) (USEPA and Corps 2011). Conventional or chemical constituents whose reported concentrations exceeded these three reference thresholds are presented in Table 4. Since Total PAHs exceeded the Dredged Material Thresholds (SFEI 2012) at two of the dredge sites the dredge material from all of the dredge sites were subjected to bioaccumulation tests for PAHs, in addition to benthic and elutriate toxicity tests.

Table 5. Sediment sample chemical components exceeding reference thresholds.

Dredge Site	**Analytes Exceeding Bay Ambient Levels (SFRWQCB 1998)**	**Analytes Exceeding SF-DODS Reference Database (US EPA 2011)**	**Analytes Exceeding Dredged Material Thresholds (SFEI 2012)**
Pier 14 North	Cadmium and Total PAHs	Arsenic, Mercury, Total PAHs, and Total DDTs	Total PAHs
Pier 9	Cadmium and Total PAHs	Arsenic, Mercury, and Total PAHs	None
Piers 32-36 OWB	Selenium and Total PAHs	Arsenic, Lead, Mercury, Total PCBs, Total PAHs, and Total Organotins	Total PAHs

In summary, the key findings by Pacific EcoRisk (2012) from the sediment toxicity and bioaccumulation tests were: 1) solid phase dredge material is not predicted to be acutely toxic to benthic organisms; 2) dredge material from Pier 32-36 Over Water Basin suspended in the water column could be toxic to some benthic organisms if sediment concentrations are above 34 percent; and 3) bioaccumulation of PAHs by benthic organisms at all dredge sites occurs at levels below published effects thresholds from the Corps' Environmental Residual Effects Database. Based on these results, the Pacific EcoRisk (2012) report found that the dredged sediments are suitable for placement at SF-DODS. SF-DODs is located approximately 50 miles offshore from the Golden Gate in the Pacific Ocean with water depths of approximately 10,000 feet. The Project's disposal of 13,500 cy from the 32-36 Over Water Basin, 10,000 cy from Pier 9 and 10,000 cy from Pier 14 North is anticipated to be diluted to levels which significantly reduces the potential for bioaccumulation of contaminants in marine organisms. Additionally, listed anadromous salmonids and green sturgeon are unlikely to be found in the vicinity of SF-DODs, because these species are typically found on the continental shelf in ocean waters less than 500

[8] Thresholds only available for mercury, total PCBs, total PAHs, total DDTs, total chlordane, Dieldrin, and dioxins/furans.

feet deep. For these reasons, impacts associated with disposal of dredged materials at SF-DODs are expected to discountable.

Although disposal of dredged materials at SF-DODs is not a concern to listed fish in San Francisco Bay, dredging will create a newly exposed surface layer on the Bay floor at depths of -9 and -11 feet[9] MLLW at the 32-36 Over Water Basin, Pier 9 and Pier 14 North. This surface, which was previously buried in sediment, may contain high levels of contaminants which become available for uptake by aquatic organisms. NMFS utilized the results of SAR to assess the potential for contaminants in the sediment to reach levels that are toxic to fish or pose a risk of bioaccumulation in prey items following dredging. Unfortunately, the analysis performed for the SAR does not provide information regarding the concentration of contaminants in the pre-dredge Bay bottom surface nor the potential post-dredge exposed surface at -9 and -11 feet MLLW. Contaminant levels analyzed and presented in the SAR were homogenized sub-samples of composite core samples that ranged between about 4 and 11 feet deep. The analysis presented in the SAR focused on characterizing the volume of sediment to be removed and assessed its suitability for disposal at SF-DODs.

Based on an analysis of sediments to be removed by dredging, Total PAHs at Pier 14 North and 32- 36 Over Water Basin are the most likely contaminants of concern to be exposed at high concentrations after dredging. Total PAHs at the dredge sites ranged from 4.6 mg/kg to 13.7 mg/kg. These concentrations are significantly higher than the average total PAH concentrations observed throughout the San Francisco Bay. Monitoring by the San Francisco Estuary Institute's (SFEI) Regional Monitoring Program has established a Bay-wide average concentration for the seven year period from 2002 to 2008 of total PAHs at 2.3 mg/kg. PAHs are known to cause cancer, reproductive anomalies, immune dysfunction growth and development impairments and other impairments in fish exposed to sufficiently high concentrations over periods of time (Johnson et al. 1999, Karrow et al. 1999, Johnson 2000, Stehr et al. 2000, Collier et al. 2002, Johnson et al. 2002, Sherry et al. 2005). Research by scientists at the NMFS Northwest Fisheries Science Center (Johnson et al. 2002) indicates that a sediment threshold level for total PAH of 1 mg/kg dry weight would protect estuarine, bottom dwelling fish (such as the English sole examined in the study), from detrimental effects such as liver lesions, spawning inhibition and reduced egg viability. Based on the results presented in the SAR, PAHs are present in high concentrations at the three dredge sites; however, it cannot be determined if the post-dredge newly exposed surface will contain higher concentrations than the existing pre-dredge Bay bottom surface, because the contaminant concentrations in the homogenized sediment samples are not necessarily representative of the pre- or post-dredge surface layers that aquatic biota are exposed to.

The main exposure scenario of concern for PAHs occurs as this chemical accumulates in sediments and is assimilated into the food web. For example, a recent study found concentrations of PAHs in stomach contents of wild juvenile salmon sampled over a four year

[9] -10 feet and -12 feet with one foot of over-dredge.

period generally paralleled PAH concentrations in sediment (Johnson et al. 2009). It is the chronic and dietary exposures, particularly to the higher weight PAHs remaining in sediments, that cause many of the effects listed above. PAHs bioaccumulate in many invertebrate species (Varanasi et al. 1989, 1992; Meador et al. 1995), but are metabolized significantly by many vertebrates (including fishes) where they are converted to water-soluble forms and excreted (Varanasi et al. 1989). Some of the intermediate metabolites in this process exhibit carcinogenic, mutagenic and cytotoxic properties.

The extent in which listed salmonids or green sturgeon would be adversely affected by contaminated sediment would depend on the duration in which listed salmonids and green sturgeon would be exposed to potentially elevated contaminant concentrations (directly or via trophic transfers) in the post-dredge surface layer. The time in which aquatic resources may be exposed to contaminants at the surface layer is dependent upon the deposition and accretion rates of sediments entering the dredge sites from other locations, which is dependent on tides, currents, and winds in the area. If the sediment deposition rates are high, new sediment settles in the dredge areas and covers the existing sediments quickly. Considering that the overall average level of PAHs in San Francisco Bay is considerably lower than the dredge sites, it is reasonable to assume newly deposited sediments will have lower concentrations of PAHs and the potential for trophic transfer of harmful contaminants from benthic organisms to green sturgeon or listed salmonids would be reduced quickly as well. Deposition rates and the chemical constituents of sediments that would settle at the dredge sites are unknown, but rates in similar locations in San Francisco Bay are estimated to range from 0.5 to 2 inches per month. At these rates, the biologically available surface layer (the top 3 inches of sediment) at dredge sites will be replaced by surrounding sediments within 2-6 months. These newly deposited sediments will likely consist of contaminant concentrations near Bay ambient conditions and thus, pose less of a contaminant risk to listed salmonids and green sturgeon than high levels of contaminants that may become exposed immediately following dredging.

