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

JUL 0 3 2017

Refer to NMFS No: WCR-2016-5245

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

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Seaplane Lagoon Ferry Terminal Project (Corps File No. 2015-00460S)

Dear Dr. Bottoms:

Thank you for your letter of July 6, 2016, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 *et seq.*) for the Seaplane Lagoon Ferry Terminal Project. The U.S. Army Corps of Engineers' (Corps) proposes to authorize the City of Alameda to construct a ferry terminal at Alameda Point in Alameda, California under Section 10 of the Rivers and Harbors Act of 1899, as amended (33 USC Section 403 *et seq.*).

Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA)(16 U.S.C. 1855(b)) for this action. NMFS has determined that the proposed Project would adversely affect EFH for various federally managed fish species under the Coastal Pelagic and Pacific Groundfish Fishery Management Plans (FMPs). We have included the results of that review in Section 3 of this document.

The enclosed biological opinion is based on our review of the proposed project and describes NMFS's analysis of potential effects on threatened southern distinct population segment (Southern DPS) of North American green sturgeon (*Acipenser medirostris*), threatened Central California Coast (CCC) steelhead (*Oncorhynchus mykiss*), and designated critical habitat in accordance with section 7 of the ESA.

In the enclosed biological opinion, NMFS concludes that the project is not likely to jeopardize the continued existence of Southern DPS green sturgeon, nor is the project likely to result in the destruction or adverse modification of critical habitat for Southern DPS green sturgeon. However, NMFS anticipates take of green sturgeon in the form of injury or mortality during the use of an impact hammer for pile installation. An incidental take statement with non-discretionary terms and conditions is included with the enclosed biological opinion. NMFS has also found that the proposed project is not likely to adversely affect threatened CCC steelhead or its critical habitat.

Regarding EFH, NMFS has reviewed the proposed project for potential effects and determined that the proposed project would adversely affect EFH for various federally managed fish species under the Coastal Pelagic and Pacific Coast Groundfish Fishery Management Plans (FMPs). However, because impacts to EFH are expected to minor, temporary, and localized there were no practical EFH Conservation Recommendations to provide. Therefore, no EFH Conservation Recommendations are included in this opinion.

Please contact Autumn Cleave, North-Central Coast Office in Santa Rosa, California at (707) 575-6056, or via e-mail at autumn.cleave@noaa.gov, if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

[signature], for

Barry A. Thom
Regional Administrator

Enclosure

cc: Janelle Leeson, U.S. Army Corps of Engineers, San Francisco, California
Jennifer Ott, City of Alameda, Alameda, California
Steve Rottenborn, H.T. Harvey & Associates, Los Gatos, California
Copy to ARN File # 151422WCR2016SR00275
Copy to Chron File

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response

Seaplane Lagoon Ferry Terminal

NMFS Consultation Number: WCR-2016-5245

Action Agency: United States Army Corps of Engineers

Affected Species and NMFS' Determinations:

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

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

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

Issued By: [signature], for

Barry A. Thom
Regional Administrator

Date: JUL 0 3 2017

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LIST OF ACRONYMS

BA	Biological Assessment
BOR	Bureau of Reclamation
CCC	Central California Coast
CDFW	California Department of Fish and Wildlife
Corps	U.S. Army Corps of Engineers
cSEL	cumulative sound exposure level
dB	decibel
DPS	distinct population segment
DQA	Data Quality Act
DWR	Department of Water Resources
EFH	essential fish habitat
ESA	Endangered Species Act
FHWG	Fisheries Hydroacoustic Working Group
FMP	Fishery Management Plans
ft	foot
ft^2	square feet
GCID	Glenn Colusa Irrigation District
HTL	high tide line
ITS	incidental take statement
m	meter
MHHW	mean higher high water
MLLW	mean lower low water
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NMFS	National Marine Fisheries Service
PAHs	polycyclic aromatic hydrocarbons
PBF	physical or biological features
PCE	primary constituent element
psu	practical salinity unit
RBDD	Red Bluff Diversion Dam
RMS	root mean squared
SAV	submerged aquatic vegetation
SEL	sound exposure level
SPL	sound pressure levels
SWPPP	storm water pollution prevention plan
TL	total length
TTS	temporary threshold shift
USGS	United States Geological Survey

1. INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3 below.

1.1 Background

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

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

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

1.2 Consultation History

By letter dated July 6, 2016, NMFS received the U.S. Army Corps of Engineers (Corps) request for informal consultation pursuant to section 7 of the ESA, for the proposed issuance of a Corps permit to the City of Alameda (Applicant), for construction of the Seaplane Lagoon Ferry Terminal, in the city of Alameda, Alameda County, California. In the initiation letter, the Corps determined the project may affect, but is not likely to adversely affect, threatened Central California Coast (CCC) steelhead (*Oncorhynchus mykiss*) and the threatened Southern distinct population segment (DPS) of North American green sturgeon (*Acipenser medirostris*) and its critical habitat. Additionally, the Corps determined that the project may adversely affect Essential Fish Habitat (EFH) for various federally managed fish species within the Pacific Coast Groundfish, Pacific Coast Salmon, and Coastal Pelagic Species Fishery Management Plans (FMP). A June of 2016 Biological Assessment (BA) prepared for the Applicant by H.T. Harvey & Associates accompanied the Corps' initiation of consultation letter.

A telephone call was held in July of 2016 between the Applicant's consultant (H.T. Harvey & Associates), the Corps, and NMFS, and emails were exchanged during August and September of 2016 to discuss the potential effects of the proposed project on NMFS-listed species. Via email dated September 27, 2016, the Corps initiated formal consultation for the Southern DPS of North American green sturgeon. On October 5, 2016, NMFS sent the Corps an email requesting more information about the project description and potential impacts. NMFS received a response with an updated underwater sound analysis on October 31, 2016, and sufficient information was provided to NMFS to initiate consultation on this date. Emails exchanged between NMFS and the Applicant's consultant, H.T. Harvey & Associates, on December 14, 2016, confirmed that the Applicant will use a bubble curtain during impact hammer pile driving. Emails exchanged between NMFS and H.T. Harvey & Associates during April of 2017 confirmed that pile driving is expected to occur for 10 hours or less per day and that the 44 days of pile installation may or may not be consecutive.

1.3 Proposed Action

For section 7 of the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02). For EFH consultation, federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal Agency (50 CFR 600.910).

The proposed project consists of the construction of a new ferry terminal within a manmade basin referred to as the Seaplane Lagoon along the Alameda Point waterfront in San Francisco Bay. Components of the proposed terminal will include an abutment and pier, a gangway, a boarding float, and waterside utilities. Project construction will result in the creation of approximately 9,038 square feet (ft^2) of overwater structure. Construction of the ferry terminal components will include installing a total of 22 piles. A 2,914 ft^2 existing wooden pier will also be removed. Seaplane Lagoon is located at Alameda Point, on the former Alameda Point Naval Air Station in City and County of Alameda, California.

Pier and Abutment Construction
The new ferry terminal pier will be supported on the shoreline by the installation of a 72 ft^2 concrete abutment. The abutment will be supported by four steel piles that will be located above the high tide line (HTL). See "Pile Installation" section below for additional information regarding the piles and installation methods. After the support piles are installed, the abutment will be cast-in-place.

The pier will be a 1,760 ft^2 cast-in-place concrete structure. The pier will be supported by 12 piles. The pier deck will have an elevation of + 13 feet NAVD 88. The pier will be covered by a canopy that will be the exact dimensions of the pier. The pier deck will be constructed by installing the support piles, placing the form, pouring concrete from trucks, then removing the form. The concrete will be pumped from the trucks that are located on an existing shoreline road.

Gangway Construction
A 1,536 ft^2 steel gangway will be constructed to connect the pier to the boarding float. The gangway will be supported by the float on one side and cantilevered supports from the landside end of the pier on the other. The elevation of the gangway will range from 8.5 to 13 feet above the water surface. The gangway will be composed of grated metal. The gangway will be covered by a canopy that will be the exact dimensions of the gangway. The gangway will be fabricated offsite and will be transported to the site by a barge. The gangway will be installed by a barge-mounted crane. There is overlap between the gangway and the boarding float, which will reduce the net gain of overwater structure by 849 ft^2.

Boarding Float Construction

A 5,670 ft^2 steel pontoon barge will be constructed and serve as the boarding float to allow passengers to board and disembark from the ferry terminal. The steel pontoon barge boarding float (float) will be supported by six piles. The float will be covered by a canopy that will be the exact dimensions of the float. The float will be fabricated offsite and will be transported to the site by a barge. The float will be installed by a barge-mounted crane.

Pile Installation

A total of 18 piles will be installed below the high HTL for construction of the pier and boarding float, and an additional four piles will be installed on the shoreline for construction of the pier abutment (Table 1). Of the 18 in-water piles, 12 will be 24-inch diameter steel piles and six will be 36-inch diameter steel piles. Piles will be installed with a vibratory hammer to as deep as possible, and an impact hammer will be used when necessary. Both hammers will be operated from a barge-mounted crane. The barge will be brought into the lagoon via a tugboat and spuds fixed to the barge will be lowered into the substrate to hold the barge in place during pile driving activities. During any impact hammer use a 12-inch thick wood cushion block will be used and a bubble curtain will be employed. A "soft start" technique will also be used during any pile installation with an impact hammer. One pile will be installed over a period of 2 days. With a total of 22 piles (18 piles in-water and four piles on land), 44 days of pile driving is anticipated (the 44 days may or may not be consecutive). It is anticipated that pile installation will take 1,800 strikes per day and installation will occur over a period of 10 hours or less per day. All pile driving will be restricted to the period between June 1 and November 30.

Table 1. Pile Installation Components.

Project Component	Pile Type	Pile Size (diameter)	Number of Piles
Pier (in-water)	Steel	24-inch	12
Boarding Float (in-water)	Steel	36-inch	6
Abutment (onshore)	Steel	24-inch	4

Hydroacoustic Monitoring.

The Applicant proposes to conduct hydroacoustic monitoring when an impact hammer is used at several, but not all, pile installations. Piles chosen to be monitored will be representative of typical water depths where piles will be driven. The location of the specific piles to be monitored and the approximate hydrophone locations for each pile being monitored will be determined in the field.

Demolition

An existing and deteriorating wooden pier at the project site will be removed. The wooden pier is supported by 30 12-inch diameter creosote-treated piles and 3 concrete foundations. A total of 36 ft^2 of creosote-treated wood and concrete will be removed from the interior of Seaplane Lagoon. Approximately 2,914 ft^2 of overwater structure in the form of pier decking will be removed. Demolition will be performed with a barge-mounted crane and hand tools. The existing pier will be removed and all debris will be hauled offsite and properly disposed of at an upland location. Piles will be pulled and removed to the mudline. Any debris found on the substrate under the pier's vicinity will be removed and disposed of at an appropriate upland location.

