ENDANGERED SPECIES AND ESSENTIAL FISH HABITAT BIOLOGICAL ASSESSMENT

Port of San Francisco Regional General Permit for Shoreline Maintenance Repair, Rehabilitation, and Replacement Activities

National Marine Fisheries Service

April 2015
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Prepared for:
The Port of San Francisco

Prepared by:
Environmental Science Associates
550 Kearny Street, Suite 800
San Francisco, CA 94108
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GLOSSARY AND ACRONYMS

Glossary

*Action Area* - all areas affected directly or indirectly by the action.

*Cumulative Effects* – those effects of future State or private activities, not involving Federal activities that are reasonably certain to occur in the Action Area of the Federal action subject to consultation.

*Effects of the Action* – 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 would be added to the environmental baseline.

*Indirect Effects* - effects caused by the action(s) and are later in time, but are still reasonably certain to occur.

*Interrelated Actions* - actions that are part of a larger action and depend on the larger action for their justification *i.e.* this action would not occur, but for a larger action.

*Interdependent Actions* - actions that have no significant independent utility apart from the action that is under consideration *i.e.* other actions would not occur but for this action.

*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 that are contemporaneous with the consultation in process.

*Likely to jeopardize the continued existence of* – to engage in an action that reasonably 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.

*May Affect, Not Likely to Adversely Affect* – the appropriate conclusion when effects on a listed species are expected to be discountable, insignificant, or completely beneficial.

*Beneficial effects* – contemporaneous positive effects without any adverse effects

*Insignificant effects* – impacts that do not reach the level where take would occur.
**Discountable effects** – effects that are extremely unlikely to occur. Based on best judgment, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur.

**May Affect, Likely to Adversely Affect** – the appropriate finding if any adverse effect may occur to listed species or critical habitat as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant, or beneficial.

### Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
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<tbody>
<tr>
<td>AC34</td>
<td>34th America’s Cup</td>
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<tr>
<td>BA</td>
<td>Biological Assessment</td>
</tr>
<tr>
<td>BO</td>
<td>Biological Opinion</td>
</tr>
<tr>
<td>BCDC</td>
<td>Bay Conservation and Development Commission</td>
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<tr>
<td>BMP</td>
<td>Best Management Practices</td>
</tr>
<tr>
<td>Caltrans</td>
<td>California Department of Transportation</td>
</tr>
<tr>
<td>CEQA</td>
<td>California Environmental Quality Act</td>
</tr>
<tr>
<td>CCC</td>
<td>Central California Coast (steelhead)</td>
</tr>
<tr>
<td>CCV</td>
<td>Central California Valley (steelhead)</td>
</tr>
<tr>
<td>CDFG1</td>
<td>California Department of Fish and Game</td>
</tr>
<tr>
<td>CDFW</td>
<td>California Department of Fish and Wildlife</td>
</tr>
<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
</tr>
<tr>
<td>Corps</td>
<td>U.S. Army Corps of Engineers</td>
</tr>
<tr>
<td>cy</td>
<td>cubic yards</td>
</tr>
<tr>
<td>dB</td>
<td>decibel(s)</td>
</tr>
<tr>
<td>DDT</td>
<td>dichlorodiphenyltrichloroethane</td>
</tr>
<tr>
<td>DO</td>
<td>dissolved oxygen</td>
</tr>
<tr>
<td>DPS</td>
<td>Distinct Population Segment</td>
</tr>
<tr>
<td>EFH</td>
<td>Essential Fish Habitat</td>
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<tr>
<td>EIR</td>
<td>Environmental Impact Report</td>
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<tr>
<td>ESA</td>
<td>Endangered Species Act</td>
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<tr>
<td>ESU</td>
<td>Evolutionarily Significant Unit</td>
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<tr>
<td>FMP</td>
<td>fisheries management plans</td>
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<tr>
<td>HAPC</td>
<td>Habitat Area of Particular Concern</td>
</tr>
<tr>
<td>Hz</td>
<td>Hertz</td>
</tr>
<tr>
<td>IEP</td>
<td>Interagency Ecological Program</td>
</tr>
<tr>
<td>LTMS</td>
<td>Long Term Management Strategy</td>
</tr>
<tr>
<td>μg/kg</td>
<td>microgram per kilogram</td>
</tr>
<tr>
<td>μPa</td>
<td>microPascal</td>
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1 Official documents published before the agency’s January 2013 name change (to CDFW) are referenced as CDFG.
<table>
<thead>
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<th>Acronym</th>
<th>Definition</th>
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<tr>
<td>mg/L</td>
<td>milligrams per liter</td>
</tr>
<tr>
<td>MMPA</td>
<td>Marine Mammal Protect Act</td>
</tr>
<tr>
<td>MSA</td>
<td>Magnuson-Stevens Fishery Conservation and Management Act</td>
</tr>
<tr>
<td>NEPA</td>
<td>National Environmental Policy Act</td>
</tr>
<tr>
<td>NMFS</td>
<td>National Marine Fisheries Service (also known as National Atmospheric and Oceanic Administration Fisheries)</td>
</tr>
<tr>
<td>NOAA</td>
<td>National Atmospheric and Oceanic Administration</td>
</tr>
<tr>
<td>NLAA</td>
<td>Not Likely to Adversely Affect</td>
</tr>
<tr>
<td>PAH</td>
<td>polycyclic aromatic hydrocarbon</td>
</tr>
<tr>
<td>PCBs</td>
<td>polychlorinated biphenyls</td>
</tr>
<tr>
<td>Port</td>
<td>Port of San Francisco</td>
</tr>
<tr>
<td>OWB</td>
<td>Open Water Basin</td>
</tr>
<tr>
<td>RGP</td>
<td>Regional General Permit</td>
</tr>
<tr>
<td>RWQCB</td>
<td>Regional Water Quality Control Board</td>
</tr>
<tr>
<td>RMP</td>
<td>Regional Monitoring Program</td>
</tr>
<tr>
<td>SAV</td>
<td>Submerged Aquatic Vegetation</td>
</tr>
<tr>
<td>SEL</td>
<td>sound exposure level</td>
</tr>
<tr>
<td>SFEI</td>
<td>San Francisco Estuary Institute</td>
</tr>
<tr>
<td>USCG</td>
<td>U.S. Coast Guard</td>
</tr>
<tr>
<td>USGS</td>
<td>U.S. Geological Survey</td>
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<tr>
<td>USFWS</td>
<td>U.S. Fish and Wildlife Service</td>
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SECTION 1
Introduction and Regulatory Authority

This Biological Assessment (BA) has been prepared to complete informal consultation with the National Marine Fisheries Service (NMFS) under Section 7 of the Federal Endangered Species Act (ESA), and for Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), for the Port of San Francisco’s (Port) proposed regional shoreline maintenance, repair, and removal project. This document has also been prepared to solicit concurrent review and input from the California Department of Fish and Wildlife Marine Region (CDFW Marine) under the California Endangered Species Act (CESA) as it applies to longfin smelt, a CESA-listed threatened species that is also a candidate for listing under the Federal ESA, for the Port of San Francisco’s (Port) proposed regional shoreline maintenance, repair, and removal project.