Due to the lack of data available on post-dredge surface contaminant concentrations and the high concentrations of contaminants detected by the SAR, there is a potential for harmful levels of contaminants to become exposed following dredging. Since harmful levels of contaminants may remain uncovered or inadequately covered for up to six months after dredging is completed, adult and juvenile listed salmonids, and green sturgeon may be exposed to high levels of sediment-borne contaminants at Pier 32-36 Over Water Basin, Pier 9, and Pier 14 North. As described above, the primary exposure pathway of salmonids and green sturgeon to PAHs is through contaminated prey items. The uptake of PAHs by fish in prey results has been shown to result in reduced fitness through liver lesions, reduced egg viability, immune dysfunction, and growth and development impairment (Palm et al. 2003, Meador et al. 2006, 2008). Such reductions in fitness from contaminant exposure have also been shown to result in delayed mortality in outmigrant salmon (Arkoosh and Collier 2002, Loge et al. 2005).

To assess the level of potential risk and level of exposure to contaminated sediments post-dredging, NMFS examined several factors associated with the Project's dredge sites. The

amount of surface area exposed on the Bay floor post-dredging is estimated to be 3.4 acres at Pier 32-36 Over Water Basin, 3.9 acres at Pier 9, and 2.3 acres at Pier 14 North. Since these areas are expected to be covered by the subsequent deposition of other Bay sediments within 2-6 months, San Francisco Bay ranges between 50,000 and 80,000 acres depending on which sub-bays, such as Richardson Bay, are included. The potential for individual fish to enter the post-dredge footprint area during the 2-6 month period of exposed contaminant-laden sediments is low and their length of residence at these sites is likely to be short, because the three dredge sites are not located within the primarily migration corridors of these species and the sites do not afford high quality foraging habitat. In consideration of the above, the number of individuals exposed for durations that may adversely affect listed salmonids and green sturgeon is anticipated to be low.

To assess and minimize the risk of contaminant exposure post-dredging, the Applicants proposed to sample the newly exposed surface within 15 days of the completion of dredging in accordance with procedures established by the DMMO. Post-dredge sampling results will be submitted to NMFS and DMMO agencies. The Applicants will discuss the sampling results and the need for possible next actions with NMFS and the DMMO agencies, and if deemed necessary, develop measures for managing sediment contaminants at the project site, as appropriate. These measures will be developed in coordination with NMFS and the DMMO agencies and provided to DMMO within 60-days of the Applicants' receiving post-dredge sampling results. Given the results of chemical analyses of the existing sediment conditions at the three proposed dredge sites (Pacific EcoRisk 2012), high levels of contaminants, specifically PAHs, are likely to occur at the dredge sites and low numbers of threatened green sturgeon and listed anadromous salmonids would be subject to short-term exposure. The level of injury associated with this short term exposure is expected to range from no effect to a minor reduction in fitness.

2. Impacts on Fish from Entrainment during Dredging

Dredging has the potential to entrain fish and other aquatic organisms in the clamshell dredge. Entrainment occurs when organisms are trapped during the uptake of sediments and water by mechanical dredging machinery. Benthic infauna are particularly vulnerable to being entrained by dredging uptake, but mobile epibenthic and demersal organisms such as burrowing shrimp, crabs, and fish may also be susceptible to entrainment under some conditions. There is little information available to quantify the level of benthic infauna entrainment during dredging, although it is known to occur. Dredging will likely result in a reduction in benthic infauna at the dredge sites, which may lead to an overall reduction in the quality of fish habitat (forage) at these sites. However, the impacts of dredging on forage for green sturgeon and salmonids will be temporary. Benthic fauna are expected to recolonize the sites and the benthic community at the sites are expected to fully recover within a year. Due to the small size of the dredge sites and the large amount of alternative forage sites that are located nearby, the temporary reduction in forage species at these sites are not expected to result in the reduced fitness of individual salmonids or sturgeon.

Listed anadromous salmonids will not be present in the action area during the June to November dredge period; thus, the potential for entrainment and disturbance of salmonids are discountable.

It is possible that green sturgeon could come in contact with the clamshell bucket of the mechanical dredge. However, due to the short duration that mechanical dredging equipment is in contact with the bottom, and the relatively small size of the footprint of substrate affected by each dredge bucket, the likelihood of a green sturgeon being entrained is very low. The 10 cubic yard clamshell bucket is relatively small and dredging will be conducted in areas less than - 11 feet MLLW. In this shallow water, dredging activities are expected to startle green sturgeon and fish will disperse from the immediately vicinity. Sturgeon that react behaviorally to dredging operations will have areas of adequate water depths and the open water in Central San Francisco Bay adjacent to work sites. Thus, startled fish will have sufficient area to escape and disturbance by dredging should not result in more than an insignificant effect on them.

C. Effects of Shading and Covering Benthic Habitat

The Project proposes 11 temporary floating docks and 16 gangways during AC34 events. These temporary floating docks and gangways will shade approximately 103,000 square feet of Central San Francisco Bay (Table 2) for periods ranging from 6 to 18 months. Overwater structures, such as docks and piers, result in shading of water column and benthic habitats. Shading is known to have the potential to reduce growth of submerged aquatic vegetation, decrease primary productivity, alter predator-prey interactions, change invertebrate assemblages, and reduce the density of benthic invertebrates (Helfman 1981; Glasby 1999; Struck et al. 2004; Stutes et al. 2006) all of which may lead to an overall reduction in the quality of fish habitat. The Project also proposes approximately 4,000 square feet of block anchors to be placed on the Bay bottom. The placement of concrete anchors on benthic habitat is expected to have similar effects as shading on benthic communities.

For the AC34 Project's temporary floating docks, gangways, and block anchors, much of the water column and seafloor located under the structures are already shaded by existing, adjacent piers and wharves. Many of the floating docks would be connected or adjacent, and all floating docks will be removed at the end of AC34 events (not to exceed 18 months). Furthermore, the Applicants' proposal to permanently remove Pier ½ would remove about 21,000 square feet (0.5 acres) of shading over aquatic habitat. With the removal of the temporary floating docks, gangways, and anchors, light penetration will be restored and sites are expected to fully recover from the effects of temporary shading. Submerged aquatic vegetation and aquatic invertebrates are known to rapidly re-colonize disturbed areas. The benthic community in areas previously shaded by temporary docks is expected to be re-established within one year of conclusion of AC34 race events. Additionally, Pier ½ will be permanently removed which will result in a net decrease in the amount of shading by overwater structures in the action area. Overall, the shading or direct covering of benthic areas from the temporary structures are expected to have negligible effects on listed fish, their prey items, and critical habitat in the action area.

D. Effects of AC34 Races on Listed Species and Critical Habitat

The Applicants estimate that 800 spectator boats (e.g., recreational boaters, commercial charter, large private yachts) are expected to observe AC34 race activities, of which 10% (80 boats) are

expected to come to San Francisco Bay from elsewhere. It is anticipated by the Applicants that all of these boats would be able to use existing marina facilities in the greater San Francisco Bay Area and the Sacramento-San Joaquin Delta to dock. Some may elect to anchor in approved open water anchorages in Central Bay. During race events, many of these visiting boaters are expected to observe the races from their boats in the northern and western portions of the Central San Francisco Bay. As visitors from other parts of the West Coast and potentially foreign ports, they pose a risk for inadvertent damage to sensitive Bay habitats, such as the eelgrass beds in Richardson Bay and the eastern shoreline of Angel Island, could introduce organic and inorganic contaminants to Bay waters, and introduce non-native and invasive species.