Operations

The proposed ferry terminal is anticipated to alleviate the increased demand for public transportation in Alameda. Currently there are two operational ferry terminals that serve the Oakland/Alameda area. Both of the existing terminals are almost at capacity and ridership is expected to increase. The proposed ferry terminal at Seaplane Lagoon is expected to run 10 ferry trips a day between Alameda and San Francisco. Six trips will be departures and four trips will be arrivals.

Shoreline Stabilization

Approximately 600 ft^2 of existing revetment will be partially removed to construct the abutment of the pier. After the abutment is constructed, the revetment will be redressed within its original footprint. Redressing the revetment will also include auguring into the soil and injecting cementitious grout for seismic safety. Work will occur above the HTL, but a silt curtain will be deployed at low tide to avoid the mobilization of material into the water column.

Landside Work

Other work that will occur above the HTL in upland areas adjacent to Seaplane Lagoon will include access and parking facilities; roadway, bicycle, and pedestrian improvements; transit facilities; landside utilities; and ramps.

Access and parking improvements will include new paving for bicycle, pedestrian, transit, and vehicular circulation. A 400-space parking facility will be constructed 0.25 miles from the access gates. The existing road will be fitted with a sidewalk to allow for pedestrian and bicycle access. The existing road will also be reconfigured. A transit turnaround will be constructed just south of the ferry terminal for public transportation. Three storm drains will be replaced - one at the parking lot, the transit turnaround, and the bus stop. A stormwater management area will be revamped at the transit turnaround. Utilities for landside improvement will include electrical service for roadway and parking lighting. Staging for landside work will occur on existing roads and equipment will include but not be limited to excavators, compactors, graders, backhoes, and dump trucks.

Construction Schedule

Project construction may begin as early as 2019. Construction is expected to be completed within one year. All in-water work will be limited to the period between June 1 and November 30.

Avoidance and Minimization Measures

The Corps proposes to require the following avoidance and minimization measures for activities associated with construction of the proposed ferry terminal:

1. All in-water work will occur between June 1 and November 30.
2. To the extent feasible, all piles will be removed and installed with a vibratory pile driver.
3. An impact pile driver will only be used when necessary to complete installation of the larger steel piles in accordance with seismic safety standards or engineering criteria.

4. If an impact pile driver is used then it will be cushioned with a 12-inch thick wood cushion block.
5. Bubble curtains will be used during any impact pile driving.
6. A "soft start" technique will be employed if an impact pile driver will be used. This technique will be used upon the initiation of pile driving or if there is a downtime of 30 minutes or more without pile driving.
7. Pile driving will occur only during daylight hours.
8. A biological monitor will be present during all pile driving to observe the work area before, during, and after pile driving.
9. The Applicant will ensure that a Marine Invasive Species Control Plan is developed and implemented prior to commencement of any in-water work. Provisions of the plan will include but not be limited to the following:
    a. environmental training of construction personnel involved in in-water work;
    b. actions to be taken to prevent the release and spread of marine invasive species, especially algal species such as *Undaria* and *Sargasso*;
    c. procedures for the safe removal and disposal of any invasive taxa observed;
    d. the onsite presence of qualified marine biologists to assist in the identification and proper handling of any invasive species; and
    e. post-construction report identifying any invasive species located and a description of handling and removal techniques. This reports will be shared with any agency that requests it.
10. Best management practices (BMPs) will be employed to protect aquatic habitats and wetlands. These BMPs will include but not be limited to the following:
    a. Installing silt fencing between wetlands and aquatic habitat and construction-related activities;
    b. Locating fueling stations away from potentially jurisdictional features; and
    c. Isolating construction work areas from any identified jurisdictional features.
11. The Applicant will prepare and implement a stormwater pollution prevention plan (SWPPP).
12. A spill prevention and control plan will be prepared to specify restrictions and procedures for fuel storage location, fueling activities, and equipment maintenance.

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

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

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

The Corps determined the proposed action may affect and is likely to adversely affect North American green sturgeon and their critical habitat. The Corps also determined the proposed action is not likely to adversely affect CCC steelhead or its critical habitat. Our concurrence is documented in the "Not Likely to Adversely Affect" Determinations section (2.12) of this opinion.

2.1 Analytical Approach

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

This biological opinion relies on the definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features" (81 FR 7214).

The designation of critical habitat for Southern DPS of North American green sturgeon uses the term primary constituent element (PCE) or essential features. The new critical habitat regulations (81 FR 7414) replace this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a "destruction or adverse modification" analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

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

- Identify the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Describe the environmental baseline in the action area.
- Analyze the effects of the proposed action on both species and their habitat using an "exposure-response-risk" approach.
- Describe any cumulative effects in the action area.

- Integrate and synthesize the above factors by: (1) reviewing the status of the species and critical habitat; and (2) adding the effects of the action, the environmental baseline, and cumulative effects to assess the risk that the proposed action poses to species and critical habitat.
- Reach a conclusion about whether species are jeopardized or critical habitat is adversely modified.
- If necessary, suggest a reasonable and prudent alternative to the proposed action.

2.1.1 Use of Best Available Scientific and Commercial Information

To conduct the assessment presented in this opinion, 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 potential effects of the proposed activities at the Seaplane Lagoon Ferry Terminal 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:

- June 2016 Biological Assessment prepared for the Applicant by H.T. Harvey & Associates,
- October 28, 2016 Memorandum prepared for the Applicant by H.T. Harvey & Associates evaluating pile driving effects on NMFS-listed species and designated critical habitat.

Information was also provided in email messages and telephone conversations between July and December 2016. For information that has been taken directly from published, citable documents, those citations have been reference in the text and listed at the end of this document. A complete administrative record of this consultation is on file at the NMFS North-Central Coast Office in Santa Rosa, California (Administrative Record Number 151422WCR2016SR00275).

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the current function of the essential PBFs that help to form that conservation value.

2.2.1 Species Description, Life History, and Status

This opinion analyzes the effects of the Seaplane Lagoon Ferry Terminal Project on the Southern

DPS of green sturgeon and their designated critical habitat.

2.2.1.1 Green Sturgeon General Life History

Green sturgeon is an anadromous, long-lived, and bottom-oriented fish species in the family Acipenseridae. Sturgeon have skeletons composed mostly of cartilage and lack scales, instead possessing five rows of characteristic bony plates on their body called "scutes." On the underside of their flattened snouts are sensory barbels and a siphon-shaped, protrusible, toothless mouth. Large adults may exceed 6 feet in length and 100 kilograms in weight (Moyle 1976). Based on genetic analyses and spawning site fidelity, NMFS determined that North American green sturgeon are comprised of at least two DPSs: a northern DPS consisting of populations originating from coastal watersheds northward of and including the Eel River ("Northern DPS green sturgeon"), with spawning confirmed in the Klamath and Rogue river systems; and a southern DPS consisting of populations originating from coastal watersheds south of the Eel River ("Southern DPS green sturgeon"), with spawning confirmed in the Sacramento River system (Adams *et al.* 2002).

Green sturgeon is the most marine-oriented species of sturgeon (Moyle 2002). Along the West Coast of North America, they range in nearshore waters from Mexico to the Bering Sea (Adams *et al.* 2002), with a general tendency to head north after their out-migration from freshwater (Lindley *et al.* 2011). While in the ocean, archival tagging indicates that green sturgeon occur in waters between 0 and 650 feet in depth, but spend most of their time in waters between 65 and 260 feet 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) reported multiple rivers and estuaries are visited by aggregations of green sturgeon in summer months, and larger estuaries (*e.g.*, San Francisco Bay) appear to be particularly important habitat. During the winter months, green sturgeon generally reside in the coastal ocean. Areas north of Vancouver Island are favored overwintering areas, with Queen Charlotte Sound and Hecate Strait likely destinations based on detections of acoustically-tagged green sturgeon (Lindley *et al.* 2008; Nelson *et al.* 2010).

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

Adult Southern DPS green sturgeon spawn in the Sacramento River watershed during the spring and early summer months (Moyle *et al.* 1995). Eggs are laid in turbulent areas on the river bottom and settle into the interstitial spaces between cobble and gravel (Adams *et al.* 2007). Like salmonids, green sturgeon require cool water temperatures for egg and larval development, with optimal temperatures ranging from 11 to 17°C (Van Eenennaam *et al.* 2006). 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 2 inches in total length (TL). After hatching larvae migrate downstream. Juveniles spend their first few years in the Delta and San Francisco Estuary before entering the marine environment as subadults. Juvenile green sturgeon salvaged at the State and Federal water export facilities in the Southern Delta are generally between 8 and 16 inches 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 months 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 2 to 5 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) analyzed stomach contents of juvenile green sturgeon captured in the Sacramento-San Joaquin Delta and found the majority of their diet was benthic invertebrates, such as mysid shrimp and amphipods (Corophium spp). Dumbauld *et al.* (2008) reported that immature green sturgeon found in Willapa Bay, Grays Harbor, and the Columbia River Estuary, fed on a diet consisting primarily of benthic prey and fish common to these estuaries (ghost shrimp, crab, and crangonid shrimp), with burrowing thalassinid shrimp representing a significant proportion of the sturgeon diet. Dumbauld *et al.* (2008) observed feeding pits (depressions in the substrate believed to be formed when green sturgeon feed) in soft-bottom intertidal areas where green sturgeon are believed to spend a substantial amount of time foraging.

2.2.1.2 Status of Southern DPS Green Sturgeon and Critical Habitat

To date, little population-level data have been collected for green sturgeon. In particular, there are no published abundance estimates for either Northern DPS or Southern DPS green sturgeon in any of the natal rivers based on survey data. As a result, efforts to estimate green sturgeon population size have had to rely on sub-optimal data with known potential biases. Available abundance information comes mainly from four sources: 1) incidental captures in the California Department of Fish and Wildlife (CDFW) 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 of ways (short time series, non-target species, etc.) and do not support more than a qualitative evaluation of changes in green sturgeon abundance.

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

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

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

The NMFS status review update completed in 2006 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). A 2015 five-year review found that there has not been a significant change in the status of Southern DPS green sturgeon and that the threatened status is still applicable (NMFS 2015).

Critical habitat was designated for the Southern DPS of green sturgeon on October 9, 2009 (74 FR 52300). Critical habitat includes coastal marine waters within 60 fathoms depth from Monterey Bay, California to Cape Flattery, Washington, and includes the Strait of Juan de Fuca to its United States boundary. Designated critical habitat also includes the Sacramento River, lower Feather River, lower Yuba River, Sacramento-San Joaquin Delta, Suisun Bay, San Pablo Bay, and San Francisco Bay in California. PBFs of designated critical habitat in estuarine areas are food resources, water flow, water quality, migration corridor, depth, and sediment quality. In freshwater riverine systems, PBFs 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, PBFs 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 PBFs have been impacted by human actions, substantially altering the historical river characteristics in which the Southern DPS of green sturgeon evolved. In addition, the Delta may have a particularly strong impact on the survival and recruitment of juvenile green sturgeon due to their protracted rearing time in brackish and estuarine waters.