The purpose of this BA is to review the Port of San Francisco’s proposed shoreline maintenance, repair and removal project (the “Proposed Project” or “Project”) in sufficient detail to determine to what extent the proposed maintenance activities may affect aquatic species listed as threatened, endangered or candidate species along with any designated or proposed critical habitats identified in the Action Area. It specifically evaluates the effects of potential federal actions necessary to permit the proposed project. This BA presents technical information about the proposed Project actions (maintenance, repair, and removal) and assesses potential effects to threatened, endangered, or proposed threatened or endangered aquatic species and their habitats. This BA identifies aquatic species that are listed or that are candidates for listing, with the potential for future listing, under the Federal ESA and Essential Fish Habitat (EFH) that have the potential to be directly or indirectly affected by the proposed project. Information presented in this BA about longfin smelt, a CESA-listed aquatic species that is also a candidate for listing under the Federal ESA, has also been included in the BA prepared for the U.S. Fish and Wildlife Service (USFWS), as the federal agency with ultimate responsibility for the species under any protection scenario. This BA does not present detailed information related to the Marine Mammal Protection Act (MMPA), as no harassment or harm to marine mammals protected under the MMPA is expected to result from the project; therefore, no Incidental Harassment Authorization permit will be sought from NMFS for this project.

General location maps provided in Figures 1 and 2 show the project vicinity and the proposed waterfront maintenance locations within the Port’s jurisdiction. Figure 2a illustrates the “Action Area addressed in this assessment. Figures 3a and 3b depict the typical shoreline configurations found along the San Francisco waterfront. Appendix A presents special-status fish and marine mammals that may occur within the Bay waters of the Proposed Project Action Area. Appendix B
Figure 1

Vicinity Map

Source: Google Maps
Figure 2
Port of S.F. Jurisdiction

LEGEND

- U.S. Pier Head Line
- Northern Waterfront area designated as non-navigable water
- Central Waterfront area designated as non-navigable water
- Southern Waterfront area

Northern Waterfront Line: Public Law 90-483, Title 1 Paragraph 114, 82 Stat. 736 (08/13/1968)
presents the USFWS-provided list of species in the project area, dated February 2015. Appendix C presents CDFW’s fish data for the Central Bay, 2005 through 2009.

1.1 U.S. Army Corps of Engineers Regulatory Authority

The Corps has primary responsibility for maintaining navigable waters throughout the United States. The Rivers and Harbors Act of 1899 (33 U.S.C. 401 et seq.) requires the Corps to issue permits for the construction of structural work in, over or under and/or any excavation or discharge into navigable waters. Pursuant to the federal Clean Water Act (33 U.S.C 1344), the Corps also regulates activities that result in the discharge of dredged or fill material into waters of the United States. Accordingly, the Corps is responsible for regulating the proposed Project’s in-water and over-water construction activities along the San Francisco waterfront that are within Corps jurisdiction. The Corps is planning to review project application materials, including this BA, and make a permit decision regarding the proposed Project activities under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act.

1.2 Regulatory Requirements

This BA presents technical information about the Project in sufficient detail to determine to what extent the Proposed Project may affect any of the threatened, endangered or proposed species and designated or proposed critical or essential habitats identified in the Action Area. In addition, the following information is provided to comply with statutory requirements to use the best scientific and commercial information available when assessing the risks posed to listed and/or proposed species and designated and/or proposed critical habitat by federal actions. This BA is prepared in accordance with legal requirements set forth under regulations implementing Section 7 of the ESA (50 CFR 402; 16 U.S.C. 1536 (c)) and Section 305(b) of the MSA. 50 CFR 402.16(b) would require reinitiation of consultation if any change in the project description may affect listed species and has not previously been analyzed.

1.3 Threatened, Endangered, or Proposed Species and Habitat covered in this Biological Assessment

1.3.1 ESA Protected Species

The following ESA listed threatened, endangered, proposed threatened/endangered species may be affected by the proposed action:

- Green Sturgeon (*Acipenser medirostris*) T
- Steelhead, Central California Coast ESU (*Oncorhynchus mykiss*) T
- Steelhead, California Central Valley ESU (*Oncorhynchus mykiss*) T
- Chinook Salmon, Central Valley (Sacramento) spring-run (*Oncorhynchus tshawytscha*) T
1.3.2 Federal Candidate and CESA Protected Species

In addition to those species listed under the Federal ESA, the following species listed under the California ESA may be affected by the proposed action:

- Longfin Smelt (*Spirinchus thaleichthys*) T

Longfin smelt are a candidate for listing under the Federal ESA, as such they are included in this assessment, as they may become ESA-listed during the 5-year term of the project.

1.3.3 Critical Habitat

The action addressed within this document would occur within Critical Habitat identified for:

- Green Sturgeon (*Acipenser medirostris*) T
- Steelhead, Central California Coast ESU (*Oncorhynchus mykiss*) T
- Steelhead, California Central Valley ESU (*Oncorhynchus mykiss*) T
- Chinook Salmon, Central Valley (Sacramento) spring-run (*Oncorhynchus tshawytscha*) E
- Chinook Salmon, Sacramento River winter-run (*Oncorhynchus tshawytscha*) E

1.3.4 Essential Fish Habitat

The Action Area addressed within this document falls within Essential Fish Habitat, as defined in the MSA, for 20 species of commercially important fish and sharks managed under three federal fisheries management plans (FMPs):

- the Pacific Groundfish FMP
- the Coastal Pelagic FMP
- the Pacific Coast Salmon FMP

**Coastal Pelagic EFH:** The Coastal Pelagic FMP is designed to protect habitat for a variety of fish species that are associated with open coastal waters. Fish managed under this plan include planktivores and their predators. Those found in Central San Francisco Bay-Delta include Northern anchovy, Pacific sardine, and jack mackerel.