The Project's Water and Air Traffic Plan is designed to prevent damage by boaters to sensitive habitat areas in Central San Francisco Bay. Boaters will be provided information on the location of eelgrass beds in the Central Bay, especially Richardson Bay, Angel Island, Treasure Island, and within Horseshoe Cove and the importance of protecting these sensitive habitats. AC34 will provide facilities and information for waste handling and other environmental services that support clean boating practices. The Water and Air Traffic Plan will also provide information on steps to prevent the introduction or spread of invasive species into the Bay. USCG will provide boaters with information regarding safe places to anchor or dock, and locations to observe the AC34 races away from sensitive Bay habitats. These measures are expected to effectively avoid damage by boaters to sensitive habitat areas in the action area. The Project's Invasive Species Control Plan will provide measures to avoid the spread of invasive species during construction associated with the removal of structures along the San Francisco waterfront.

The Project proposes conservation measures that will permanently improve habitat in the action area. The Project proposes to replace 10 existing mooring buoys in North San Francisco Bay. The mooring sites are currently damaging benthic habitat and submerged vegetation by dragging anchors along the seafloor. The Project will replace these moorings with a new configuration that consists of chain floats that do not drag and damage benthic habitat. The Project also proposes to remove approximately 35,500 square feet of piles, many of which are wood treated with creosote, at Pier ½ and 64. Creosote is a petroleum product that primarily consists of PAHs. Creosote can leach out of the wood over time into the adjacent water column and sediments. Pilings treated with creosote have been shown to cause harm to both hard-bottom, and sediment-dwelling benthic invertebrates and fish in the Bay through the release of PAHS (USEPA 2008, Vines et al. 2000; Goyette and Brooks 1998, Stratus Consulting 2006). These conservation actions will reduce or eliminate on-going sources of habitat damage within the vicinity of the moorings and reduce the sources of contaminants along the San Francisco waterfront.

NMFS believes the Project has developed measures which are adequate to ensure race-related vessels do not adversely affect salmonids or green sturgeon or critical habitat in the action area. Best management practices will be implemented to avoid the spread of invasive, non-native species from both visiting vessels and during demolition of existing structures along the San Francisco waterfront. These include outreach to boaters planning to attend the AC34 events to educate them about the importance of cleaning their hulls before they leave home port and taking

actions to prevent the release and spread of marine invasive species, especially algal species such as Undaria and Sargasso. Workers will follow procedures for the safe removal and disposal of any invasive taxa observed on structures that are being removed prior to disposal or reuse of pilings, docks, and other features and marine biologists would be on-call to assist the workers in the identification and proper handling of any invasive species on equipment or materials that are being removed from the Bay. Furthermore, the Applicant's proposal to replace 10 existing mooring with new mooring configurations and remove creosote piles will eliminate on-going impacts to critical habitat near the moorings and contaminant sources in Central San Francisco Bay.

VII. CUMULATIVE EFFECTS

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

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

VIII. INTEGRATION AND SYNTHESIS

CCC and CV steelhead, CV spring-run Chinook salmon, Sacramento River winter-run Chinook salmon, and southern DPS green sturgeon have experienced serious declines in abundance and long-term population trends suggest a negative growth rate. Human-induced factors have reduced populations and degraded habitat, which in turn has reduced the population's resilience to natural events, such as droughts, floods, and variable ocean conditions. Global climate change presents another real threat to the long-term persistence of the population, especially when combined with the current depressed population status and human caused impacts. Within the project's action area in Central San Francisco Bay, the effects of shoreline development, industrialization, and urbanization are evident. These activities have eliminated tidal marsh habitats, introduced non-native species, degraded water quality, contaminated sediment, and

altered the hydrology and fish habitat of the action area. As a result, forage species that listed salmonids and green sturgeon depend on have been reduced, periodic sources of contaminants are introduced from ships, piers, adjacent land areas, and stormwater runoff, and natural shoreline habitat areas have been eliminated.

Since construction activities for the proposed project could occur at any time of year, CCC and CV steelhead, CV spring-run Chinook salmon, Sacramento River winter-run Chinook salmon, and Southern DPS green sturgeon may be present in or near work site during construction activities. However, only green sturgeon are expected to occur in the action area during dredging.

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

Dredging may result in higher levels of turbidity for longer periods of time than other in-water activities. The project proposes to use a mechanical (clamshell) dredge for dredging between June 1 and November 30. This period avoids the migration periods of listed anadromous salmonids in San Francisco Bay and few green sturgeon are expected to be present at or in close proximity to dredge sites during dredging activities. Anticipated turbidity levels are not expected to result in harm or injury, or behavioral responses that impair migration, foraging, or make green sturgeon more susceptible to predation.

Post-dredging, the newly exposed Bay floor surface may contain high levels of contaminants. Sediment analysis conducted by Pacific EcoRisk (2012) shows the potential for the newly exposed surface on the Bay floor to contain high levels of contaminants which become available for uptake by aquatic organisms post-dredging. Since harmful levels of contaminants may remain uncovered or inadequately covered for a period of up to six months after dredging is completed, adult and juvenile listed salmonids, and green sturgeon may be exposed to harmful high levels of sediment-laden contaminants at Pier 32-36 Over Water Basin, Pier 9 and Pier 14 North. Listed anadromous salmonids and green sturgeon are exposed to PAHs through its bioaccumulation in prey items. Green sturgeon and salmonids exposed to high concentrations of PAHs in prey items could experience liver lesions, reduced egg viability, immune dysfunction, and growth and development impairment. These injuries have the potential to result in a reduction of the fitness of individual fish and the mortality of an individual later in time. Fish located within the dredge sites after dredging within six months of dredging may be exposed to high levels of PAHs. NMFS expects the number of green sturgeon and salmonids exposed to this effect to be small because the area of effect is small, and the abundance of green sturgeon and salmonids in the action area is low.

Listed salmonids and green sturgeon may be adversely affected by elevated underwater sound levels during the driving of large steel piles with an impact hammer. Peak SPLs above 206 dB from a single strike will be limited to the area immediately adjacent to the pile (6 and 7 feet from the pile) and it is unlikely individual fish will occur within this close a proximately during construction activities since construction equipment will likely startle fish away from the pile driving sites before pile driving initiates and a bubble curtain will likely prevent fish from being located within 7 feet of the 48-inch pipe piles. However, accumulated SELs may result in injury or death to green sturgeon or salmonids if individuals remain within a distance of 485 feet from the piles being driven. NMFS expects the number of green sturgeon and salmonids exposed to this effect to be small because the duration of pile driving is short (9 days), the area of effect is small, and the abundance of green sturgeon and salmonids in the action area is low. In addition, exposed sturgeon and salmonids would be unlikely to remain in the same location to experience the full duration of the pile driving due to tidal currents and behavioral movements. Behavioral effects during pile driving may extend up to 3,824 feet. This noise may discourage green sturgeon and salmonids from utilizing the action area during construction, but this area represents a small portion of the Central San Francisco Bay and these habitat areas will become available again once the 9 days of pile driving is completed.

Temporary floating docks and gangways and block anchors installed for AC34 events will shade or directly cover approximately 107,000 square feet of benthic areas for approximately 6-18 months. This area of temporary shading is expected to fully recover when these structures are removed at the conclusion of AC34 events in November 2013. In addition, the Applicants' proposal to permanently remove Pier ½ would remove about 21,000 square feet (0.5 acres) of shading over aquatic habitat. The Project also proposes to remove approximately 35,500 square feet of piles, many of which are wood treated with creosote, at Pier ½ and 64. Removal of these piles will reduce a source of contaminants along the San Francisco waterfront.

During AC34 events, boaters from other parts of the West Coast and potentially foreign ports pose a risk for inadvertent damage to sensitive Bay habitats, such as eelgrass beds and could introduce non-native, invasive species. The Applicants have proposed several measures to reduce the impacts of races and spectator vessels on listed salmonids and green sturgeon, and their critical habitat through outreach and voluntary stewardship programs. Furthermore, 10 existing mooring buoys/anchors that drag along the seafloor and damage submerged aquatic vegetation in North San Francisco Bay will be permanently replaced with new mooring configurations that consist of chain floats will permanently improve habitat conditions in the Bay. Installation of these new moorings is expected to improve habitat conditions in the vicinity of these moorings.