2.2.2 Factors Responsible for Green Sturgeon Stock Declines

NMFS cites many reasons (primarily anthropogenic) for the decline of Southern DPS 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, ocean conditions, and global climate change. The

NMFS 2015 five-year review found that evaluation of new information since the previous status review does not suggest a significant change in the status of Southern DPS green sturgeon and, with respect to threats, the available information indicates that some threats, such as those posed by fisheries and impassable barriers, have been reduced (NMFS 2015).

2.2.2.1 Habitat Degradation and Destruction

The best scientific information presently available demonstrates a multitude of factors, past and present, have contributed to the decline of 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 (Adams *et al.* 2002).

2.2.2.2 Commercial and Recreational Harvest

Until recently, commercial and recreational harvest of Southern DPS green sturgeon was allowed under State and Federal law. Since 2006, the threat posed by commercial and recreational fishing has decreased given that intentional lethal take of green sturgeon has been prohibited through fishing regulations (NMFS 2015). Regulations in California, Oregon and Washington prohibit retention of green sturgeon and these regulations pertain to the range of both Southern and Northern DPS green sturgeon. Lethal take still occurs as a result of by-catch mortality associated with the California halibut bottom trawl fishery and incidental catch of green sturgeon occurs in the west coast Pacific Groundfish fisheries. The impact of by-catch in these fisheries on the overall population abundance of the Southern DPS is still unknown (NMFS 2015).

2.2.2.3 Natural Stochastic Events

Natural events such as droughts, landslides, floods, and other catastrophes have adversely affected 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 sturgeon to rebound from natural stochastic events and depressed populations to critically low levels.

2.2.2.4 Global Climate Change

Another factor affecting the rangewide status of Southern DPS green sturgeon and their critical habitat at large is climate change. Impacts from global climate change are already occurring in California. For example, average annual air temperatures, heat extremes, and sea level have all increased in California over the last century (Kadir *et al.* 2013). Snow melt from the Sierra Nevada has declined (Kadir *et al.* 2013). However, total annual precipitation amounts have shown no discernable change (Kadir *et al.* 2013). Green sturgeon may have already experienced some detrimental impacts from climate change. NMFS believes the impacts on listed fish to date are likely fairly minor because natural, and local, climate factors likely still drive most of the climatic conditions sturgeon experience, and many of these factors have much less influence on sturgeon abundance and distribution than human disturbance across the landscape.

The threat to listed green sturgeon from global climate change will increase in the future.

Modeling of climate change impacts in California suggests that average summer air temperatures are expected to continue to increase (Lindley *et al.* 2007; Moser *et al.* 2012). Heat waves are expected to occur more often, and heat wave temperatures are likely to be higher (Hayhoe *et al.* 2004; Moser *et al.* 2012; Kadir *et al.* 2013). Total precipitation in California may decline; critically dry years may increase (Lindley *et al.* 2007, Schneider 2007, Moser *et al.* 2012).

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

Estuaries may also experience changes detrimental to green sturgeon. Estuarine productivity is likely to change based on changes in freshwater flows, nutrient cycling, and sediment amounts (Scavia *et al.* 2002; Ruggiero *et al.* 2010). Cloern *et al.* (2011) estimated that the salinity in San Francisco Bay could increase by 0.30-0.45 practical salinity unit (psu) per decade due to the confounding effects of decreasing freshwater inflow and sea level rise. In marine environments, ecosystems and habitats important to sturgeon are likely to experience changes in temperatures, circulation, water chemistry, and food supplies (Abdul-Aziz *et al.* 2011; Brewer and Barry 2008; Doney *et al.* 2012; Feely 2004; 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; Santer *et al.* 2011).

2.3 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area for the project is located within Seaplane Lagoon and upland areas at the Waterfront Town Center area of Alameda Point, on the former Alameda Point Naval Air Station, at the western end of Alameda Point. The action area includes the new ferry terminal footprint and all areas below high HTL that may be directly or indirectly affected by the project, including the maximum area that could be affected by elevated underwater sound levels during pile driving. For this project, the action are encompasses the lagoon due to elevated underwater sound levels during pile driving. The lagoon is a rectangular lagoon that is 3,000 feet by 1,600 feet, for a total of 4,800,000 ft^2 (1,102 acres). The action area does not extend outside the opening of the lagoon because it is almost entirely enclosed by a concrete bulkhead, rock slope revetments, and a breakwater. Only 6 percent of the lagoon's perimeter allows access into San Francisco Bay via the 600-foot opening at the southern end.

2.4 Environmental Baseline

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

2.4.1 Action Area Overview

The action area for this project consists of the Seaplane Lagoon and adjacent upland areas in the City of Alameda, Alameda County, California. Seaplane Lagoon is a 1,102-acre rectangular manmade basin constructed as part of the Alameda Naval Air Station in the 1930's and 1940's. The lagoon is bordered by an existing concrete and steel sheet pile bulkhead to the north, rock slope revetments to the east and west, and a rock breakwater to the south (Figure 1). There is an existing derelict wooden pier that is located along the eastern shoreline, which includes a 12-foot wide walkway and a 35-foot circular deck. The lagoon's shoreline is composed of riprap and the lagoon connects to the open waters of San Francisco Bay through the 600-foot opening in the breakwater on the south side. The substrate in the lagoon is mainly composed of silty mud and sand substrates. Water depths in the lagoon range from -10 to -20 feet mean lower low water (MLLW). Based on the last known survey in 2010, native submerged aquatic vegetation (SAV), including eelgrass (*Zostera marina*), is not present within the action area.

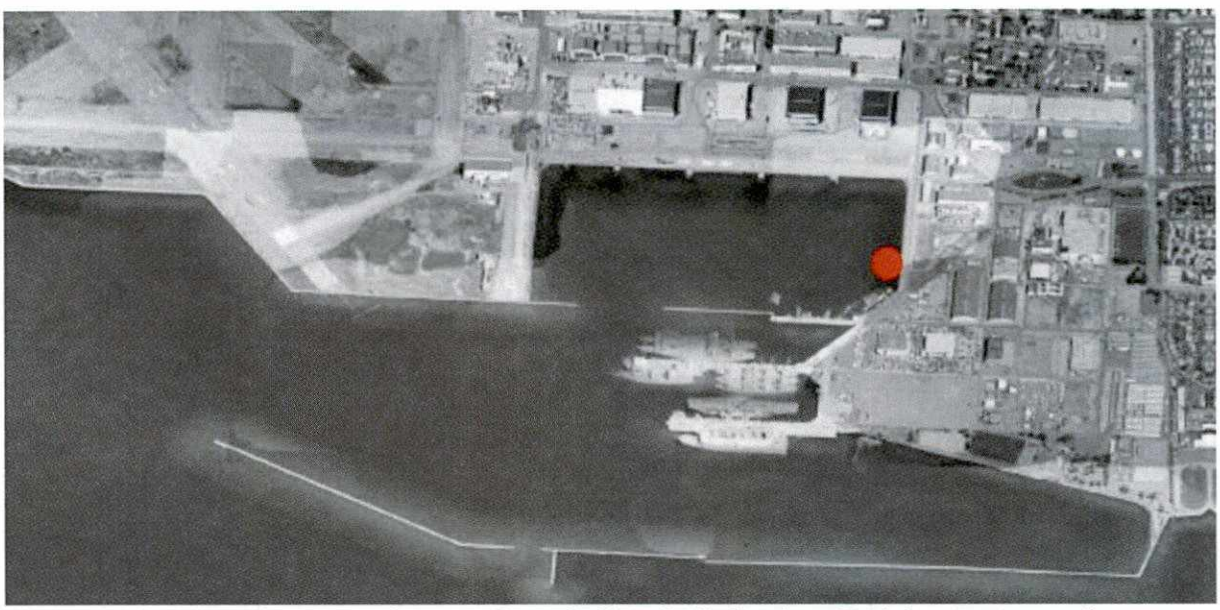

Figure 1. Seaplane Lagoon at former Alameda Naval Air Station. Red dot represents ferry terminal location.

The action area is characterized as nearshore estuarine habitat that has been highly modified by the densely developed Alameda waterfront and former Alameda Naval Air Station. The new ferry terminal will be located on the eastern shoreline of the lagoon (Figure 1). The transition from upland areas to subtidal habitat is a narrow zone consisting of rock rip rap and concrete rubble. The substrate of lagoon bottom is silty mud and sand. Soft substrate benthic habitat in San Francisco Bay is known to support an invertebrate community characterized by a diverse array of polychaetes, amphipods, and cumaceans (Thompson *et al.* 2007).

2.4.2 Status of Species and Critical Habitat in Action Area

2.4.2.1 Green Sturgeon

Green sturgeon are iteroparous[1], and adults pass through San Francisco Bay during spawning and post-spawning migrations. Pre-spawn green sturgeon enter San Francisco 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 San Francisco Bay after spawning in the Sacramento River in the spring and early summer for months prior to immigrating 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 2007; Kelly *et al.* 2007). Subadult and non-spawning adult green sturgeon utilize both ocean and estuarine environments for rearing and foraging. Due to these life-history characteristics, juvenile, subadult and adult green sturgeon may be present in the action area year-round. However, Seaplane Lagoon is a semi-enclosed basin due to the presence of breakwaters and the action area does not offer any unique habitat or foraging conditions which would attract green sturgeon into the basin.

While surveys for green sturgeon have not been conducted in the action area, mud flats and tidal sloughs along the Alameda shoreline may be used as foraging habitat by green sturgeon. Within the San Francisco Estuary, green sturgeon likely prey on demersal fish (*e.g.*, sand lance [*Ammodytes hexapterus*]) and benthic invertebrates similar to those that green sturgeon are known to prey upon in estuaries of Washington and Oregon (Dumbauld *et al.* 2008). Green sturgeon are also known to be generalist feeders and may feed opportunistically on a variety of benthic species encountered. For example, the invasive overbite clam (*Corbula amurensis*) has become a common food of white sturgeon and green sturgeon in San Francisco Bay (CDFG 2002).

Based on distribution data and foraging habits of green sturgeon, NMFS assumes this species could occasionally be present in the action area to forage on benthic prey and fish commonly found in soft-bottom habitats (*e.g.*, ghost shrimp, crab, and crangonid shrimp) of the San Francisco Estuary. Although soft-bottom habitat exists in the action area, the area is periodically disturbed by dredging which likely has reduced the quality and quantity of benthic prey organisms available for green sturgeon foraging.

2.4.2.2 Green Sturgeon Critical Habitat

The project's action area is designated as critical habitat for the Southern DPS of green sturgeon. PBFs of designated critical habitat in the action area include food resources, water flow, water quality, mitigation corridor, depth, and sediment quality. The current condition of critical habitat in the action area is degraded over its historical conditions. Habitat degradation is primarily due to a long history of industrial and military development along Alameda Point.

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

2.4.3 Factors Affecting the Species Environment in the Action Area

The San Francisco Bay/Delta is one of the most human-altered estuaries in the world (Knowles and Cayan 2004). Major drivers of change in the action area that are common to many estuaries are water consumption and diversion, human modification of sediment supply, introduction of nonnative species, sewage and other pollutant inputs, and climate shifts. Responses to these drivers in San Francisco Bay include shifts in the timing and extent of freshwater inflow and salinity intrusion, decreasing turbidity, restructuring of plankton communities, nutrient enrichment and metal contamination of biota, and large-scale food web changes (Cloern and Jassby 2012).