**Pacific Groundfish EFH:** The Pacific Groundfish FMP is designed to protect habitat for more than 90 species of fish, including rockfish, flatfish, roundfish, some sharks and skates, and other species that associate with the underwater substrate. Fifteen (15) species are reported present in Central San Francisco Bay-Delta waters and include English sole, sand sole, curlfin sole, Pacific sanddab, starry flounder, lingcod, brown rockfish, Pacific whiting, kelp greenling, leopard shark, spiny dogfish shark, skates, soupfin shark, bocaccio, and cabezon.

**Pacific Salmon EFH:** The Pacific Salmon FMP is designed to protect habitat for commercially important salmonid species. Sacramento Chinook salmon is the only one of these species that
may be seasonally present in the Action Area, although historically Coho salmon were common in San Francisco Bay.

1.3.5 MMPA Protected Species

No endangered or threatened marine mammals listed by ESA nor as having depleted populations under the MMPA occur within San Francisco Bay. The following marine mammals protected by the MMPA are known to be recent inhabitants within San Francisco Bay:

- Harbor seal (*Phoca vitulina richardsi*)
- California sea lion (*Zalophus californianus*)
- Harbor porpoise (*Phocoena phocoena*)
- California gray whale (*Eschrichtius robustus*)
- Humpback whale (*Megaptera novaeangliae*)

This BA does not present information related to the Marine Mammal Protection Act (MMPA), as no harassment or harm to marine mammals protected under the MMPA is expected to result from the project; therefore, no Incidental Harassment Authorization will be sought from NMFS for this project.

1.3.6 Habitat Areas of Particular Concern (HAPC)

Within the San Francisco Bay-Delta region, NMFS has identified two habitat areas of particular concern. They include:

- Eelgrass beds (*Zostera marina*)
- Native Olympia oyster beds (*Ostrea lurida*)
SECTION 2
Consultation

2.1 Consultation to Date

The following lists the formal communications and consultations to date between the client, consultants, and regulatory agencies:

- On November 20, 2014, Rachel Bonnefil (Acta) spoke with Arn Aarreberg (California Department of Fish and Wildlife, or CDFW) regarding the Proposed Project, providing a brief description and introduction, and scheduling a follow-up conversation.

- On November 25, 2014, Rachel Bonnefil (Acta) and Priya Finnemore (ESA) spoke with Arn Aarreberg (CDFW) regarding the Proposed Project, potential effects on listed species, the anticipated approval process, as well as recommendations for avoidance and minimization measures. CDFW recommendations to avoid the need for an Incidental Take Permit for effects to the state-listed longfin smelt included conducting work within LTMS work windows and staying below hydroacoustic impact thresholds developed for pile driving (as provided in the Interim Criteria for Injury to Fish, developed by the Hydroacoustic Working Group). CDFW suggested the preparation of a ‘combined’ Aquatic BA, for review by both NMFS and CDFW Marine.

- On December 15, 2014, Rachel Bonnefil (Acta) and Priya Finnemore (ESA) spoke with Mandy Morrison (NMFS) regarding the permitting process, mitigation measures, and methods for quantifying impacts from the maintenance process (and specifically hydroacoustic impacts for pile driving, using the NFMS noise calculator). NMFS suggested that pile driving impacts from wood piles alone would be unlikely to exceed hydroacoustic impact thresholds, and therefore would be ‘not likely to adversely affect’ in-water species. NMFS also suggested that some piles may be preferable to cut at mudline, rather than pull out entirely, if sediments are anticipated to have elevated levels of contaminants. Lastly, NMFS suggested that the potential spread of invasive species would need to be considered if the project were to propose activities that would facilitate and/or increase navigation.

- On February 3, 2015, Priya Finnemore (ESA) requested email confirmation of current version of the NMFS noise calculator (for calculating hydroacoustic impacts from pile driving activities) as well as requesting input on whether it need be utilized for the installation of wood piles. Gary Stern (NMFS) responded the same day, by providing the most current version of the NMFS noise calculator, and by clarifying that it need not be used for wood piles, only for the calculation of noise associated with steel or concrete piles.
In addition, an inter-agency meeting took place at the Army Corps of Engineers San Francisco District on January 14, 2015 to discuss the regulatory process, project description, effects, and avoidance and minimization measures. NMFS, USFWS, and CDFW were invited to the meeting and did not attend, but were provided with all project information distributed at the meeting.

### 2.2 Future Consultation

The following analysis is based on the components of the currently defined proposed project maintenance activities and actions. This document presents a conservative view of the maximum extent of impacts that could result to federally listed or candidate species associated with the proposed action.

The proposed action is currently undergoing review by various state permitting agencies (California Department of Fish & Wildlife, the SF Bay Conservation and Development Commission, and the San Francisco Bay Regional Water Quality Control Board). Accordingly, it is possible that additional mitigation measures may be added to the proposed action outside of the Section 7 consultation process. Any such measures would not change the analysis presented in this document because this document analyzes the extent of impacts anticipated to NMFS federally listed species for the purpose of the Corps’ informal consultation obligations under Section 7 of the Act.

Pursuant to federal regulations, if subsequent to the completion of this consultation the proposed action is revised either by: (1) selecting a less impactful alternative or (2) adding more stringent mitigation measures through the NEPA process (or any other environmental review process) and new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent that was not previously considered, then the federal agencies with jurisdiction for actions related to potential effects on such species would need to either request a subsequent concurrence that the proposed action is ‘Not Likely to Adversely Affect’ listed species or initiate formal consultation (50 CFR 402.16(a-d)).
SECTION 3
Action Area

The Action Area is defined as all areas that may be affected directly or indirectly by the federal action(s) and not merely the immediate area involved in the action. The “Action Area” includes the entire project footprint and all areas that may be directly or indirectly affected by the proposed project. Based on the interrelated and interdependent actions and potential indirect effects associated with the project, the Action Area is slightly larger than the project area described in the Project Description below.

The Port of San Francisco’s Project Area, within which in-water maintenance activities are proposed, encompasses an approximately 3½-mile stretch of shoreline along the southern San Francisco waterfront (see Figure 2) between Pier 40 in the north to just south of Heron’s Head Park at Pier 98 on the south.