Based on the above, a small number of juvenile, sub-adult, and adult green sturgeon, and adult and smolt CCC steelhead, CV steelhead, CV spring-run Chinook, and Sacramento River winter-run Chinook are expected to be adversely affected by the Project's proposed pile driving and dredging activities. Therefore, it is unlikely that the small potential loss of individuals as a result

of the project will impact future adult returns, due to the large number of individual green sturgeon and salmonids unaffected by the project compared to the small number of green sturgeon and salmonids likely affected by the project. Due to the life history strategy of green sturgeon which spawn every 3-5 years over an adult lifespan of as much as 40 years (Moyle 2002), the few individuals injured or killed during pile driving or contaminant exposure are likely to be replaced in subsequent generations of green sturgeon. Similarly, due to the relatively large number of juveniles produced by each spawning pair, adult salmonids in future years are expected to produce enough juveniles to replace the small number of individuals injured or killed during pile driving or contaminant exposure. It is unlikely that the small potential loss of juveniles by this project will impact future adult returns.

Regarding future climate change effects in the action area, California could be subject to higher average summer air temperatures and lower total precipitation levels. The Sierra Nevada snow pack is likely to decrease by as much as 70 to 90 percent by the end of this century under the highest emission scenarios modeled. Reductions in the amount of snowfall and rainfall would reduce stream flow levels in Northern and Central Coastal rivers. Estuaries may also experience changes in productivity due to changes in freshwater flows, nutrient cycling, and sediment amounts. For this project, construction would be completed no later than 2014 and the above effects of climate change will not be detected within that time frame. The short-term effects of project construction will have completely elapsed prior to initiation of climate change effects. Since the effects to listed fish associated with the future operation of the Cruise Terminal are insignificant or discountable, future climate change effects will not add to the anticipated effects of this project.

IX. CONCLUSION

After reviewing the best available scientific and commercial data, the current status of CCC steelhead, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is NMFS' biological opinion that the 34th America's Cup, James R. Herman Cruise Terminal, and Northeast Wharf Plaza Project in Central San Francisco Bay is not likely to jeopardize the continued existence of threatened CCC steelhead, threatened CV steelhead, threatened CV spring-run Chinook salmon, endangered Sacramento River winter-run Chinook salmon, and threatened southern DPS green sturgeon.

After reviewing the best available scientific and commercial data, the current status of the critical habitat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is NMFS' opinion that the 34th America's Cup, James R. Herman Cruise Terminal, and Northeast Wharf Plaza Project in Central San Francisco Bay is not likely to adversely modify or destroy critical habitat for CCC steelhead, Sacramento River winter-run Chinook salmon, and southern DPS green sturgeon.

X. INCIDENTAL TAKE STATEMENT

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

The measures described below are nondiscretionary, and must be undertaken by the USCG, NPS, and Corps for the exemption in section 7(o)(2) to apply. The USCG, NPS, and Corps have a continuing duty to regulate the activity covered by this incidental take statement. If the USCG, NPS, and 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 USCG, NPS, and Corps must report the progress of the actions and its impact on the species to NMFS as specified in the incidental take statement (50 CFR §402.14(I)(3)).

A. Amount or Extent of Take

NMFS anticipates that take of threatened CCC steelhead, threatened CV steelhead, threatened CV spring-run Chinook salmon, endangered Sacramento River winter-run Chinook salmon, and threatened southern DPS green sturgeon threatened southern DPS green sturgeon associated with the 34th America's Cup, James R. Herman Cruise Terminal, and Northeast Wharf Plaza project in the City and County of San Francisco, California will be in the form of mortality and/or injury through temporary impacts from construction activities associated with pile driving and contaminants exposed by dredging. The number of listed salmonids and green sturgeon that may be incidentally taken during activities at the 34th America's Cup, James R. Herman Cruise Terminal, and Northeast Wharf Plaza project is expected to be small.

Finding dead or injured fish will be difficult due to their small size in relation to the size of the action area, the difficulty in observing dead or injured fish in the waters of Central San Francisco Bay due to depth, lack of water clarity, and the presence of predators and scavengers such as birds. Therefore, NMFS will use the area of sound pressure wave impact extending into the water column from each pile, and the time period for pile driving as a surrogate for number of fish. For listed salmonids and green sturgeon, those fish located within 485 feet of the Pier 27 during the installation of the project's steel piles between November 2013 and December 2014 may be injured or killed. If project hydroacoustic monitoring indicates that sound pressure levels

greater than 187 dB SEL (re: 1 μPa^2-s) extend beyond 485 feet during the installation of any of the piles, the amount of incidental take may be exceeded.

Quantifying the effects of contaminated sediment from dredging will be difficult due to the migratory nature of listed salmonids and green sturgeon, the complexities surrounding trophic interactions of listed species with contaminated prey items, and the likelihood that effects of contaminants on listed species may occur later in time. Therefore, NMFS will use the area where elevated contaminant concentrations are located and exposure time of fish to contaminants as a surrogate for number of fish. For listed salmonids and green sturgeon, those fish located within the areas where post-dredge contaminant levels are above the bioaccumulation triggers and pre-dredge contaminant concentrations within six months of dredging at these locations may be injured or killed.

B. Effect of the Take

In the accompanying biological opinion, NMFS has determined that the anticipated take is not likely to result in jeopardy to CCC steelhead, CV steelhead, CV spring-run Chinook salmon, Sacramento River winter-run Chinook salmon, and southern DPS green sturgeon.

C. Reasonable and Prudent Measures

NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize take of CCC steelhead, CV steelhead, CV spring-run Chinook salmon, Sacramento River winter-run Chinook salmon, and southern DPS green sturgeon:

1. Ensure construction methods, minimization measures, and monitoring are properly implemented and assists in the evaluation of project effects on listed salmonids green sturgeon.

2. Prepare and submit plans and reports regarding the construction of the proposed project, the results of the fisheries and hydroacoustic monitoring program, and the results of the post-dredge sampling analysis.

D. Terms and Conditions

The USCG, NPS, Corps, and its permitees must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and define the reporting and monitoring requirements.

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

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

   a. The permittee(s) 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.

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

2. The following terms and conditions implements reasonable and prudent measure 3:

   a. The USCG, NPS, Corps, or permittee shall provide a written report to NMFS by January 15 of the year following construction of the project. The USCG, NPS, Corps, or permittee shall provide a written report to NMFS with results of post-dredge sediment sampling and analyses as soon as it is available for review. These reports should be submitted to NMFS North Central Coast Office, Attention: Supervisor of Protected Resources Division, 777 Sonoma Avenue, Room 325, Santa Rosa, California, 95404-6528. The report shall contain, at a minimum, the following information:

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

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

iii. Post-dredge sediment analysis- The report should include the description of the field sediment collection methods, sample processing methods, analytical chemistry results, and biological testing results.

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.

XII. REINITIATION NOTICE

This concludes formal consultation for the 34th America's Cup and James R. Herman Cruise Terminal and Northeast Wharf Plaza Project in Central San Francisco Bay. 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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MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT
ESSENTIAL FISH HABITAT CONSULTATION

ACTION AGENCIES: United States Coast Guard (USCG); United States Army Corps of Engineers, South Pacific Division, San Francisco District (Corps); National Park Service (NPS)

ACTION: The 34th America's Cup in San Francisco Bay, California

CONDUCTED BY: National Marine Fisheries Service, Southwest Region

TRACKING NUMBER: 2011/06500

DATE ISSUED: xxxx

Statutory and Regulatory Information

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

Pursuant to the MSA, each federal agency is mandated to consult with NMFS (as delegated by the Secretary of Commerce) with respect to any action authorized, funded, or undertaken, or proposed to be, by such agency that may adversely affect any EFH under this Act. 16 U.S.C.