The land, shoreline and subtidal areas of the action area have been highly modified by urban, maritime, and military development along the Alameda shoreline and the adjacent Port of Oakland. The City of Alameda contains commercial and high density residential development and high use streets. The hydrology of the action area is modified as a result. Terrestrial portions of the action area include large amounts of bay fill and receive water from direct precipitation, which will flow into storm drains and into a stormwater management system. Water and sediment quality within the action area is affected by stormwater runoff, industrial activities, and other urban influences. Wastewater discharges from the former Alameda Naval Air Station drained into Seaplane Lagoon when the facility operated from the 1930's to 1990's. As part of a broad Superfund cleanup action at the Alameda Naval Air Station, contaminated sediments were dredged from the Seaplane Lagoon in 2011.

2.4.4 Previous Section 7 Consultations and Section 10 Permits in the Action Area

Pursuant to section 7 of the ESA, NMFS has conducted three interagency consultation within the action area of the project. All three consultations were conducted with the Corps and were completed as informal consultations.

- Seaplane Lagoon Geotechnical Borings (PCTS #WCR-2016-4585) involved geotechnical borings at four sites in Seaplane Lagoon. A June 2, 2016 concurrence letter for the project concluded the proposed action was not likely to adversely affect listed fish species or designated critical habitat under the jurisdiction of NMFS.
- Alameda Point Site A Phase 1 (PCTS #WCR-2016-5879) involved the repair of a degraded bulkhead and shoreline protection in the Seaplane Lagoon. A January 31, 2017 concurrence letter for the project concluded the proposed action was not likely to adversely affect listed fish species or designated critical habitat under the jurisdiction of NMFS.
- Alameda Point Stormwater Outfalls Upgrade (PCTS #WCR-2015-3610) involved improvements to the stormwater drainage system and Alameda Point and the replacement of five outfalls. A November 16, 2015 concurrence letter concluded that the proposed action was not likely to adversely affect listed fish species or designated critical habitat under the jurisdiction of NMFS.

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, but are not likely to, occur in the action area. Sturgeon monitoring approved under these programs includes juvenile and adult net surveys and tagging studies. In general, these activities are closely monitored and require measures to minimize take during the research activities. As of June 2017, no research or enhancement activities requiring Section 10(a)(1)(A) research and enhancement permits or section 4(d) limits have occurred in the action area.

2.4.5 Climate Change Impacts in the Action Area

Information discussed above in the Rangewide Status of the Species and Critical Habitat section of this opinion (Section 2.2) indicates that green sturgeon in the action area may have already experienced some detrimental impacts from climate change. These detrimental impacts across the action area are likely to be minor because natural and local climate factors continue to drive most of the climatic conditions green sturgeon experience. These natural factors are likely less influential on fish abundance and distribution than anthropogenic impacts across the action area. However, in the future impacts in the action area from climate change are likely to increase as air and water temperatures warm, and precipitation rates change.

2.5 Effects of the Action

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

In this biological opinion, our approach to determine the direct and indirect effects of the proposed action, and interrelated or interdependent activities, on Southern DPS green sturgeon 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, to which Southern DPS green sturgeon are likely to be exposed. Next, we evaluated the likely response of green sturgeon to these stressors in terms of changes to survival, growth, and reproduction, and changes to the ability of PBFs to support the value of critical habitat in the action area. Where data to quantitatively determine the effects of the proposed action on 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 through elevated levels of underwater sound during pile driving, disturbance during pier demolition, and degradation of water quality during pile driving and pier demolition. When completed, the operation of ferry boats to and from the new facility may affect threatened green sturgeon through temporary increases in turbidity, noise disturbance, and the spread of invasive species.

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., SWPPP, spill prevention and control plan, etc.) that prevent the runoff and discharge of pollutants from landside activities to the waters of San Francisco Bay.

2.5.1 Effects of Construction Activities on Listed Species and Critical Habitat

In-water and shoreline construction activities by the proposed project consist of demolition of an existing wooden pier, removal of piles and debris on the bottom substrate, pile installation, construction of a pier and abutment, construction of a gangway, and construction of a boarding float. These activities will likely result in temporary impacts to water quality, disturbance of benthic habitat, and elevated underwater sound levels.

In-water construction activities will be limited to one year and occur during the period between June 1 and November 30. Effects to critical habitat are expected from the increased amount of overwater structure and new pile installations (approximately 0.12 acres total). The potential effects of in-water construction are presented below.

2.5.1.1 Overview of Pile Driving Impacts

Green sturgeon may be affected by exposure to high underwater sound pressure levels (SPLs) produced during pile driving. Fish may be injured or killed when exposed to high levels of underwater sound, especially those generated by impulsive sound sources such as pile driving with impact hammers. Pathologies of fish associated with very high sound level exposure and drastic changes in pressure are collectively known as *barotraumas*. These include hemorrhage and rupture of blood vessels and internal organs, including the swim bladder and kidneys. Death can be instantaneous, occur within minutes after exposure, or occur several days later. Fish can also die when exposed to lower, continuous sound pressure levels if exposed for longer periods of time. Hastings (1995) found death rates of 50 percent and 56 percent for gouramis (*Trichogaster sp.*) when exposed for two hours or less to continuous sound at 192 dB root mean squared (RMS) (re: 1 μPa) at 400 Hz and 198 dB (re: 1 μPa) at 150 Hz, respectively, and 25 percent for goldfish (*Carassius auratus*) when exposed to sounds of 204 dB (re: 1 μPa) at 250 Hz[2]. 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 these sound levels.

Hearing loss in fishes can also occur from exposure to high intensity sounds. These sounds can over-stimulate the auditory system of fishes and may result in temporary threshold shifts (TTS). TTS is considered a non-injurious temporary reduction in hearing sensitivity. Physical ear injury may also occur for fish exposed to high levels of continuous sound, manifested as a loss of hair cells, located on the epithelium of the inner ear (Hastings and Popper 2005). These hair cells are capable of sustaining injury or damage that may result in a temporary decrease in hearing sensitivity. However, this type of noise-induced hearing loss in fishes is generally considered recoverable, as fish possess the ability to regenerate damaged hair cells (Lombarte *et al.* 1993;

[2] Pressures will not be added to each metric for the remainder of the section: dB peak has a pressure of 1 μPa, dB sound exposure level (SEL) has a pressure of 1 $\mu Pa^2 \cdot sec$, RMS dB has a pressure of 1 μPa.

Smith *et al*. 2006). Permanent hearing loss has not been documented in fish. Even if threshold shifts in hearing do not occur, loud sounds can mask the ability of fish to hear their environment. This effect from loud sound exposure is referred to as acoustic or auditory masking. Masking generally results from an unwanted or unimportant sound impeding a fish's ability to hear sounds of interest.

Underwater sound exposures have also been shown to alter the behavior of fishes (see review by Hastings and Popper 2005). The observed behavioral changes include startle responses and increases in stress hormones. Exposure to pile driving sound pressure levels may also result in "agitation" of fishes indicated by a change in swimming behavior detected by Shin (1995) or "alarm" detected by Fewtrell (2003). Other potential changes include reduced predator awareness and reduced feeding. The potential for adverse behavioral effects will depend on a number of factors, including the sensitivity to sound, the type and duration of the sound, as well as life stages of fish that are present in the areas affected by underwater sound produced during pile driving. A fish that exhibits a startle response to a sudden loud sound may not necessarily be injured, but it is exhibiting behavior that suggests it perceives a stimulus indicating potential danger in its immediate environment. However, fish do not exhibit a startle response every time they experience a strong hydroacoustic stimulus.

In order to assess the potential effects to fish exposed to pile driving sound, a coalition of federal and state resource and transportation agencies along the West Coast, the Fisheries Hydroacoustic Working Group (FHWG), used data from a variety of sound sources and species to establish interim acoustic criteria for the onset of injury to fishes from impact pile driving exposure (FHWG 2008). Most historical research has used peak pressure to evaluate the effects on fishes from underwater sound. Current research, however, suggests that sound exposure level (SEL), a measure of the total sound energy expressed as the time-integrated, sound pressure squared, is also a relevant metric for evaluating the effects of sound on fishes. An advantage of the SEL metric is that the acoustic energy can be accumulated across multiple events and expressed as the cumulative SEL (cSEL). Therefore a dual metric criteria was established by the FHWG and includes a threshold for peak pressure (206 dB) and cSEL (187 dB for fishes 2 grams or larger and 183 dB for fishes smaller than 2 grams). Injury would be expected if either threshold is exceeded. There is uncertainty as to the behavioral response of fish to underwater sound produced when driving piles in or near water. Until new information indicates otherwise, NMFS believes a 150 dB RMS threshold for behavioral responses for green sturgeon is appropriate.

Currently, there are few data available regarding effects of pile driving directly focused on green sturgeon. There is some evidence of pile driving-related underwater sound pressures resulting in mortality of white sturgeon during the construction of the Benicia-Martinez Bridge. In 2002, unattenuated piles driven with a large impact hammer at the Benicia-Martinez Bridge Project resulted in the mortality of a 24" white sturgeon (*Acipenser transmontanus*). The piles for the bridge piers were 98-inch diameter steel piles and were driven in water ranging from 40 and 50 feet deep in the main channel of Carquinez Strait. Peak underwater sound pressure levels ranged from 227 dB at approximately 16 feet from the pile to 178 dB at approximately 3,600 feet from the pile (Buehler *et al.* 2015).

2.5.1.2 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. A dual metric criteria of 206 dB peak SPL for any single strike and a cSEL of 187 dB 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. Green sturgeon that may be present within the action area of this project are significantly greater than 2 grams in size.

Different types of piles (*e.g.*, wood, steel, concrete) result in different levels of underwater sound when struck with a pile driver. For the proposed Seaplane Lagoon Ferry Terminal, only steel piles will be used for construction. In the updated Compendium of Pile Driving Sound Data (Buehler *et al.* 2015), the most recent pile driving monitoring results are compiled in order to provide information regarding the potential levels of underwater sound pressure levels generated with the installation of different pile and hammer types. Several pile driving case studies conducted within the San Francisco Bay region using steel, concrete, and composite piles are included in the compendium. Impact hammers produce the highest elevated underwater sound levels, particularly when used in combination with steel piles. Vibratory hammers produce less sound than impact hammers and are often employed as a measure to reduce the sound generated by pile driving, and in turn, the potential for adverse effects on fish (Buehler *et al.* 2015).

Water depth at the pile driving site will also influence the rate of sound attenuation. In deep water areas high sound pressure waves are likely to travel further out into the Bay. Within shallow water, the rate of attenuation is expected to be much higher, reducing the expected area of adverse effects as compared to deeper water. Pile driving for the proposed project will occur in water depths ranging from approximately -10 feet MLLW to -20 feet at MLLW, and will be located within a semi-enclosed basin. Elevated sound levels are not expected to travel through the lagoon's rock breakwaters. Additionally, as distance from the pile increases, sound attenuation reduces sound pressure levels and the potential harmful effects to fish also decreases.