The “Action Area” includes the entire project footprint and all areas that may be directly or indirectly affected by the proposed project. Therefore, the Action Area is considered to include all existing Port shoreline infrastructure along the southern waterfront; it varies in width from a few feet along the unimproved shoreline edges to a few hundred feet along inlets at China basin and Islais Creek, where Port infrastructure extends. Figure 2a illustrates the “Action Area.”
source: Port of San Francisco; ESA

Figure 2a
Action Area
SECTION 4
Project Description

4.1 Background

Born out of the Gold Rush, today’s Port of San Francisco is a public agency responsible for managing the 7-1/2 miles of San Francisco Bay shoreline stretching from Hyde Street Pier in the north to India Basin in the south. The Port’s responsibilities include promoting maritime commerce, navigation, and fisheries; restoring the environment; and providing public recreation and shoreline access. More than 1,000 acres fall under its jurisdiction.

The Port’s history reaches back to the early years of California statehood. With the Gold Rush attracting hundreds of ships to San Francisco Bay from around the world, a State Commission was created in 1863 to improve the City’s harbor. As the City moved into the 20th century, the Port grew in leaps and bounds. The waterfront became an industrial area of finger piers, railroad terminals, and warehouses. With the outbreak of World War II, San Francisco became a military logistics center; troops, equipment and supplies left the Port in support of the Pacific theater. The City’s shipbuilding and ship repair industries flourished. In the 1950s, San Francisco continued to be the West Coast’s premier cargo port.

Today, the Port of San Francisco has redefined its marketing strategies and continues to offer the world’s shipping fleet major assets such as naturally deep water, hundreds of thousands of square feet of covered storage, on-dock rail, acres of unobstructed lay-down space and modern well-maintained cargo terminals.

In 1968, the State transferred its responsibilities for the San Francisco waterfront to the City and County of San Francisco through the Burton Act. As a condition of the transfer, the State required the City to create a Port Commission that has the authority to manage the San Francisco waterfront for the citizens of California. Although the Port is a department of the City and County of San Francisco, the Port receives no financial support from the City, and relies almost solely on the leasing of Port property for its revenues.

Over the last thirty years, as the City’s downtown grew towards the water’s edge, new uses established themselves in previously industrial areas. The Port today oversees a myriad of maritime, commercial and public activities. While at one time industrial maritime uses dominated the northern edge of the city, today cargo shipping and ship repair are located primarily south of China Basin. Cruise ships, excursion boats, passenger ferries, recreational
boating, commercial and sport fishing activities and other commercial maritime operations remain on the northern waterfront.

In order to keep the Port’s facilities safe and operational, and to avoid unnecessary release of contaminants and/or debris from aging and dilapidated structures into the Bay, the Port proposes to address their large and growing backlog of needed maintenance repairs, rehabilitation, and replacement for their existing shoreline structures under the proposed Regional General Permit and associated approvals and authorizations.

4.2 Project Purpose and Objectives

The Port of San Francisco ("Port") has jurisdiction over 7 miles of shoreline along the northern and eastern edge of the City of San Francisco (Figures 1 and 2). Most of the buildings, piers and supporting infrastructure are over 75 years old. As a result, the Port has a large and growing backlog of needed maintenance and repairs. If rehabilitation and replacement of these existing shoreline structures are not addressed, many of these existing structures will continue to degrade and eventually fall into the Bay. In order to maintain navigational and recreational safety, protect and improve water quality, and improve shoreline access and appearance, these regular maintenance and repair activities need to be performed on an ongoing basis.

In pursuing a Regional General Permit for maintenance activities, the Port seeks to streamline regulatory compliance for routine activities with minimal impacts by reducing the burden of piecemeal approvals for such work, increase regulatory predictability for the Port in planning, funding, and implementing needed maintenance and repairs, and keep the Port’s facilities operational and avoid release of debris from dilapidated structures.

Proposed activities consist of maintenance, repair and replacement activities for the Port of San Francisco’s (“Port”) facilities along the southern shoreline (Figures 1 and 2), as described below. Figures 3a and 3b depict the typical shoreline configurations found along the San Francisco waterfront. The proposed activities are restricted to repairing, replacing, or removing existing aging shoreline infrastructure and navigational equipment on an as-needed basis. The work includes routine repair and maintenance as well as the repair, rehabilitation, or replacement of structures or fills recently damaged or destroyed by discrete events such as storms, floods, fire, or collisions.

The types of maintenance and repair intended to be covered by the proposed General Permit would continue a program of construction activities necessary to maintain current Port facilities and uses to comply with Port Building Code requirements, maintain public safety, and/or keep facilities in a state of good repair. The project scope includes required implementation of best management practices (BMPs) established by the RWQCB and the resource agencies to protect water quality and biological resources, and historic resource evaluations to ensure work is consistent with Secretary of Interior Historic Preservation Standards.
Seawall Construction Types

Example: Rock Embankment & Wood Seawall

Example: Concrete Seawall (beneath former Pier 36)
Figure 3b

Seawall Construction Types

Example: Exposed Rip Rap

Example: Natural Shoreline
All of the proposed activities would be eligible for authorization under U.S. Army Corps of Engineers (Corps) Nationwide Permit ("NWP 3-Maintenance") covering shoreline maintenance and removal activities. The proposed shoreline maintenance, removal, and restoration activities listed below are included in this request for a programmatic permit (such as a Regional General Permit, or RGP, from the Corps) because: the activities are fairly similar in nature; they are expected to be conducted on a fairly frequent or routine basis for a limited duration; they will affect existing currently-serviceable structures and include no "new" work or structures; they will generally maintain the existing character, capacity, and use of existing currently-serviceable structures; they are either exempt or have existing coverage under the California Environmental Quality Act (CEQA); and they are expected to result in no more than minimal effects on waters of the U.S., both individually and cumulatively. Consistent with the terms of NWP 3, uses of the repaired/replaced structures would not differ from those specified or contemplated in the original construction, allowing for minor deviations including those due to changes in materials, techniques, standards, or regulatory requirements.

4.3 Proposed Project Activities

The vicinity map (Figure 1) provides an overview of all the areas where proposed maintenance, repair, and removal would occur within the Port’s jurisdiction along the San Francisco waterfront. The Project Area extends for approximately 3½ miles along the waterfront from Pier 40 in the north to just south of Heron’s Head Park at Pier 98 in the south. Examples of typical shoreline types and existing shoreline infrastructure within the Port’s jurisdiction are shown in Figures 3a and 3b.