§1855(b)(2). The MSA further mandates that where NMFS receives information from a Fishery Management Council or federal or state agency or determines from other sources that an action authorized, funded, or undertaken, or proposed to be, by any federal or state agency would adversely effect any EFH identified under this Act, NMFS has an obligation to recommend to such agency measures that can be taken by such agency to conserve EFH. 16 U.S.C. §1855(4)(A). The term "adverse effect" is interpreted at 50 C.F.R. §600.810(a) as any impact that reduces quality and/or quantity of EFH and may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce quantity and/or quality of EFH. In addition, adverse effects to EFH may result from actions occurring within EFH or outside EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

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

Background and Consultation History

The United States Coast Guard (USCG), the U.S. Army Corps of Engineers (Corps) and the National Park Service (NPS) are joint-lead agencies for the preparation and hosting of the 34th America's Cup Races (AC34) within Central San Francisco Bay, California. The City and County of San Francisco (CCSF) are the local sponsors for AC34. The USCG would issue a Marine Event Permit authorizing AC34 on-water activities, as well as Special Local Regulation to safely and securely manage marine traffic during the events. The Corps would issue a section 10 permit under the Rivers and Harbors Act for in-water construction and proposed dredging in preparation of AC34 events. The NPS proposes to accommodate additional visitors during AC34 events by temporarily installing self-contained portable toilets on NPS lands. Based on USCG authority over the in-water portion of the race event, NPS and Corps have designated USCG to be the lead federal agency for this consultation. Please see the attached Endangered Species Act (ESA) Biological Opinion for a detailed accounting of the ESA and EFH consultation history. A brief summary of consultation events and official correspondence is as follows:

- Between March and November 2011, NMFS provided technical and policy assistance to CCSF, USCG, NPS, and Corps that resulted in completion of a Biological Assessment and Essential Fish Habitat Assessment in November 2011. During this time, at least 10 meetings were held among NMFS, CCSF, and the federal action agencies.

- The USCG requested initiation of EFH and ESA consultation by letter dated November 23, 2011.

- NMFS provided comments on the BA to the USCG via email dated December 20, 2011, requesting clarification of project elements and additional project information.

- By email message on April 27, 2012, Boudreau Associates provided NMFS and the Corps with a revised project description. Project changes included reductions in the amount of proposed dredging, number of floating docks, amount of permanent on deck and in-water improvements, the amount of venue programming for the race events, and revisions to the race schedule

Proposed Action

The America's Cup is a series of yacht sailing races hosted at changing locations around the world. San Francisco Bay has been chosen as the location for the 34th America's Cup Races in 2012 and 2013, with the CCSF as the project sponsors. The proposed AC34 includes race events in August – October of 2012 and July-September of 2013, involving improvements and services at several facilities and locations. A detailed description of the project action can be found in the attached Biological Opinion. Primary components of the proposed AC34 project include:

- Hosting 11 race days in 2012 and 44 race days in 2013;
- In-water construction including seismic repair of existing piers; installation of temporary floating docks, moorings, and associated gangways; removing temporary floating docks, gangways, and anchors, and pile installation;
- Dredging 13,500 cubic yards (cy) within the basin between Piers 32 and 36; 10,000 cy at Pier 14 North, and 10,000 cy at Pier 9 to achieve required depths to accommodate race and spectator boats associated with AC34 race events.

Bay fill from piles, pile repair structures and mooring anchors is proposed at 9 locations for a total of 0.16 acres (6,984 square feet). A total of 707 square feet of fill will be permanent, while 6,277 square feet of fill will be temporary. Proposed anchoring will be either helical or concrete block anchoring systems.

New overwater structures in the form of floating docks, gangways, infill on pier decking, and barge placement will be placed at 11 locations for a total of 2.36 acres (102,768 square feet, Table 2 in attached Biological Opinion.). Floating docks would be made of either concrete, aluminum or timber pre-cast sections with maximum widths of 8-16 feet. Docks will be constructed off-site and delivered by truck or barge. Floating docks, gangways, and barges will be installed prior to 2012 race events, removed at the end of 2012 race events, and then re-installed prior to race events in 2013. At the conclusion of 2013 events, the dock systems, including piles, would be dismantled and removed.

Pile driving is proposed for floating docks, seismic retrofitting, marginal wharf and pile repairs as described in Table 1 in the attached Biological Opinion.

In-water construction would last from one to six months during spring and fall of 2012 or 2013, depending on the specific location and extent of construction required. The longest duration of construction would be at Piers 30-32 and Piers 27-29 where seismic upgrades and AC village would be constructed.

Dredging of approximately 13,500 cy is proposed within the basin between Piers 32 and 36; 10,000 cy at Pier 14 North; and 10,000 cy at Pier 9. Dredging will impact a footprint of approximately 9.6 acres. Dredging design depths would range between -11 feet MLLW plus 1 foot overdepth to -9 feet MLLW plus 1 foot overdepth. The dredging would accommodate anchored mooring of AC racing boats and other AC34 support and spectator vessels. Dredging would be accomplished with a maximum 10 cy clamshell dredge bucket. Dredging would be conducted in 2012 and 2013 between June 1 and November 30. Based on sediment analyses conducted by the Applicants, the dredge sediment is suitable for disposal at SF-DODS. Another potential location for disposal is at the Montezuma Wetlands Restoration Project.

Post dredge sampling will be conducted within 15 days of dredging according to the DMMO process. Post-dredge sampling results will be submitted to NMFS and DMMO agencies. The CCSF will discuss the sampling results and the need for possible next actions with NMFS and the DMMO agencies, and if deemed necessary, develop measures for managing sediment contaminants at the project site, as appropriate. These measures will be developed in coordination with NMFS and the DMMO agencies and provided to DMMO within 60-days of the Applicants' receiving post-dredge sampling results.

In addition, CCSF estimates 800 spectator boats (e.g., recreational boaters, commercial charter, large private yachts are expected to observe AC34 race activities, of which 10% (80 boats) are expected to come to San Francisco Bay from elsewhere. All of these vessels would be able to use existing marina facilities in the greater Bay-Delta to dock. Some may elect to anchor in approved open water anchorages in Central Bay. During race events, many of these visiting boaters are expected to observe the races from their boats in the northern and western portions of the Central Bay.

CCSF have proposed a number of conservation measures to avoid, minimize, or otherwise offset adverse effects on Endangered Species Act- listed species and EFH. A full list of avoidance and minimization measures is provided in the attached Biological Opinion, including the measures listed below.

Proposed avoidance and minimization measures:

- Measures included in the Invasive Species Control Plan will be implemented to avoid the spread of invasive species during construction associated with the removal of structures along the San Francisco waterfront.

- Information will be provided to visiting boaters that identifies sensitive habitats and species in the Bay and measures to avoid impacts to marine resources.

- Piles will be removed by direct pull or vibratory hammer. Broken and damaged pilings that cannot be removed by either the vibratory hammer or direct pull shall be removed with either a clamshell bucket or environmental clamshell. If the entire pile cannot be removed, the pile will be cut.

- Prior to cutting piles at Pier 64, NMFS will be consulted to review the mudline elevation and contaminants in the sediment.