For the Seaplane Lagoon Ferry Terminal Project, the Applicant proposes to use a vibratory hammer to install the piles as deep as possible and an impact hammer will be used when the vibratory hammer cannot complete the installation. The Applicant also proposes to use a 12-inch thick wood cushion block and a bubble curtain during impact hammer use to attenuate underwater sound levels during installation of all steel piles. Based on the use of a cushion block, bubble curtain, and pile sizes proposed for this project, the assessment of acoustic impacts presented in this biological opinion assumes an estimated reduction of 10 dB in sound pressure. Although reductions in 11 to 26 dB have been measured for wood cushion blocks and reductions in 15 to 30 dB have been measured for bubble curtains, 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 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 then fewer large fish are likely to be present due to shallow water depths. At the Seaplane Lagoon Ferry Terminal Project, pile driving with an impact hammer will occur over a period of up to 44 days. It is expected that one pile will be installed over 2 days. With a total of 22 piles to install (18 piles in-water and four piles onshore), impact hammer use is expected to occur over a period of 44 days. The installation of these piles will occur between June 1 and November 30.

2.5.1.3 Assessment of Pile Driving Effects at Seaplane Lagoon Ferry Terminal

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 highest sound levels associated with the construction of the ferry terminal will occur during driving of the 36-inch steel piles with an impact hammer (Table 2). However, the project description does not indicate the days on which the 36-inch piles will be driven. Therefore, even though Table 2 indicates that peak SPLs of 206 dB and accumulated SELs associated with smaller piles should be less than those generated by the 36-inch steel piles, our effects analysis assumes that all installed piles will have the larger ranges.

Table 2 presents estimates of sound levels associated with impact hammer pile driving. These estimates were provided by the Applicant's consultant. NMFS also examined hydroacoustic monitoring results for similar sized piles presented in the Compendium of Pile Driving Sound Data (Buehler *et al.* 2015) and generated estimates with a spreadsheet model to estimate peak SPLs and cSELs at various distances from the source. Table 2 assumes that elevated underwater sound will not travel outside of the lagoon due to the location of the proposed ferry terminal being directly adjacent to a rock slope revetment to the east and a breakwater to the south, which are assumed to not efficiently transmit sound. Furthermore, the lagoon is almost entirely bordered by hardened structures that do not efficiently transmit sound.

Table 2. Sound levels associated with impact hammer pile driving and use of cushion block and bubble curtain.

Pile type and size	Max single strike peak at 33 feet (10 m)	Accumulated SEL at 33 feet (10 m)	Single strike RMS at 33 feet (10 m)	Distance (ft) to 206 dB peak	Distance (ft) to 187 dB accumulated SEL/day	Distance (ft) to 150 dB RMS
36-inch steel	208 dB	181 dB	193 dB	46	1,365	3,000*
24-inch steel	193 dB	168 dB	179 dB	3.2	262	2,815
24-inch steel above HTL	187 dB	163 dB	175 dB	3.2	121	1,522

* The spreadsheet model estimated the distance to 150 dB RMS to be 24,134 ft. However, the table depicts the actual distances underwater sound can travel within the 3,000-foot wide lagoon.

Pile driving with an impact hammer will occur at a rate of approximately 1,800 strikes per day. It is expected that one pile will be installed over two days by a combination of vibratory hammer and impact hammer. Pile driving will occur during a 10-hour work day. Pile installation will occur for 44 days in a single year between June 1 and November 30.

To complete the majority of the pile installations, the project proposes to use a vibratory hammer. Vibratory hammers use counter-rotating eccentric weights to transmit vertical vibrations into the pile, causing the sediment surrounding the pile to liquefy and allow the pile to penetrate the substrate. The vibratory hammer produces sound energy that is spread out over time and is generally 10 to 20 dB lower than impact pile driving (Buehler *et al.* 2015). Based on the results of hydroacoustic monitoring of vibratory hammer pile installations (Buehler *et al.* 2015), the sound levels generated by vibratory hammer use at Seaplane Lagoon will be considerably below the injury and mortality thresholds for both single strike and cumulative SEL, and no adverse effects to green sturgeon are anticipated. However, pile driving activities by vibratory hammer could result in noise that may startle green sturgeon and result in temporary dispersion from the action area. The potential behavioral effects of pile driving on green sturgeon are presented below.

Although the Applicant proposes, to the extent feasible, to remove and install piles with a vibratory pile driver, it is anticipated that an impact pile driver will be required to complete installation of the larger steel piles. The estimated underwater sound levels associated with impact hammer use by this project (Table 2) are expected to exceed the dual metric criteria established by the FHWG (peak pressure of 206 dB and cSEL of 187 dB for fishes 2 grams or larger) and could result in the mortality or injury of threatened green sturgeon. However, several factors reduce the likelihood that sturgeon will be present or injured by a single strike peak SPL above 206 dB within 46 feet of a pile.

First, the placement of an air bubble curtain will occupy 5-10 feet of the radial distance immediately outward from the pile. Air bubble curtains are constructed by the placement of one or more horizontal concentric rings of perforated tubing 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 ~10 feet immediately outward of the pile. Secondly, activation of the air bubble curtain immediately prior to the initiation of pile driving is expected to startle fish adjacent to the pile and likely result in a flight response. Additional noise will be created by the air compressors operating the bubble curtain, and boats and barges containing the pile driving equipment and crew will be operating immediately overhead. This noise will likely be perceived by fish as a stimulus indicating potential danger in its immediate environment so sturgeon are not expected to remain in the area directly adjacent to a pile during driving. Dolat (1997) reported a variety of fish species demonstrate an avoidance reaction in the near-field (*i.e.*, immediately adjacent to the sound source) to underwater sounds. Lastly, the short duration of impact pile driving use (approximately 1,800 strikes per day for a total of 44 days) will also limit the amount of exposure incurred by green sturgeon in the action area. Thus, the likelihood of an individual green sturgeon's presence in the area subjected to SPLs above 206 dB (within 46 feet of the pile) is very low and the likelihood of injury is proportionate to the low likelihood of presence.

Although it is unlikely sound levels associated with the single strike of an impact hammer on a 36-inch diameter pile will cause injury or mortality, cumulative SEL (cSEL) has the potential to result in injury or mortality of green sturgeon for a significantly greater distance from the pile. For the project's installation of steel piles, NMFS anticipates the extent of SPLs above cSEL of 187 dB would extend up to a radial distance of approximately 1,365 feet from the pile driving activities (a total area of 67 acres). Since elevated levels of sound will be absorbed by the Seaplane Lagoon's breakwater, the radial distance of 1,365 feet does not extend into the open waters of San Francisco Bay. With elevated sound levels contained within Seaplane Lagoon, only green sturgeon that have entered the action area by swimming between the breakwaters have the potential to be exposed to injury and mortality associated with cSEL.

During pile driving, the estimated area of effect by cSEL will encompass 67 acres of the 1,102 acres in the lagoon. For the purposes of this analysis, the zone of potential injury or mortality to threatened green sturgeon is the area in which fish could experience a range of barotraumas, including the damage to the inner ear, eyes, blood, nervous system, kidney, and liver. These injuries have the potential to result in the mortality of an individual fish either immediately or later in time.

Depending on the time of year, green sturgeon may be commonly found within San Francisco Bay as indicated by the results of acoustic tag monitoring conducted by the California Fish Tagging Consortium. However, tagging studies have shown that most adult green sturgeon detected in the summer and fall months are found around the Golden Gate and up to the Carquinez Bridge (Hearn *et al.* 2010). To date, tagging studies provide little information on juvenile green sturgeon distribution and behavior, but sampling has indicated juveniles mostly occur in small groups in the Bay/Delta region (Adams *et al.* 2002; Hearn *et al.* 2010) and are unlikely to occur in more than small numbers in Central and South San Francisco Bay. Although the action area of this project provides sites with soft bottom substrate that is suitable for green sturgeon foraging, few sturgeon are anticipated to travel into the Seaplane Lagoon basin during pile driving.

If foraging behavior and movements of green sturgeon bring some individuals into Seaplane Lagoon during project construction activities, they could be subjected to elevated sound levels during impact hammer pile driving activities. However, NMFS estimates that this number will be small and only a very small number of threatened Southern DPS green sturgeon may be injured or killed by the proposed pile driving because few individuals are likely to be exposed to a cSEL of 187 dB or greater. To incur injury or mortality, an individual would need to remain continuously within the zone of accumulated SEL for an extended period of time during impact hammer pile driving. For this project, a green sturgeon would need to remain within 1,365 feet from the impact hammer during multiple pile strikes.

Within the zone of cSEL of 187 dB (up to 1,365 feet from the pile being driven), most exposed sturgeon are unlikely to remain in the same location to experience the full duration of pile driving (*i.e.*, up to 10 hours per day because a vibratory hammer will be used for the majority of pile installation) due to tidal changes and behavioral movements. Thus, few, if any, sturgeon are expected to remain stationary long enough to accumulate SPLs to levels which cause injury or mortality. Although no data are available to quantify the risk of exposure to the cSEL threshold of 187 dB, NMFS believes that, for the reasons stated herein, the potential risk of injury and mortality to green sturgeon is low. Most sturgeon within the action area will be expected to temporarily disperse with this intrusion, or move with tidal currents and behavioral movements. Adjacent areas in San Francisco Bay outside the action area provide fish sufficient area with habitat of similar or higher quality to avoid harm from increased sound levels in the action area and provide adequate carrying capacity to support individual sturgeon that are temporarily displaced during pile driving.

Beyond the zone of potential injury or mortality during impact hammer pile driving and during use of a vibratory hammer, elevated sound levels may result in disturbance and behavior effects within the action area. The area of behavioral effects will encompass the entire width of Seaplane Lagoon. The lagoon's rock breakwaters are expected to attenuate elevated levels of underwater sound. Thus, the zone of behavioral impact during pile driving is expected to extend to all of the Seaplane Lagoon, but should not extend outside the lagoon's breakwaters. Within the zone of behavioral impact, fish may demonstrate temporary abnormal behavior within this zone during pile driving indicative of stress or exhibit a startle response. A fish that exhibits a startle response may not be injured, but is exhibiting behavior that suggests it perceives a stimulus indicating potential danger in its immediate environment.

If any green sturgeon enter the behavior impact zone described above during pile driving, there could be behavioral reactions. As noted above, many fish species demonstrate an avoidance reaction in the near-field (Dolat 1997). While behavioral impacts to green sturgeon during pile driving have not been specifically studied, NMFS anticipates that green sturgeon, like other fish studied, will exhibit startle and avoidance behavioral reactions. Due to the availability of estuarine habitat directly adjacent to the action area, and anticipated behavioral responses, green sturgeon are expected to react to the sound produced by pile driving by swimming away from the action area. Adequate water depths and the open water area of Central San Francisco Bay adjacent to Seaplane Lagoon will provide startled fish sufficient area to escape and elevated sound levels should not result in significant effects on these individuals. Areas adjacent to the project's action area provide habitat of similar or higher quality and provide adequate carrying capacity to support individual sturgeon that are temporarily displaced during pile driving by the project.