A list and brief description of the proposed maintenance and removal activities for the Port’s shoreline facilities, including a general description of the methods and materials for each class of activity, are described in the following sections below. The work includes routine repair, maintenance, and removal as well as the repair, rehabilitation, or replacement of structures or fills recently damaged or destroyed by discrete events such as storms, floods, fire, or collisions. Approximate quantities per year, and for the total requested authorization period of 5 years, are estimated in the sections below and summarized in Table 4-1. It should be noted that individual discrete maintenance and removal activities would be performed for a duration of no more than three days.

A general description of the construction methods and equipment is provided further below in Section 4.4. The proposed schedule for project activities is provided in Section 4.5 below. Avoidance and Minimization measures and Best Management Practices that will be employed during construction activities, to avoid impacts to water quality and biological resources, are described in Section 5.
4.3.1 Maintenance, Repair, and Restoration of Existing Structures

Proposed maintenance activities include the repair, rehabilitation, restoration or replacement of any previously authorized structures or fill, including structures or fills recently damaged or destroyed by discrete events (such as storms, floods, fire, or collisions), as summarized in Table 4-1 below, and described in the following sections:

### 1. Bank Stabilization

Maintenance and repair of existing banks (including unarmored and armored shorelines), seawalls, dikes and existing riprap: ≤ 500 linear feet of existing structures per year (1,000 linear feet total), provided that the activity meets the Terms and Conditions of NWP 3 (Maintenance), including:
• The structure or fill is not to be put to uses differing from those specified or contemplated in the original construction. Minor deviations, including those due to changes in materials, techniques, standards, or regulatory requirements, are authorized;

• The repair, rehabilitation or replacement of structures or fills destroyed or damaged by discrete events (such as storms, floods, fire, etc.) is commenced or is under contract to commence within two years of the damaging event (unless this two-year limit is waived by the District Engineer of the Corps);

• No temporary fill material is placed in a manner that will be eroded by normal or expected high flow; and

• Temporary fills are removed in their entirety and the affected area returned to pre-construction elevations (and revegetated, as appropriate).

Banks, seawalls, and other shoreline protection will be repaired using either land-based or marine-based equipment as described below. Bank stabilization materials will include rip-rap and concrete.

2. Navigation Aids and Markers

The maintenance and restoration of existing navigation aids and regulatory markers approved by, and installed in accordance with, the requirements of the U.S. Coast Guard will be conducted at a rate of approximately 5 per year (25 markers total for 5 years), comprising 1 cy/year (5 cy total)².

Navigation aids will be replaced or repaired using marine-based equipment as described below. Floating devices will be composed of materials that will not disintegrate; including concrete, steel, plastics or closed cell foam encapsulated sun resistant polyethylene.

3. Pile Replacement (existing)

Repair and replacement of existing wooden (non-creosote treated) piles, typically 12” diameter (no concrete or steel piles) will be conducted for ≤1,000 piles per year (5,000 piles total)³. The Port estimates that pile replacement would constitute the replacement of a total of 784 square feet (or 726 cy) of fill per year, and approximately 3,925 square feet (or 3,634 cy) of fill over the 5 year period.

Piles will be driven using either a land-based or barge-mounted pile driver. Wherever feasible, piles will be driven using a vibratory hammer to minimize hydroacoustic impacts. An impact hammer may be needed to finish pile driving and achieve the final required depth. The impact hammer (3,000 lbs. or less) will be equipped with a 12” thick wooden cushion block, and would employ a “soft start” technique.

Maintenance and repair of existing piles will be performed using marine based equipment as described in Section 4.4 below. Pile wrap will be installed by divers.

² Provided that the activity meets the terms and conditions of NWP 3, as listed in 4.3.1.1 Bank Stabilization, above.
³ Ibid.
Materials used in pile replacement and repair will include wood piles (typically 12-inch diameter), pile wrap composed of polyvinyl chloride (PVC), wood pile stubs and cylindrical steel connectors.

The Port has considered alternatives for replacement of wood piles in light of NOAA’s 2009 guidelines for use of treated wood in aquatic environments. The proposed pile material is wrapped, preservative-treated (typically ACZA or similar) Douglas fir. This type of pile is the industry standard for west coast use; the Port has successfully installed and used this type of pile for over a decade. Wrapped Douglas fir piles can last over thirty years in the San Francisco Bay and are capable of absorbing ship impact energy without breaking. Bearing piles will not be subjected to impact and therefore should incur virtually no damage to their wraps from ship berthing. Fender piles will be subjected to ship berthing and their wraps may incur damage. The Port makes periodic inspections of its structures including its fender piles, and replaces fender pile wraps as required. The Port pile laborers and pile driving equipment are only capable of handling wood piles.

Replacement of wood piles with concrete or steel piles is not feasible because they are very difficult to connect with the existing wood framing, which is the material under all of the Port’s pier aprons. In addition, it is technically infeasible to install a concrete or steel pile through a deck or apron and manipulate it to fit in the same location as the removed wooden pile. The Port needs to replace intermittent piles on a one to one basis, and installing concrete or steel piles in place of wooden piles is not feasible from an engineering, economic, schedule or construction perspective. Cedar piles do not have the durability and structural strength of treated Douglas fir piles and are not the recognized industry standard wood pile. Composite piles are very expensive and do not have the energy absorption capabilities of the Douglas fir piles; they tend to permanently deform from berthing impacts, even light impact. The Port has used polyethylene coated wood piles somewhat unsuccessfully in the past; the coatings tended to disintegrate rapidly, especially with berthing activity. In addition, the actual act of installing piles with any coating, whether it be polyethylene or marine based paint, inevitably leads to scraping of the coatings into the Bay. Finally, as noted in NOAA’s treated wood guidelines, the water quality effects of installing new treated wood can be offset by removal of old creosote treated piles and over-water structures, as is proposed under this General Permit. Consequently, the Port proposes to use treated Douglas fir piles for all pile replacement conducted under the proposed General Permit. Replacement and removal of treated wood piles and decking will be conducted in accordance with NOAA’s 2009 guidelines for use of treated wood to the extent possible.