- A boater outreach program will be implemented to avoid and minimize impacts from trash, invasive species, and other pollutants associated with spectator boats during the race event as described in the Water and Air Traffic Plan and the Zero Waste Plan.

Proposed mitigation:

- **Removal of Creosote Piles and Dilapidated Piers.** The Applicants propose to remove approximately 42,488 sq ft of creosote piles from the Central Bay by removing two dilapidated piers, Piers 64 and ½. Pier 64 consists of approximately 14,454 sq. ft. of creosote piles and is located near Mission Rock along the San Francisco waterfront. This pier consists of a collection of remnant creosote piles and a dilapidated pier structure, which is commonly used by birds. A new bird platform will be built to replace the existing platform proposed for removal. The largest replacement platform that would be built would be 1,500 sq ft and involve construction of approximately eight 16-inch diameter concrete or steel piles. The platform would be rebuilt in a location close to the original platform, and be constructed at the same time Pier 64 was demolished. Pier ½ consists of approximately 21,000 sq. ft. of creosote piles and is located between the Ferry Building and Pier 1. Pile removal at both Pier 64 and Pier ½ is planned to take place before December 2014. Piles will be removed through vibratory extraction, followed by direct pull, clamshell removal and cutting, as necessary based on site-specific investigations. By removing 350-400 creosote treated wood piles, 350-400 concrete encased piles, the dilapidated pier platform, and a partially collapsed timber wharf extension, the proposed work at Pier 64 and Pier ½ will mitigate for 707 sq ft of permanent fill at a 2:1 ratio and 6,277 sq ft of temporary fill at a 1.1:1 ratio (for total of 8,319 sq ft or 0.19 acres).

- **Invasive Species Prevention.** The Applicants established an Invasive Species Task Force (ISTF) specifically for the America's Cup Project with interested parties and resource agencies (Coastal Commission, CDFG, Regional Water Quality Control Board, San Francisco Estuary Project, State Lands Commission, CA Department of Boating and Waterways, and USCG) and representatives from the Smithsonian Environmental

Research Center. The ISTF members worked together to create a list of Best Management Practices (BMPs) that will be distributed to boaters as directed in the dissemination plan. These BMPs will educate boaters planning to attend the AC34 events about the importance of cleaning their hulls before they leave home port. In addition, the Project Applicants will establish a 'boater pledge' program and will offer incentive flags to boat owners who pledge to comply with the BMP guidelines to avoid the spread of invasive species.

- **Water and Air Traffic Plan.** The CCSF has completed a Water and Air Traffic Plan (http://www.swrcb.ca.gov/sanfranciscobay/public_notices/AC/12-02-11/AirTrafficPlan.pdf) that will include information for visiting boaters that identifies sensitive habitats and species in the Bay and measures to avoid impacts to marine resources. The plan and its content would be distributed to targeted areas that may currently have invasive species that could be transferred by visiting vessels to San Francisco Bay. The plan will include (but is not limited to) the following:
    - Information on the location of eelgrass beds in the Central Bay, especially Richardson Bay and adjacent to Angel and Treasure Island and within Horseshoe Cove and the importance of protecting these sensitive habitats;
    - Information on proper and legal waste handling in the bay and facilities for onshore disposal during the AC34 activities;
    - Information about onsite and nearby environmental services that support clean boating practices; and
    - Information on invasive species and their impact on bay marine ecosystems and preventative steps that boaters should take to prevent the introduction or spread of invasive species into the bay.

- **Replacing Moorings.** The CCSF is proposing to further mitigate any potential impacts to eel grass beds in San Francisco Bay by replacing 10 existing mooring buoys/anchors in the North Bay with new mooring configurations. Some of the existing mooring in the North Bay have the incidental effect of impacting eelgrass habitats through chain and anchor drag. The new moorings would include a buoy system to lift the chain off the surface of the bottom. These mooring designs were identified and proposed by National Marine Fisheries Service and would provide the long-term benefit of protecting eelgrass in San Francisco Bay. The CCSF has coordinated with NMFS to identify priority locations to replace anchors. Figures from the San Francisco Bay Subtidal Habitat Goals Interactive Maps site (http://sfbaysubtidal.org/map_portal/SubVeg.html) were provided by NMFS with anchor locations circled. The locations and number of anchors proposed are listed below.
    - 2 anchors in south Sausalito, CA
    - 2 anchors in Sausalito, CA
    - 1 anchor at Angel Island
    - 3 anchors at Brooks Island in Richmond, CA

- 2 anchors at northwest end of Marina Bay Yacht Harbor Entrance channel (end of Port of Richmond Pier) in Richmond, CA

The CCSF will coordinate with NMFS on the various anchor systems available that will reduce bottom scouring. These systems will replace the 10 identified anchor/locations before the racing events in 2013 begin.

- **Benthic Study Funding.** The CCSF proposes to provide $100,000 to fund a study to address benthic impacts associated with dredging in the SF Bay Area in order to mitigate for the proposed dredging of 33,500 cy of sediment associated with the project. The Long Term Management Study identified several studies that would be valuable to help reduce the effects of dredging in the Bay over the long term. The specific study has not been defined at this time but will be addressed in upcoming LTMS Management and Science Committee meetings in the next year.

The conservation measures described here, in the attached Biological Opinion and in the consultation initiation package as parts of the proposed action are intended to reduce, avoid, or otherwise compensate for adverse effects to EFH. The NMFS regards these conservation measures as integral components of the proposed action and expects that all proposed activities will be completed consistent with those measures. We have completed our effects analysis accordingly. Any deviation from these conservation measures will be beyond the scope of this consultation and may require supplemental consultation to determine what effect the modified action is likely to have on EFH.

Action Area

For purposes of this consultation, the action area is comprised of approximately 10,880 acres within Central San Francisco Bay. Proposed in-water construction activities occur over 78.2 acres in waters along and adjacent to the San Francisco waterfront from Pier 80 northward to Aquatic Park cove. Race activities include the racing area within the Western Central San Francisco Bay flanked by the Gold Gate, Angel Island, the north shore of San Francisco, and south to Treasure Island and the San Francisco-Oakland Bay Bridge.

The project area includes uplands, shoreline, intertidal and subtidal habitats. The majority of benthic aquatic habitats within the project area are soft mud and/or sand sediments. Some hard bottom habitat is present around Angel Island and the Golden Gate. Eelgrass is present along the Marin County shoreline, at isolated locations around Angel Island and Treasure Island, and along the Richmond shoreline.

The proposed project occurs within EFH for various federally managed fish species within the Pacific Groundfish, Pacific Salmon and Coastal Pelagic Fishery Management Plans (FMPs). In addition, the project occurs within areas designated as Habitat Areas of Particular Concern (HAPC) for various federally managed fish species within the Pacific Groundfish FMP. HAPC

are described in the regulations as subsets of EFH which are rare, particularly susceptible to human-induced degradation, especially ecologically important, or located in an environmentally stressed area. Designated HAPC are not afforded any additional regulatory protection under MSA; however, federal projects with potential adverse impacts to HAPC will be more carefully scrutinized during the consultation process. As defined in the Pacific Groundfish FMP, AC34 project area contains the following types of HAPC: coastal estuary HAPC and submerged aquatic vegetation HAPC.

Effects of the Action

Based on information provided in the EFH assessment and developed during consultation, NMFS concludes that proposed action would adversely affect EFH for various federally managed species within the Pacific Groundfish, Pacific Salmon, and Coastal Pelagic FMPs through (1) increased turbidity in the water column, (2) disturbance of benthic habitats, (3) exposure of contaminated sediments at sediment surface and within the water column, (4) increased noise in the water column, (5) short-term increase in shading of water column and benthic habitat, and (6) increased risk of introduction/spread of invasive species.