2.5.1.4 Assessment of Effects on Water Quality

Water quality in the action area may be degraded during construction activities. Disturbance of soft bottom sediments during the demolition of the derelict pier will involve removal of piles and debris from the bottom substrate. Installation of new piles for the construction of the ferry terminal is also likely to result in temporary increased levels of turbidity in the water column.

Turbidity

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

During the project's in-water construction activities, fine-grain sediments such as the silty mud and sand material found within Seaplane Lagoon will be disturbed and will generate increased levels of turbidity in the water column. The extent of turbidity plumes resulting from the project will depend on the tide, currents, and wind conditions during these activities. NMFS expects that the elevated levels of turbidity during project activities will be minor and localized due to the type of work to be performed, and only sediment within the immediate vicinity of the installed piles or removed materials will be disturbed.

Based on the above, the extent and levels of turbidity associated with construction activities by the project are not expected to result in harm or injury to green sturgeon, or behavioral responses that impair migration, foraging, or make green sturgeon more susceptible to predation. If sturgeon temporarily relocate from areas of increased turbidity, habitat of similar or better value is available in San Francisco Bay adjacent to the action area for displaced individuals. Adjacent habitat areas also provide adequate carrying capacity to support individual sturgeon that are temporarily displaced. For these reasons, the potential effects of minor and localized areas of elevated turbidity associated with construction activities are expected to be insignificant to green sturgeon.

Contaminants

As described above in the Environmental Baseline section of this opinion, water and sediment quality within the action area is affected by stormwater runoff, industrial activities, and other urban influences. Dredging performed as part of a Superfund cleanup action in 2011 removed contaminated sediments from the floor of Seaplane Lagoon.

During pile installation and pier demolition, bottom sediments will be disturbed and contaminants may be released to the water column. However, based on the type of activities to be conducted by this project the suspended plumes of sediment and potential contaminants released during construction are expected to be localized and short-term. Any minor and localized elevations in contaminants which might result from those suspended plumes should be quickly diluted by tidal circulation to levels that are unlikely to adversely affect threatened green sturgeon.

2.5.1.5 Assessment of Effects of Future Operations

Upon completion of the new terminal at Seaplane Lagoon, approximately 10 ferry trips will run each day between Alameda and San Francisco. Future ferry operations have the potential to release toxic substances into the water column, increase turbidity due to vessel traffic, elevate underwater sound through increased vessel traffic, and introduce or facilitate the spread invasive aquatic plant species through increased vessel traffic.

Release of Toxic Substances

Long-term facility operations such as refueling, fluid leakage, and equipment maintenance in

Seaplane Lagoon pose some risk of contamination of aquatic habitat and subsequent injury or death to threatened green sturgeon. Oils and similar substances from ferry maintenance activities can contain a wide variety of polynuclear aromatic hydrocarbons (PAHs), and metals. Both can result in adverse impacts to listed fish. Some of the effects that metals can have on fish are: immobilization and impaired locomotion, reduced growth, reduced reproduction, genetic damage, tumors and lesions, developmental abnormalities, behavior changes (avoidance), and impairment of olfactory and brain functions (Eisler 2000).

To address any potential for the release of toxic substances into the waters of San Francisco Bay, the project will prepare and implement a spill prevention and control plan. The plan will specify restrictions and procedures for fuel storage location, fueling activities, and equipment maintenance. In addition, the project will prepare a SWPPP to protect water quality during construction. The SWPPP will include measures to collect and contain any discharges that are potentially hazardous. Due to these measures, NMFS expects that the potential for release of toxic substances as a result of future operations is low and spill response measures will avoid potential adverse effects to green sturgeon.

Turbidity

New ferry traffic into the relatively shallow Seaplane Lagoon is likely to disturb bottom sediments as vessels travel to and from the new terminal. Increased levels of turbidity associated with ferry operations are expected to be low because vessels will operate at low speeds in the lagoon to limit wake impacts and to ensure passenger safety. Turbidity plumes associated with ferry vessel traffic are expected to rapidly dissipate and the area will return to background levels with tidal circulation. In addition, the interior of Seaplane Lagoon offers marginal habitat value for green sturgeon; thus, individuals are unlikely to enter the basin or remain within the basin for extended periods. As stated above, green sturgeon are well adapted to living in estuaries with a fine sediment bottom and tolerant of high levels of turbidity. For the above reasons, NMFS anticipates any increases in turbidity from new ferry vessel traffic to be insignificant for green sturgeon.

Vessel Noise

Noise associated with future ferry vessel traffic may startle fish. In San Francisco Bay, ambient sound levels are reported to range from 120-155 dB peak (as reported in Buehler *et al.* 2015). Under current conditions, vessel traffic in the vicinity of the action area is high due to the proximately to the Port of Oakland. Thus, ambient sound levels in the action area are likely similar at times to the 155 dB or higher due to heavy vessel traffic in the area. With this level of ambient sound in the environmental setting of Seaplane Lagoon, it is unlikely that the noise associated with future ferry traffic will startle fish in a manner that results in behavioral responses that impair migration, foraging, or make green sturgeon more susceptible to predation. Therefore, NMFS anticipates the effects of any increases in noise associated with future ferry vessel traffic on green sturgeon to be negligible.

Introduction of Invasive Species

Increased boat traffic in the area could introduce non-native, invasive plant species into the action area. For example, the non-native Asian kelp *Undaria pinnatifida* is a native of the Western Pacific (*e.g.*, Japan, Korea), is quick-growing, opportunistic, and can quickly become established on ship hulls, moorings, ropes, and docks. Invasive kelp negatively impacts native species by outcompeting native aquatic vegetation for space and light. *Undaria* has been documented in California since 2000. In 2009, it was documented in the San Francisco Marina and at several locations along the City of San Francisco's waterfront. Ferry traffic associated with this project may also facilitate or increase the potential spread of invasive species. The City of Alameda proposes to develop and implement a Marine Invasive Species Control Plan to address invasive vegetation, such as *Undaria.* NMFS anticipates the implementation of this plan will effectively prevent the spread of non-native, invasive aquatic plant species to Seaplane Lagoon.

2.5.1.6 Assessment of Effects on Critical Habitat

The action area is designated as critical habitat for Southern DPS green sturgeon and project implementation is anticipated to impact designated critical habitat. Construction activities are expected to temporarily alter water quality and benthic habitat in the action area. Table 3 shows the permanent impacts to critical habitat in the action area.

Table 3. Permanent Habitat Impacts.

Project Component	Impact Type	Installation (ft^2)	Removal (ft^2)	Net Increase (ft^2)
New ferry terminal/wooden pier removal	Shading	8,189	2,914	5,275
Piles installed/removed	Loss of benthic habitat	93.7	36	57.7

Water Quality

The effects of project construction activities and future ferry operations on water quality are discussed above in sections 2.5.1.4 and 2.5.1.5 of this opinion, and also apply to designated critical habitat in the action area. As described above, the effects of the proposed project may result in increased levels of turbidity and the suspension of sediment-associated contaminants. The impacts on water quality from turbidity and contaminants are not expected to degrade PBFs of green sturgeon because the level of potential contaminant exposure is low and elevated turbidity is expected to be short-term, minor, and localized.

The project's removal of an existing pier at the construction site will result in the elimination of 30 creosote pilings in the action area. Polycyclic aromatic hydrocarbons (PAHs) leach from creosote-treated wood into the environment. PAHs are known to cause cancer, reproductive anomalies, and immune dysfunction in fishes. Exposures to embryos can result in a suite of detrimental effects: edema (swelling) of the yolk sack, hemorrhaging, disruption of cardiac function, enzyme induction, mutation of progeny, craniofacial and spinal deformities, neuronal cell death, anemia, reduced growth, and impaired swimming (NMFS 2009). The proposed removal of creosote-treated piles will eliminate this on-going source of PAH leaching in Seaplane Lagoon.

Disturbance of the Benthic Community

Demolition of the derelict pier and the installation of piles at the ferry terminal will disturb bottom sediments and the associated benthic community in the project's action area. This disturbance may remove prey organisms for green sturgeon. Once construction activities are completed, these impacts to the benthic community could extend over a period of 1-3 years based on recovery rates for benthic disturbance in the scientific literature (Oliver *et al.* 1977; Watling *et al.* 2001). During this term, the amount of forage for green sturgeon may be reduced in the action area.

Information on juvenile green sturgeon foraging behavior and their prey organisms in San Francisco Bay is limited. Dumbauld *et al.* (2008) reported green sturgeon prey on demersal fish (e.g., sand lance) and benthic invertebrates in estuaries of Washington and Oregon. Radtke (1966) analyzed stomach contents of juvenile green sturgeon captured in the Sacramento-San Joaquin Delta and found the majority of their diet was benthic invertebrates, such as mysid shrimp and amphipods. Given the small area of benthic habitat lost or disturbed in the action area (57.7 ft^2), the likely availability of forage elsewhere in the action area, and the recovery of the benthic community after disturbance, impacts to prey resource availability due to project construction are expected to be minor. Based on the above, NMFS does not expect the temporary reduction of benthic prey in the action area will prevent sturgeon from finding suitable forage at the quantities and quality necessary for normal behavior (*e.g.,* maintenance, growth, reproduction).

Reduced Use of Action Area during Pile Driving

As described above in Section 2.5.1.3 of this opinion, elevated SPLs within the action area are expected to create a zone of behavioral impacts (*i.e.*, sound levels greater than 150 dB RMS) that may result in a level of disturbance that causes green sturgeon to avoid using the area for foraging during pile driving. Assuming the worst case scenario, elevated sound levels result in an adverse behavioral response during pile driving, and the action area is rendered unusable by green sturgeon during hours when pile driving operations are underway. For the Project's use of an impact hammer to install steel piles, the area of behavioral effects may be as large as 1,102 acres (*i.e.*, full action area) and this area may be avoided by green sturgeon for up to 10 hours a day for a total 44 days.

The action area is thought to provide foraging habitat for sturgeon because the site includes soft bottom subtidal habitat. Although pile driving will not exceed 10 hours a day, this temporal loss of foraging area could be an adverse effect on PBFs for adequate prey/food resources. During pile driving over the Project's 44 days of pile driving activities, green sturgeon may avoid foraging in portions of the action area. However, when each day's pile driving activities have concluded, this area and its food resources will again be fully accessible to green sturgeon. Due to the short duration of a single pile driving episode (*i.e.*, up to ten hours per day), this temporary impact is not anticipated to prevent sturgeon from finding suitable forage at the quantities and quality necessary for normal behavior (*e.g.,* maintenance, growth, reproduction). When all of the Project's pile driving activities have been completed, NMFS does not expect any lasting reduction in habitat value related to elevated sound levels from pile driving.

Introduction of Invasive Species
Increased boat traffic in the area could facilitate the spread of invasive, non-native aquatic plant species. These effects are discussed above in section 2.5.1.5 of this opinion and also apply to designated critical habitat in the action area.