4. Piers and Associated Over-Water Structures

The maintenance and reconfiguration of existing piers, wharves, fenders, dolphins, whales (including under-pier structures such as joists, stringers, and pipelines/utilities attached to pier under deck), pier aprons (including bull rails, kickboards, pavement), and minor coring of pier decks (to install related structures) will occur as needed. The Port estimates that maintenance will be conducted for approximately 100,000 sq. ft. per year (500,000 sq. ft. total)\(^4\).

\(^4\) Ibid.
Note that the majority of these structures are not within, but above, jurisdictional waters. Therefore, only potential unintended construction-related debris would constitute a discharge of fill.

Pier repair will be conducted using either land-based or marine-based equipment as described in Section 4.4 below. Under-pier pipelines will be repaired and maintained by a small team of plumbers and/or boat operators in a work boat using manual plumbing tools. Work hours for under-pier work are limited by tide stage (the boat must close enough to the underside of the pier area to reach the pipelines but not dangerously close). Flow to the pipeline will be shut off at the source before the start of work.

Materials used for pier maintenance and repair will include energy-absorbing fendering, wood framing, asphalt, reinforcing steel and concrete.

Pier decking will be composed of wood, plastic or non-resistive material. These maintenance activities are limited to reconfiguration and removal with no new construction proposed.

The replacement of existing piles associated with these over-water activities (and the approximate quantities of in-water fill for these replacement piles) is addressed under No. 3 – Pile Replacement, above.

5. Fencing

The repair and/or replacement of existing fencing along the shoreline will be conducted, for \( \leq 200 \) linear feet (~100 sf) per year (1,000 linear feet, or 500 sf, total for 5 years)\(^5\).

Fencing repair and maintenance will be performed from the land by laborers and possibly ironworkers. Equipment and materials will include pneumatic and welding tools and fencing materials composed of wood and aluminum.

6. Bulkheads and Breakwaters

The repair of existing bulkheads and breakwaters will be conducted for approximately 100 linear feet per year (500 linear feet total for 5 years)\(^6\). This repair would involve approximately 300 sq. ft. (or 100 cy) of replacement fill per year, or 1,500 sq. ft. (or 500 cy) of replacement fill for the 5 year period.

Repair and maintenance of bulkheads and breakwaters will be performed using marine-based equipment as described in Section 4.4 below. Materials will include wood framing, reinforcing steel, and concrete.

\(^5\) Ibid.
\(^6\) Ibid.
7. Docking Facilities

The replacement or reconfiguration of existing docking facilities (including docks, piers, gangways, etc.) will be conducted for approximately 150,000 sq. ft./year (750,000 sq. ft. total)\(^7\).

Note that the majority of these structures are not within, but above, jurisdictional waters. Therefore, only potential unintended construction-related debris would constitute a discharge of fill.

Docking facilities will be repaired, maintained and replaced using marine based equipment as described above. The dock modules will be fabricated off site, placed on a barge and towed to the location where they will be installed. The sections will then be assembled, moved into place and bolted around the piles. Specific installation methods depend on float type, framing system (structural internal members), location of pile hoops, available equipment and other factors. Dock installation does not typically create underwater turbidity or noise and hence BMPs are not typically required.

Gangways are typically placed into position and attached with the aid of a barge-mounted crane. The gangways are designed to be perpendicular to the pier or seawall or roughly parallel to the pier or seawall. For the perpendicular connection, a simple drop link hinge connection to the pier or seawall is proposed. The parallel connection will require an external platform measuring approximately five feet square. In most cases the abutment connections can be installed from the landside. At pier locations, this platform will be designed as a cantilevered connection to the pier face with sufficient strength to support the gangway for both dead and live loads.

Floating docks and gangways will be made of concrete, aluminum, or lighter-duty timber pre-cast sections. Light-transmitting materials or measures will be used or considered whenever feasible.

8. Bollards, Cranes, Pier Canopies and Other Small Appendages

The repair and/or replacement of existing bollards, cranes, pier canopies, and other small appendages (including ladders, fender, and camels) is proposed for a total of approximately 50 small appendages per year (100 appendages total)\(^8\).

Note that the majority of these structures are not within, but above, jurisdictional waters. Therefore, only potential unintended construction-related debris would constitute a discharge of fill.

4.3.2 Removal of Dilapidated Structures and Support Piles

The proposed permanent debris removal activities would provide an overall net benefit to the in-water environment as well as improve navigation. Debris removal is described in the following section.

\(^7\) Ibid.
\(^8\) Ibid.
1. Piles and Associated Structures

Permanent removal of existing piles (including fender piles) and associated structures such as decks, piers, stringers, beams, and girders will occur at a rate of approximately 54,000 sq. ft./year (approximately 270,000 sq. ft. total) and will include the removal of approximately 2000 cy of pile fill per year (or 10,000 cy of pile fill for the 5 year period) 9.

Pier and pile removal will be accomplished using marine based equipment as described in Section 4.4 below. As much asphalt as possible will be removed from the pier deck. However, where there is severe deterioration it is not safe to remove all asphalt. Pier decks will be removed using a barge-mounted excavator mounted on a derrick barge with a crane. Barge mounted excavators will be used to remove debris from the tidal zone, and will place the debris on a barge with runoff and debris containment along its perimeter.

Piles are typically pulled out using either the same barge mounted crane type that would be used for installation, or vibrated out using a vibratory hammer. Rigging straps are secured to the piles and the crane applies a large and steady upward force to dislodge the pile. Piles that cannot be pulled, or piles that are not recommended for pulling due to known contaminant levels in the surrounding substrate, will be cut two feet below the mudline to the extent feasible, with an excavator equipped with a rotating grappler hook or by divers using waterproof chainsaws.

Debris will be placed onto material barges and disposed directly or moved to a storage yard until a reuse has been determined. Debris will be reused or recycled to the extent feasible; for example, concrete and asphalt can be crushed and reuse on Port property. All material unsuitable for onsite reuse will be trucked to an approved recycling facility or landfill.

Land-based or barge mounted excavators will be used to remove debris from the tidal zone. Work will be done during low tides and the machines will carefully pick up debris, and not scrape or grade the shoreline.

4.4 Construction Equipment and Methods

The proposed activities will be conducted from land whenever possible; however, it is most common that the Port cannot conduct the proposed maintenance and repair activities, which are focused on the Port's in-water structures and facilities, from land. Therefore, from a practical standpoint, marine-based equipment will be used for the majority of the proposed activities. Land-based and marine-based activities will be conducted using two basic suites of equipment, with minor variations as needed for specific tasks. These two basic equipment suites are as follows:

- **Land-Based Equipment**: Landside work will be performed using conventional earthwork equipment such as an excavator, a side-dump truck, a mobile crane, a forklift, a small front-end loader, asphalt equipment, and various small construction tools such as pneumatic tools, welding tools, hammers, saws and drills.