Turbidity

Short term increases in turbidity would occur during dredging, pile removal and vessel mooring placement and removal. While fish in San Francisco Bay are exposed to naturally elevated concentrations of suspended sediments resulting from storm flow runoff events, wind and wave action, and benthic foraging activities of other aquatic organisms (Schoellhammer 1996), dredging induced concentrations of suspended sediments may be significantly elevated to have direct effects on fish behavior. If suspended sediment loads remain high for an extended period of time, fish may suffer increased larval mortality (Wilber & Clarke 2001), reduced feeding ability (Benfield & Minello 1996) and be prone to fish gill injury (Nightingale & Simenstad 2001a). Additionally, the contents of the suspended material may react with the dissolved oxygen in the water and result in short-term oxygen depletion to aquatic resources (Nightingale & Simenstad 2001).

Turbidity is expected to dissipate within one tidal cycle due to high tidal flushing and water exchange present in the waters adjacent to the Port.

Benthic disturbance

Dredging would result in benthic disturbance and removal of invertebrate prey within 26.1 acres of soft substrate habitat. Many EFH species forage on infaunal and bottom-dwelling organisms, such as polychaete worms, crustacean, and other EFH prey types. Dredging may adversely affect these prey species at the site by directly removing or burying these organisms (Newell *et al.* 1998, Van der Veer *et al.* 1985) and providing substrate for invasive species. Recolonization studies suggest that recovery (generally meaning the later phase of benthic community

development after disturbance when species that inhabited the area prior to disturbance begin to re-establish) may not be quite as straightforward, and can be regulated by physical factors including particle size distribution, currents, and compaction/stabilization processes following disturbance. Rates of recovery listed in the literature range from several months to several years for estuarine muds (McCauley *et al.* 1976, Oliver *et al.* 1977, Currie & Parry 1996, Tuck *et al.*1998, Watling *et al.* 2001) to up to 2 to 3 years for sands and gravels (Reish 1961, Thrush *et al.* 1995, Watling *et al.* 2001, Gilkinson *et al.* 2005). Recolonization can also take up to 1 to 3 years in areas of strong current but up to 5 to 10 years in areas of low current (Oliver *et al.* 1977). Thus, forage resources for fish that feed on the benthos may be substantially reduced before recovery is achieved. Based on available literature, NMFS will assume recovery of prey resources will exceed one year. In addition, the temporary placement of anchors and steel piles would result in the short-term loss of approximately 0.28 acres of benthic habitat as foraging areas.

Proposed mitigation at Piers 64 and ½ will compensate for temporary fill from anchors and steel piles. Monetary contribution towards a benthic recovery study in San Francisco Bay, as proposed to mitigate for dredging impacts, will not result in direct compensation for disturbance to benthic habitats. However, results of the study will help resource managers better understand potential impacts from dredging in San Francisco Bay, and therefore, better avoid, minimize and/or compensate for those impacts in the future. NMFS supports the proposed out-of-kind mitigation for AC34.

Contaminants

Dredging and in-water construction activities may cause contaminated sediments to be suspended in the water column and re-deposited in the action area where contaminants may continue to be exposed to the aquatic community after the project is complete.

Results from testing of sediments for the past five years within the vicinity of the action area show that sediments along the San Francisco waterfront contain concentrations of mercury, PCBs, PAHs, and Dieldrin above thresholds where bioaccumulation occurs[10] (Applied Marine Sciences *et al.* 2012 [Appendix F]). Dredging also has the potential to expose buried contaminants by removing upper layers of sediment and exposing a new surface layer of bottom material that is then in direct contact with biota and the water column. This newly exposed surface layer may have greater concentrations of contaminants than existed before dredging.

Areas that will be dredged were tested to determine whether the dredged material is suitable for disposal at the San Francisco Deep Ocean Disposal Site (SF-DODS). The sediments were subjected to full Inland Testing Manual testing (as per the Dredged Material Management Office

[10] Thresholds for mercury, total PCBs, and total PAHs are based on San Francisco Bay ambient sediment concentrations determined via the Regional Monitoring Program (RMP), and Are recalculated and updated each year. Thresholds for Dieldrin are based on similar values in use in other parts of the country and generally remain the same year-to-year.

[DMMO] guidelines) and a Sampling and Analyses Report (SAR) was prepared (Pacific EcoRisk 2012) to provide the characterization of these sediments. The SAR includes the results of the conventional and chemical analyses with comparisons to Bay Ambient sediment concentrations (SFRWQCB 1998) and the SF-DODs reference site database. Additionally, NMFS staff compared the results of these analyses with the 2012 Dredged Material Testing Thresholds for San Francisco Bay Area Sediments[11] (SFEI 2012). In general, the key findings were: 1) solid phase dredge material is not predicted to be acutely toxic to benthic organisms; 2) dredge material from Pier 32-36 suspended in the water column could be toxic to some benthic organisms if sediment concentrations are above 34 percent; and 3) bioaccumulation of PAHs by benthic organisms at all dredge sites occurs at levels below published effects thresholds. During dredging by the Project it is anticipated that sediment concentrations in the water column will be less than concentrations (34 percent) shown to be toxic to benthic organisms.

Based on the results presented in the SAR, PAHs are present in high concentrations at the three dredge sites; however, it cannot be determined if the post-dredge newly exposed surface will contain higher concentrations than the existing pre-dredge Bay bottom surface, because the contaminant concentrations in the homogenized sediment samples are not necessarily representative of the pre- or post-dredge surface layers that aquatic biota are exposed to.
To assess and minimize the risk of contaminant exposure post-dredging, sediments on the exposed Bay floor will be sampled within 15 days of the completion of dredging in accordance with procedures established by the Dredged Material Management Office (DMMO). Post-dredge sampling results will be submitted to NMFS and DMMO agencies. The Applicants will discuss the sampling results and the need for possible next actions with NMFS and the DMMO agencies, and if deemed necessary, develop measures for managing sediment contaminants at the project site, as appropriate. These measures will be developed in coordination with NMFS and the DMMO agencies and provided to DMMO within 60-days of the Applicants' receiving post-dredge sampling results. Exposure time of the newly exposed surface layer is dependent upon the deposition rate of new sediment from nearby areas, which is dependent on tides, currents, and winds in the area. Deposition rates at the dredge sites have not been measured.

Noise

Sound pressure waves generated in the water column during pile driving and dredging activities can result in physical or behavioral effects to fish. As described in the attached Biological Opinion, sound monitoring data collected from recent pile driving projects indicate that sound pressure levels resulting from the proposed project's installation of 14-inch steel H Beams at Pier 27 and 48-inch steel pipe piles at Pier 27 will, at times, reach levels that result in potential injury to fish in the project's action area. NMFS anticipates the zone of potential injury or mortality (e.g., damage to the inner ear, eyes, blood, nervous system, kidney, and liver) would extend up to a radial distance of approximately 485 feet from the pile driving activities at Pier 27. Since the proposed project is located adjacent to a seawall, sound will mainly travel outwards into Central

[11] Thresholds only available for mercury, total PCBs, total PAHs, total DDTs, total chlordane, Dieldrin, and dioxins/furans.

San Francisco Bay. Elevated sound levels from pile driving will be temporary, occurring over approximately 9 days between November 2013 and December 2014.