Overwater Shading
Implementation of the project will increase the footprint of overwater structures in the action area. Overwater structures, such as docks and piers, result in shading of the water column and benthic habitats. Shading of the water column has 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 (Glasby 1999; Helfman 1981; Struck *et al.* 2004; Stutes *et al.* 2006), all of which may lead to an overall reduction in the quality of fish habitat.

For construction of the Seaplane Lagoon Ferry Terminal, the project will remove the remnants of an existing wooden pier that includes approximately 2,914 ft^2 of overwater structure in the action area (Table 3). The new terminal will include 9,038 ft^2 of new overwater structure; however, the 849 ft^2 overlap of the gangway and boarding float will lead to a total of 8,189 ft^2 of new overwater shading. When the pier demolition is taken into account, project construction will result in the net increase of approximately 5,275 ft^2 of new overwater structure in the action area (Table 3).

Water depths in Seaplane Lagoon range from -10 to -20 feet and the shoreline consists of abrupt transitions from the lagoon bottom to hardened shorelines or structures. With this configuration, there are limited surfaces of suitable mudflat or shallow subtidal zones to support submerged aquatic vegetation in the action area. Although an increase in the amount of shading of benthic habitat is anticipated, completion of the project will have negligible effects on the action area's ability to support submerged aquatic vegetation. In addition, the new ferry terminal is designed in a manner that minimizes shading of the water column. The boarding float will be secured with permanent piles that maintain the structure 8 to 13 feet above mean higher high water (MHHW). This is important because this distance above the water surface allows for light transmission under the structure during periods when the sun is not directly overhead. Furthermore, the gangway will be composed of grated material that will allow for light transmittance. For the above reasons, the creation of new overwater structure in Seaplane Lagoon will not significantly increase amount of overwater shading and the effects of additional shading are not expected to degrade PBFs of designated critical habitat in the action area.

2.6 Cumulative Effects

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

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

2.7 Integration and Synthesis

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

Southern DPS green sturgeon have experienced serious declines in abundance and long-term population trends that 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 greater San Francisco Bay Region, the effects of shoreline development, industrialization, and urbanization are evident. As a result, forage species that green sturgeon depend on have been reduced throughout the San Francisco Estuary.

In-water and shoreline construction activities by the proposed project consist of demolition of an existing wooden pier, removal of piles and debris on the bottom substrate, pile installation, construction of a pier and abutment, construction of a gangway, and construction of a boarding float. These activities are expected to result in temporary impacts to water quality, disturbance of benthic habitat, and elevated underwater sound levels. Due to the marginal quality of aquatic habitat with the semi-enclosed manmade basin of Seaplane Lagoon, few green sturgeon are likely to be present in the action area during in-water construction activities.

If foraging behavior and movements of green sturgeon bring some individuals into Seaplane Lagoon during project construction activities, some individuals could be exposed to elevated levels of underwater sound during pile driving and the effects could range from disturbance to barotrauma. Injury or mortality of individuals due to barotrauma may occur during the use of an impact hammer. However, NMFS estimates that a very small number of threatened Southern DPS green sturgeon may be injured or killed by the proposed pile driving because few individuals are likely to be exposed to a cSEL of 187 dB or greater, and no individuals are likely to be exposed to peak SPLs of 206 dB or greater. To incur injury or mortality from cSEL, an individual would need to remain continuously within the zone of cSEL for an extended period of time. For this project, a green sturgeon would need to remain within 1,365 feet from the impact hammer during multiple pile strikes. The use of a vibratory hammer by the project to install the majority of the steel piles is expected to avoid generation of underwater sound levels that are harmful to fish, because vibratory hammers generate lower sound levels and different sound wave forms than impact hammers (Buehler *et al.* 2015). Pile driving activities could result in noise that may startle green sturgeon and result in temporary dispersion from the action area. If green sturgeon were to react behaviorally to the sound produced by construction activities, adequate water depths and area within the adjacent open waters of Central San Francisco Bay are expected to provide fish sufficient area to disperse.

During construction, water quality in the action area may be degraded through the disturbance of bottom sediments. NMFS expects that the elevated levels of turbidity during project activities will be minor and localized because only sediment within the immediate vicinity of the installed piles or removed materials will be disturbed. Although there may be contaminated sediments in the action area, the suspended plumes of sediment and potential contaminants released during construction are expected to be localized and short-term. Any minor and localized elevations in contaminants which might result from those suspended plumes should be quickly diluted by tidal circulation to levels that are unlikely to adversely affect green sturgeon.

Upon completion of the new ferry terminal, approximately 10 ferry trips will run each day from the facility. These future operations have the potential to release toxic substances into the water column, increase turbidity due to vessel traffic, elevate underwater sound through increased vessel traffic, and introduce or facilitate the spread invasive species through increased vessel traffic. To address the potential release of toxic substances into the waters of San Francisco Bay, the project will prepare and implement a spill prevention and control plan. Increased levels of turbidity associated with ferry vessel traffic in Seaplane Lagoon are expected to be low because vessels will operate at low speeds in the lagoon to limit wake impacts and to ensure passenger safety. In addition, green sturgeon are well adapted to living in estuaries with a fine sediment bottom and tolerant of high levels of turbidity. Due to the existing heavy volume of vessel traffic in the vicinity of the action area and high levels of ambient sound, it is unlikely that the noise associated with future ferry traffic will startle fish in a manner that results in behavioral responses that impair migration, foraging, or make green sturgeon more susceptible to predation. To address the potential introduction of non-native, invasive aquatic plants by new ferry traffic, the Applicant proposes to develop and implement a Marine Invasive Species Control Plan. NMFS anticipates the implementation of this plan will effectively prevent the spread of invasive aquatic plant species to Seaplane Lagoon.

The action area is designated critical habitat for Southern DPS green sturgeon. Critical habitat is expected to be impacted by project construction through temporary degradation of water quality and temporary impacts to foraging habitat. Water quality may be degraded through increased turbidity and suspension of sediment-borne contaminants. Habitat within Seaplane Lagoon will also be temporarily affected during construction through elevated SPLs and physical disturbance of benthic habitat. Once the pile driving is complete, temporary impacts from elevated SPLs will cease. Temporary impacts from the very small areas of benthic habitat disturbed by pile removal, pile installation, and demolition activities are expected to recover in 1-3 years. The project will result in the net increase of approximately 5,275 ft^2 of overwater structure in the action area. Due to the placement of the boarding float 8 to 13 feet above the water surface and use of grated material in the gangway, the effects of shading are expected to be negligible.

Based on the above, a very small number of green sturgeon are likely to be adversely affected by the project's proposed activities. This small potential loss of individuals as a result of the project construction will not impact future adult returns, due to the large number of individual green sturgeon unaffected by the project compared to the very small number of green sturgeon likely affected by the project. Due to the life history strategy of green sturgeon that spawn every 3-5 years over an adult lifespan of as much as 40 years (Moyle 2002), the few individuals injured or killed during pile driving are likely to be replaced in subsequent generations of green sturgeon.

Regarding future climate change effects in the action area, California could be subject to higher average summer air temperatures and lower total precipitation levels. 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, in-water activities will occur in 2017 or 2018, and the above effects of climate change are not likely to be detected within that time frame. If the effects of climate change are detected, they will likely materialize as moderate changes to the current climate conditions within the action area. These changes may place further stress on green sturgeon populations. The effects of the proposed action combined with moderate climate change effects may result in conditions similar to those produced by natural ocean-atmospheric variations (as described in the Environmental Baseline) and annual variations. The species are expected to persist throughout these phenomena, as they have in the past, even when concurrently exposed to the effects of similar projects.

2.8 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent activities, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of threatened Southern DPS green sturgeon, or destroy or adversely modify its designated critical habitat.

2.9 Incidental Take Statement

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

2.9.1 Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take is reasonably certain to occur as follows: NMFS anticipates that take of threatened green sturgeon associated with the Seaplane Lagoon Ferry Terminal Project in Alameda County, California will be in the form of injury or death caused by cSEL during impact hammer pile driving.

Due to the relatively small area of potential effect and its location under water with low visibility, NMFS is not able to estimate the specific number of green sturgeon that may be in the action area during the proposed action. Monitoring or measuring the number of listed fish actually injured or killed by elevated sound levels during pile driving is also not feasible. Observation of injured or killed fish is unlikely because they may not float to the surface or may be carried away by the currents in and near the action area into Central San Francisco Bay. Due to the difficulty in quantifying the number of listed green sturgeon affected by pile driving, a surrogate measure of take is necessary to establish a limit to the take exempted by this incidental take statement. For this action, compliance with the expected elevated underwater sound levels during pile driving is the best surrogate measure for incidental take associated with project implementation. Therefore, NMFS will consider the extent of take exceeded if elevated sound levels during pile driving indicate that accumulated sound pressure levels greater than 187 dB SEL extend beyond 1,365 feet during the installation of any of the project's steel piles. This distance represent the maximum area where green sturgeon injury or death is reasonably certain during impact hammer pile driving by this project.

2.9.2 Effect of the Take

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

2.9.3 Reasonable and Prudent Measures

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

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

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

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

2.9.4 Terms and Conditions

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

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

   a. Prior to the initiation of construction, the Applicant shall develop and submit to NMFS for review a hydroacoustic monitoring plan that includes underwater sound measurements at various distances and depths from impact hammer pile driving operations. At a minimum, the plan must include the following: (1) all hydrophones will be placed at least 1 m (3.3 feet) below the surface; (2) if only one hydrophone is used, it will be placed 10 m (33 feet) from the pile at midwater depth; (3) if more than one hydrophone is used to calculate transmission loss over distance, water depth where the hydrophone will be located will be at least 4 m (13 ft); and (4) if waters are less than 4 m (13 ft) deep, a single hydrophone will be placed at midwater depth.

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

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

   d. If any sturgeon are found dead or injured during visual observations, the biologist shall contact NMFS biologist Autumn Cleave by phone immediately at (707) 575-6056 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. Any such transfer will be subject to such conditions as NMFS deems appropriate.

2. The following term and condition implements reasonable and prudent measure 2:

   a. The Corps or the Applicant shall provide a written report to NMFS by January 15 of the year following construction of the project. The report shall be submitted to NMFS North-Central Coast Office, Attention: San Francisco Bay Branch Supervisor, 777 Sonoma Avenue, Room 325, Santa Rosa, California, 95404-6528. The report shall contain, at a minimum, the following information:

i. **Construction related activities** – (1) dates construction began and was completed; (2) dates pile removal and installation occurred; (3) a description of any and all measures taken to minimize effects on green sturgeon (e.g., utilization of a vibratory hammer); and (4) the number of fish killed or injured during the project action.

ii. **Hydroacoustic monitoring** – (1) a description of the methods used to monitor sound; (2) dates that hydroacoustic monitoring was conducted; (3) the locations (depths and distance from point of impact) where monitoring was conducted; (4) the total number of pile strikes per pile; (5) total number of strikes per day; (6) the interval between strikes; (7) the peak/SPL, RMS and SEL per strike; and (8) accumulated SEL per day for each hydroacoustic monitor deployed.