9 Ibid.
• **Marine-Based Equipment:** Work from the water will be performed using a suite of construction equipment staged on a pile driving barge and operated by a pile crew. Pile divers may also work from a pile barge for some repairs. For any given repair and/or replacement project the barge may have on board: a crane, a forklift, an excavator, a small front end loader, and various small construction tools such as pneumatic tools, welding tools, hammers, saws, and drills. In addition, there may be a secondary barge used for delivery and disposal of supplies. At all times, there is an additional crew and a small vessel navigating around the construction site cleaning up fallen debris from the water. Closed debris containment booms, floating debris screens, and/or absorbent booms will be positioned beneath and alongside work areas whenever possible.

### 4.5 Schedule

Individual discrete maintenance and removal activities would be performed for a duration of no more than three (3) days.

Maintenance repair, replacement, and removal activities with the potential to result in more than minimal short-term impacts to biological resources will be conducted within seasonal work windows (between June 1 and November 30) to reduce potential impacts on special-status species. These repair, replacement, and removal activities, proposed for authorization within the seasonal work window (June 1 to November 30) only, consist of the following:

- Bank stabilization
- Bulkheads and breakwaters

Due to their minimal nature and low potential to result in adverse effects to biological resources (as discussed in more detail in Section 8 - Effects of the Action), the below-listed maintenance repair, replacement, and removal activities are proposed for year-round authorization:

- Navigational aids and markers
- Pile replacement (existing)
- Piers and associated over-water structures
- Fencing
- Docking facilities
- Bollards, cranes, pier canopies, and other small appendages
- Permanent removal of dilapidated piles and associated structures

For the above-listed activities, which are proposed for year round authorization due to their minimal nature, the following should be noted:

The duration of any of the discrete repair activities will not exceed 3 days.

The proposed repair, replacement, and/or permanent removal of existing piles would be limited to wood piles only, the majority of which are 12” diameter wood piles. Pile installation and removal will utilize vibratory hammer to the maximum extent feasible;
when an impact hammer is required (to achieve target pile depth), avoidance and minimization measures for noise (as provided in Section 5) will be implemented. Based on Caltrans data on underwater sound pressure levels for the impact driving of wood piles, wood piles do not generate underwater noise that exceeds regulatory thresholds (see Section 8, below, for further discussion). Finally, the permanent removal of dilapidated piles (most of which are creosote-treated) would improve localized and eventually long-term water and sediment quality, as well as reducing fill in the Bay.

With respect to: piers and associated over-water structures; docking facilities; bollards, cranes, pier canopies, and other small appendages, the majority of these structures are not within, but above, jurisdictional waters. Therefore, only potential unintended construction-related debris that may be generated during the proposed repair, replacement, or permanent removal of these overwater structures could constitute a discharge of debris or fill into the Bay.

If any work is proposed during the Pacific herring spawning or hatching season (December 1 – February 28), a CDFW approved herring monitor will monitor the project site daily, and at any time when in-water construction activity is taking place.

In the event that the on-site monitor detects herring spawning at or within 200 meters of in-water construction activity, the in-water construction activity will be shut down for a minimum of 14 days, or until the monitor determines that the hatch has been completed and larval herring have left the site. The in-water or other construction activity may resume thereafter.

Avoidance and minimization measures related to the timing of construction are discussed in greater detail below, and in Section 5 – Avoidance and Minimization Measures.
SECTION 5
Avoidance, Minimization, and Conservation Measures

The below-outlined avoidance and minimization (A&M) measures, best management practices (BMPs), and conservation measures are proposed by the Port, in order to avoid and minimize potential Project effects on federally listed species and their habitat within the Action Area, including: CCC steelhead, critical habitat for CCC steelhead, Chinook salmon, green sturgeon, critical habitat for green sturgeon, and EFH for a variety of MSA-managed species and MSA managed fish species, harbor seal, California sea lion, harbor porpoise, and Pacific herring.

These proposed avoidance, minimization, and conservation measures proposed by the Port are consistent with: input received from regulatory agencies during pre-permitting outreach; the majority of the criteria established under the 2013 Corps of Engineers/National Marine Fisheries Service NLAA Program, the Port’s standard specifications for over-water work, and conditions of recent permits and Biological Opinions for similar waterfront work. Based on the minimal nature of the proposed maintenance activities, the anticipated net reduction in overwater structures and in-Bay fill, and the anticipated long-term benefits and improvements to water and sediment quality and habitat associated with the permanent removal of dilapidated structures and piles (including creosote-treated piles), the proposed project is anticipated to result in a net environmental benefit. As a result, the Port does not propose any compensatory mitigation.

The following avoidance, minimization, and conservation measures are proposed by the Port to avoid or reduce potential effects to sensitive resources as addressed in this document:

1. Noise Impacts from Pile Driving

The avoidance and minimization measures specific to pile driving activity, below, have been developed in accordance with the majority of the measures outlined in the 2013 NLAA program criteria, in order to reduce project effects on sensitive resources. Specific sound attenuation devices (such as bubble curtains) will not be required, as underwater noise thresholds will not be exceeded (e.g., because only wood piles, generally 12” diameter, will be used). Avoidance and minimization measures that will reduce project noise effects include the following:

- Whenever feasible, a vibratory hammer will be used.
- If an impact hammer is utilized, a 12-inch thick wood cushion block will be used during all impact pile driving operations, and only wood piles will be impact driven.
• If an impact hammer is utilized, impact driving of wood piles will be limited to one hammer, 3000 pounds or smaller, and less than 20 piles per day.

• A “soft start” technique to pile driving will be implemented, at the start of each work day or after a break of 30 minutes or more, to give fish and marine mammals an opportunity to vacate the area.