Beyond the range of physical injury, NMFS estimates fish may demonstrate temporary abnormal behavior indicative of stress or exhibit a startle response. NMFS anticipates the zone of potential abnormal behavior would extend up to a radial distance of approximately 3,824 feet at Pier 27. Adequate water depths and the open water area of Central San Francisco Bay adjacent to the action area will provide startled fish sufficient area to escape and elevated sound levels should not result in significant effects on these individuals. Areas adjacent to the project's action area provide habitat of similar or higher quality and provide adequate carrying capacity to support fish that are temporarily displaced during the pile driving.

Shading

The underwater light environment is a naturally light-reduced ecosystem. Light is attenuated with depth as a result of refraction at the water's surface and through scatter and absorption of light by phytoplankton, detritus and dissolved organic matter in the water column. Depending on the biological, physical, and chemical properties of the water, the light available at depth may be dramatically reduced from that available at the surface. Because light energy drives the photosynthetic process controlling plant growth and survival, it is one of the principal limiting factors of primary productivity (Govindjee and Govindjee 1975, Underwood and Kromkamp 1999, Maclntyre *et al*. 1996).

In the already reduced light environment of San Francisco Bay, the addition of overwater structures further reduces underwater light penetration through shading. Under-structure light levels can fall below the threshold for the photosynthesis of diatoms, algae, and eelgrass (Kenworthy and Haunert 1991). Thus, shading by such structures may adversely affect vegetation, habitat complexity, and overall net primary production (Haas *et al.* 2002, Struck *et al*. 2004). Reductions in benthic primary productivity may in turn adversely affect invertebrate distribution patterns. For example, Struck *et al*. (2004) observed invertebrate densities under bridges at 25-52 percent of those observed at adjacent unshaded sites. These results were found to be correlated with diminished macrophyte biomass, a direct result of increased shading.

Fishes rely on visual cues for spatial orientation, prey capture, schooling, predator avoidance, and migration. The shadow cast by an overwater structure may increase predation on federally managed species by creating a light/dark interface that allows ambush predators to remain in a darkened area barely visible to prey and watch for prey to swim by against a bright background high visibility (Helfinan 1981). Prey species moving around the structure are unable to see predators in the dark area under the structure and are more susceptible to predation.

The placement of floating docks adjacent to existing piers and wharfs is expected to result in 2.36 acres of additional shading of bay waters and seafloor for approximately 6-18 months. Much of the water column and seafloor located under the proposed floating docks are already

shaded by the existing piers to which the floating docks would be connected or adjacent, and all floating docks will be removed at the end of project needs (not to exceed 18 months) in both 2012 and 2013. Furthermore, mitigation proposed at Piers 64 and ½ will remove some shading over aquatic habitat.

Eelgrass disturbance

Although naturally restricted in distribution, eelgrass vegetated areas are recognized as important ecological communities in shallow bays and estuaries because of their multiple biological and physical values. Eelgrass habitat functions as an important structural environment for resident bay and estuarine species, offering predation and current velocity refuge (Orth 1977, Peterson and Quammen 1982), as well as a food source. Eelgrass functions as a nursery area for many commercially and recreational important finfish and shellfish species, including those that are resident within bays and estuaries, as well as oceanic species that enter estuaries to breed or spawn (Hoffman 1986, Heck *et al.* 1989, Dean *et al.* 2000, Semmens 2008). Eelgrass also provides a unique habitat that supports a high diversity of non-commercially important species whose ecological roles are less well understood (Peterson *et al.* 1984, Murphy *et al*. 2000, Malavasi *et al.* 2007). Eelgrass beds also supply organic material to nearshore environments, and their root systems stabilize area sediments. In San Francisco Bay, eelgrass beds are considered to be a valuable shallow water habitat, providing shelter, feeding, or breeding habitat for many species of invertebrates, fishes, and some waterfowl.

Proposed AC34 race events will occur in open water areas away from documented eelgrass beds. However, direct damage of eelgrass may result from spectator boats traveling through or anchoring in areas with eelgrass (e.g., grounding, contact with propellers, and anchor scour).

Because the exact number of spectator boats, and the areas where they will traverse and/or anchor are unknown, it is not possible to predict how much, if any, eelgrass is damaged by their activities. Replacing existing moorings located within or near documented eelgrass, as proposed by the CCSF should provide advance mitigation for impacts to eelgrass that do occur. Furthermore, the Water and Air Traffic Plan will direct boaters away from sensitive eelgrass habitats.

Invasive species

The introduction of exotic species into estuarine and marine habitats has been well documented (Rosecchi *et al*. 1993, Kohler & Courtenay 1986, Spence *et al*. 1996). Exotic fish, shellfish, pathogens, and plants can enter the environment from industrial shipping (*e.g.*, as ballast), recreational boating, aquaculture, biotechnology, and aquariums. Dredging activities contribute to the establishment of invasive species in several ways. Barges and hydraulic dredges that travel into San Francisco Bay carrying ballast waters from other areas can directly transport and introduce invasive species. The maintenance of shipping channels via dredging may indirectly lead to transport of invasive species by allowing large vessels (able to travel from far distances)

access to the Bay. Additionally, the act of removing soft-bottom sediments and their associated biotic assemblages during dredging creates an area of disturbance which is extremely susceptible to recolonization by invasive species, often resulting in the displacement of native species. As a result, dredging can increase both the number of new invasive species entering the bay and the distribution and abundance of existing invasive species in the bay.

The transportation of nonindigenous organisms to new environments can have many severe impacts on habitat (Omori *et al.* 1994). Long-term impacts of the introduction of nonindigenous and reared species can change the natural community structure and dynamics, lower the overall fitness and genetic diversity of natural stocks, and pass and/or introduce exotic lethal disease. Overall, exotic species introductions create five types of negative impacts: 1) habitat alteration, 2) trophic alteration, 3) gene pool alteration, 4) spatial alteration, and 5) introduction of diseases. Habitat alteration includes the excessive colonization of exotic species which preclude the growth of endemic organisms. The introduction of exotic species may alter community structure by predation on native species or by population explosions of the introduced species. Spatial alteration occurs when territorial introduced species compete with and displace native species. Although hybridization is rare, it may occur between native and introduced species and can result in gene pool deterioration. Introduced organisms increase competition with indigenous species or forage on indigenous species, which can reduce fish and shellfish populations. Long-term impacts from the introduction of nonindigenous and reared species can change the natural community structure and dynamics, lower the overall fitness and genetic diversity of natural stocks, and pass and/or introduce exotic lethal diseases. The introduction of exotic organisms also threatens native biodiversity and could lead to changes in relative abundances of species and individuals that are of ecological and economic importance. The introduction of bacteria, viruses, and parasites is another severe threat to EFH as it may reduce habitat quality. New pathogens or higher concentrations of disease can be spread throughout the environment resulting in deleterious habitat conditions.

The potential for redistribution of non-native invasive species following dredging and introduction of non-native species from visiting boats could adversely affect fish foraging habitat by changing the marine community and therein the suitability of that habitat to provide foraging habitat. Information is not available to quantify the threat from spread of existing non-natives species or introduction of new non-natives into San Francisco Bay from AC34 activities. However, CCSF have taken preventative steps with the Invasive Species Task Force and the distribution of the Water and Air Traffic Plan to boaters, which includes actions boaters should take to prevent being the vector for introducing invasive organisms. These steps should limit the introduction of invasive species to SF Bay to the extent possible.

EFH Conclusions

As described in the above effects analysis, NMFS has determined that the proposed AC34 project would adversely affect EFH for various federally managed fish species within the Pacific Groundfish, Pacific Salmonid, and Coastal Pelagic FMPs. However, the project incorporates

numerous conservation and mitigation measures to adequately address adverse effects, and therefore, NMFS has no conservation recommendations to provide.

Supplemental Consultation

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

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