2.10 Conservation Recommendations

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

NMFS has the following conservation recommendation:

1. Hydroacoustic monitoring should be conducted during the installation of all the project's 22 steel piles with an impact hammer. A complete set of hydroacoustic monitoring results from this project will improve our ability to estimate elevated underwater sound levels associated with in-water and onshore pile driving activities.

2.11 Reinitiation of Consultation

This concludes formal consultation for the Seaplane Lagoon Ferry Terminal Project.

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

2.12 "Not Likely to Adversely Affect" Determinations

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

NMFS evaluated the proposed project for potential adverse effects to threatened CCC steelhead and their critical habitat. NMFS considered the life history of steelhead (Busby *et al.* 1996), the project's biological assessment prepared by H.T. Harvey & Associates June 2016, aerial photographs of the project site, and current habitat conditions.

The life history of steelhead is summarized in Busby *et al.* (1996). CCC steelhead use San Francisco Bay as a migration corridor. These anadromous salmonids pass through the greater San Francisco Bay on their way to the ocean to rear as juveniles or to upstream areas to spawn as adults. Their migrations generally take place in the winter and spring months. Steelhead migrate to the ocean as smolts from January through May and migrate from the ocean upstream to spawn from December through April (Fukushima and Lesh 1998).

The designation of critical habitat for CCC steelhead (70 FR 52488) uses the term primary constituent element or essential features. The new critical habitat regulations (81 FR 7414) replace this term with physical or biological features (PBFs). This shift in terminology does not change the approach used in conducting our analysis, whether the original designation identified primary constituent elements, physical or biological features, or essential features. In this opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat. The current condition of CCC steelhead critical habitat in the action area is degraded over its historical conditions. The PBFs of food resources, substrate type or size and quality, water flow, and water quality have been impacted by human actions, substantially altering the historical estuarine characteristics of the action area.

The action area of the project is accessible to CCC steelhead from Central San Francisco Bay through an opening of the breakwater on the southern edge of the manmade basin. Water depths in Seaplane Lagoon range from -10 to -20 feet and the shoreline consists of abrupt transitions from the lagoon bottom to hardened shorelines or structures. With this configuration, there are limited surfaces of suitable mudflat or shallow subtidal zones to support submerged aquatic vegetation in the action area. In addition, substrate in the action area is primarily silt and sand, and thus, contains poor foraging habitat and no spawning habitat for steelhead. Although steelhead could enter Seaplane Lagoon during their seasonal migration through the Bay, habitat conditions are marginally suitable and fish are unlikely to be attracted into the action area.

In consideration of the life history of CCC steelhead and the in-water construction schedule proposed by the Applicant (June 1 to November 30), NMFS expects CCC steelhead presence during work activities to be extremely unlikely. Therefore, effects to steelhead associated with any temporary and localized impacts from construction activities (*i.e.*, pier demolition and pile driving mentioned previously) are discountable.

As described in section 2.5.1.4 of this opinion, disturbance of soft bottom sediments are expected during the demolition of the derelict pier as piles and debris are removed from the substrate. Installation of new piles for the construction of the ferry terminal will also disturb soft bottom sediments in the action area. These activities are anticipated to mobilize fine-grain sediments such as the silty mud and sand material found within Seaplane Lagoon and generate increased levels of turbidity. Disturbance of bottom could also re-suspend contaminant-laden sediments. However, NMFS expects that these plumes of sediments will rapidly dissipate with tidal circulation and will cease when construction activities are terminated. Thus, degraded water quality conditions are expected to be temporary and fully dissipate prior to the potential presence of CCC steelhead in the action area.

Effects of elevated levels of underwater sound during pile driving are presented in section 2.5.1.3. During the project's pile driving activities, elevated levels of underwater sound could result in a range of effects on fish from disturbance to injury/mortality. CCC steelhead may be injured or killed when exposed to high levels of underwater sound, especially those generated by impulsive sound sources such as pile driving with impact hammers. However, this project's pile driving activities are limited to the period between June 1 and November 30 when CCC steelhead are very unlikely to be present in the action area. As with degraded water quality, elevated underwater sound levels will be temporary and fully dissipate when construction activities cease.

Benthic habitat disturbance by project activities are described in section 2.5.1.6. Project construction activities could injure or remove prey organisms for CCC steelhead. However, once construction activities are completed, the benthic community in disturbed areas is expected to recover in 1-3 years based on recovery rates in the scientific literature (Oliver *et al*. 1977; Watling *et al*. 2001). Because of the small size of disturbed areas (directly adjacent to items removed and piles installed), NMFS expects the effects on prey organisms will be minor and CCC steelhead will be able to find prey items in nearby areas while the disturbed areas recover. Therefore, effects of benthic habitat disturbance on CCC steelhead and their designated critical habitat are expected to be insignificant.

Potential effects of future ferry operations are presented in section 2.5.1.5. Upon the completion of construction, future ferry boats traveling to and from the boarding dock are expected to disturb bottom sediments and generate increased levels of noise in the action area. Noise associated with ferry boat traffic may startle fish. Although there is no water quality or sound data to quantify these levels, observations from similar ferry boat operations in Vallejo, Larkspur, Sausalito and other, similar locations around the San Francisco Bay indicate increased levels of turbidity and noise will be minor, localized, and limited to short periods of time during the arrival and departure of the ferry boats. These short-term increases in turbidity are expected to rapidly return to background levels with tidal circulation. Steelhead startled by elevated noise levels will have adequate opportunity to avoid boat traffic in adjacent open-water areas in Central San Francisco Bay. The project's development and implementation of a Marine Invasive Species Control Plan is anticipated to effectively prevent the spread of non-native invasive aquatic plant species to Seaplane Lagoon.

The effects of new overwater structure in the action area are described in section 2.5.1.6. The project will result in a 5,275 ft^2 increase in overwater structure. Shading by overwater structures has 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 (Glasby 1999; Helfman 1981; Struck *et al.* 2004; Stutes *et al.* 2006), all of which may lead to an overall reduction in the quality of fish habitat. This project has incorporated measures that are anticipated to reduce the amount of shading by positioning the ferry terminal's boarding float 8 to 13 feet above the water surface and the gangway will be composed of grated material that will allow for light transmittance. In consideration of the marginal habitat conditions inside the manmade basin of Seaplane Lagoon and measures to reduce the extent of shading impacts, the potential effects of new overwater structures are not expected to degrade existing habitat values in the action area or result in adverse impacts to designated critical habitat.

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

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

This analysis is based, in part, on the EFH assessment provided by the Corps and descriptions of EFH for Pacific Coast groundfish (Pacific Fishery Management Council [PFMC] 2005), coastal pelagic species (PFMC 1998), and Pacific Coast salmon (PFMC 2014) contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

Effects of the proposed project will impact EFH for various federally managed fish species within the Pacific Coast Groundfish, Pacific Coast Salmon, and Coastal Pelagic Species FMPs. Furthermore, the project area is located in estuary Habitat Area of Particular Concern for various federally managed fish species within the Pacific Coast Groundfish and Pacific Coast salmon FMPs.

3.2 Adverse Effects on Essential Fish Habitat

Adverse effects to EFH will occur through: (1) increased turbidity in the water column; (2)

release of contaminants; (3) disturbance of benthic habitat, including the associated biological community; (4) an increase in overwater shading; and (5) the potential spread of invasive species. EFH will also be temporarily impacted by elevated underwater sound levels during pile driving.

The effects of elevated levels of turbidity and the re-suspension of containment-laden sediments during construction activities are presented in section 2.5.1.4 of the above biological opinion and apply to EFH for Pacific Coast Groundfish, Pacific Coast Salmon, and Coastal Pelagic Species FMPs. Bottom sediments will be disturbed during pile removal and installation activities. However, the area of project activities where increased turbidity will occur is small and will be confined to the manmade basin of Seaplane Lagoon. In-water work is expected to have localized and short-term periods of elevated turbidity that dissipate with tidal circulation.

The effects of the future operation of the ferry terminal are presented in section 2.5.1.5 of the above biological opinion and apply to EFH for Pacific Coast Groundfish, Pacific Coast Salmon, and Coastal Pelagic Species FMPs. Noise associated with future ferry vessel traffic may startle fish. However, under current conditions, vessel traffic in the vicinity of the action area is high due to the proximately to the Port of Oakland. With this level of ambient sound and existing habitat conditions in Seaplane Lagoon, it is unlikely that noise and disturbance associated with future ferry traffic will impair EFH.

The effects of benthic habitat disturbance are presented in section 2.5.1.6 of the above biological opinion and apply to EFH for Pacific Coast Groundfish, Pacific Coast Salmon, and Coastal Pelagic Species FMPs. Because of the small size of disturbed areas (directly under and adjacent to pilings removed or installed), NMFS expects that the effects of disturbance to the benthic community from this project's construction activities will be minor.

The effects of new overwater structure and shading of the water column are presented in section 2.5.1.6 of the above biological opinion and apply to EFH for Pacific Coast Groundfish, Pacific Coast Salmon, and Coastal Pelagic Species FMPs. Although project construction will result in a net increase of approximately 5,275 ft^2 of new overwater structure, the effect of shading is expected to have negligible effects on EFH including the area's ability to support submerged aquatic vegetation. This is due to existing water depths (-10 to -20 feet) and the shoreline consists of abrupt transitions from the lagoon bottom to hardened shorelines or structures. With this configuration, there are limited surfaces of suitable mudflat or shallow subtidal zones to support submerged aquatic vegetation.

The effects of the potential introduction of non-native and invasive aquatic plant species are presented in section 2.5.1.5 of the above biological opinion and apply to EFH for Pacific Coast Groundfish, Pacific Coast Salmon, and Coastal Pelagic Species FMPs. To address the potential introduction of non-native and invasive aquatic plants by new ferry traffic, the Applicant proposes to develop and implement a Marine Invasive Species Control Plan. NMFS anticipates the implementation of this plan will effectively prevent the spread of invasive aquatic plant species to Seaplane Lagoon.

The effects of elevated levels of underwater sound during pile driving are presented in section

2.5.1.3 of the above biological opinion and apply to EFH for Pacific Coast Groundfish, Pacific Coast Salmon, and Coastal Pelagic Species FMPs. Approximately 1,102 acres of the Seaplane Lagoon will be impacted for up to 10 hours a day for 44 days by the installation of steel piles. However, it is expected that fish will utilize other adjacent habitats during pile driving activities and the elevated sound pressure levels will have no permanent impact on EFH.

3.3 Essential Fish Habitat Conservation Recommendations

There are no practical EFH Conservation Recommendations to provide because impacts to EFH are expected to minor, temporary, and localized.

3.4 Supplemental Consultation

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

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are the Corps and the City of Alameda. Other interested users could include Federal Transit Authority, Water Emergency Transportation Authority, U.S. Fish and Wildlife Service, San Francisco Bay Conservation and Development Commission, and the San Francisco Bay Regional Water Quality Control Board. Individual copies of this opinion were provided to the Corps and the City of Alameda. This opinion will be posted on the Public Consultation Tracking System website (https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts). The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

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