2. Seasonal Avoidance of Sensitive Species

In-water maintenance work with the potential to result in more than minimal short-term impacts to biological resources, including Project activities that are expected to create turbidity or disturb the seabed, will be conducted within seasonal work windows identified to reduce potential impacts on special-status species (i.e., work will be conducted from June 1 – November 30). Activities proposed within the seasonal work window of June 1 to November 30 are listed below, and discussed in more detail in Section 4.3 - Proposed Project Activities and Section 8 – Effects of the Action:

• Bank stabilization
• Bulkheads and breakwaters

In-water or above-water work which is minimal in nature and has low potential to result in adverse effects to biological resources is proposed for year-round authorization. Activities proposed for year-round authorization are listed below, and discussed in more detail in Section 4.3 – Proposed Project Activities and Section 8 – Effects of the Action:

• Navigational aids and markers
• Pile replacement (existing)
• Piers and associated over-water structures
• Fencing
• Docking facilities
• Bollards, cranes, pier canopies, and other small appendages
• Permanent removal of dilapidated piles and associated structures

No work will be performed within 250’ of Ridgway’s rail nesting habitat during nesting season (no work near nesting habitat will occur between February 1 and August 31st of any year). If work that has potential to impact special status bird species is proposed to be performed outside applicable seasonal windows, consultation with NMFS, USFWS and/or CDFW will be undertaken as appropriate.

If any work poses potential to disturb nesting birds protected by the Migratory Bird Treaty Act during nesting season (generally April through August), Port staff or a qualified consultant will inspect the work area for nesting activity.

If any work is proposed during the Pacific herring spawning or hatching season (December 1 – February 28), a CDFW approved herring monitor will monitor the project site daily, and at any time when in-water construction activity is taking place.
In the event that the on-site monitor detects herring spawning at, or within 200 meters of in-water construction activity, the in-water construction activity will be shut down for a minimum of 14 days, or until the monitor determines that the hatch has been completed and larval herring have left the site. The in-water or other construction activity may resume thereafter.

3. **Shading**

The Port anticipates a net reduction in the area of over-water structures, with Project implementation. Existing over-water structures will be replaced/repaired, with no expansion or minimal expansion in footprint; other deteriorating structures may be removed permanently. Therefore, no BMPs or A&M measures for shading are proposed.

The Port will maintain records of additions and removal of overwater structures, to track net quantities and ensure the above goal is met over the life of the requested RGP. If a net increase is observed at the end of the RGP period, the Port will negotiate appropriate compensatory mitigation with the regulatory and resource agencies.

4. **Invasive Species**

Invasive species impacts (direct and indirect) will be considered if any proposed Project activities would result in the new facilitation of navigation. However, none are anticipated by the Project at this time.

5. **Wetlands/Special Aquatic Site (SAS) Impacts**

Minimal wetland habitat or other Special Aquatic Sites occur within the work area, and those known are confined to the areas surrounding Heron’s Head Park and Pier 94. No work is expected within these wetlands or Special Aquatic Sites as a part of the Project.

6. **Fill Placement**

Fill quantities will be the minimum necessary to achieve the Project purpose. The Port anticipates a net removal of fill with Project implementation.

The Port will maintain records of additions and removal of fill, to track net quantities and ensure the above goal is met over the life of the RGP. If a net increase in fill is observed at the end of the RGP period, the Port will negotiate appropriate compensatory mitigation with the regulatory and resource agencies.

7. **Sediment Removal/Substrate Disturbance and Water Quality**

Sediment removal quantities will be the minimum necessary to achieve the Project purpose. No dredging is proposed; sediment removal would be performed only in conjunction with and as necessary for repairs and maintenance.
5. Avoidance, Minimization, and Conservation Measures

When practicable and feasible, debris removal in the tidal zone will be done during low tides and equipment will pick up debris, not excavate, scrape or grade the shoreline.

Pile removal (of wood piles only, and typically 12” diameter) will be conducted in accordance with the Port’s standard specifications, the San Francisco Bay Subtidal Goals Project Report, and the majority of the 2013 Corps/NMFS NLAA Program criteria, e.g.,:

- Piles will be removed by direct pull or vibratory hammer, where possible;
- Piles that cannot be pulled (or piles in known contaminated sediments, per below) will be cut two feet below the mudline, to the extent feasible;
- Piles will be removed only at low tide; and
- No jetting will be performed.

Disturbance of sediment will be minimized to the extent feasible during activities such as removal of piles and debris or minor excavation in conjunction with maintenance/repair of existing structures.

Silt curtains will be used where work will generate significant turbidity (i.e., for minor excavation in conjunction with maintenance of existing structures) and where site-specific conditions allow. However, the majority of the proposed work areas are subject to strong currents that make the use of silt curtains infeasible.

Absorbent pads will be available for use in the event that petroleum sheen develops during sediment-disturbing activities.

Existing sediment quality data available for areas planned for pile removal or sediment excavation will be reviewed prior to conducting work, to assess risks of mobilizing or exposing contaminated sediments.

Existing piles in areas with known elevated contaminant levels will be cut instead of pulled; cut piles will be capped as warranted.


Standard BMPs would be applied by the party undertaking the applicable maintenance work to protect species and their habitat(s) from pollution due to fuels, oils, lubricants, and other harmful materials. BMPs for this proposed project would follow those detailed in the San Francisco Department of Public Health Pollution Prevention Toolkit for Maritime Industries (SFDPH, 2011).

Closed debris containment booms, floating debris screens, and/or absorbent booms will be positioned beneath and alongside work areas whenever possible.
For small-scale over-water repairs and maintenance, tarps, tubs and/or vacuums will be used as appropriate to catch sawdust, debris, and drips.

All construction material, wastes, debris, sediment, rubbish, trash, fencing, etc., will be removed from the site on a regular basis during work and at project completion. Debris will be transported to an authorized disposal area.

The party undertaking maintenance work will exercise every reasonable precaution to protect listed species and EFH-protected species and their habitat(s) from maintenance by-products and pollutants such as construction debris, chemicals, fresh cement, saw-water, or other deleterious materials. Care will be used by equipment operators to control debris so that it does not enter the Bay.

To prevent any debris from falling into the Bay during maintenance activities, to the maximum extent practicable, the Port will employ the Best Available Technology in implementing the following measures:

- During maintenance, the barges performing the work will be moored in a position to capture and contain the debris generated during any sub-structure or in-water work. In the event that debris does reach the Bay, personnel in workboats within the work area will immediately retrieve the debris for proper handling and disposal. All debris will be disposed of at an authorized upland disposal site.
- Avoidance measures will be taken to ensure that fresh cement or concrete will not be allowed to enter San Francisco Bay. Maintenance waste will be collected and transported to an authorized upland disposal area, as appropriate, and per federal, state, and local laws and regulations;
- All hazardous material will be stored upland in storage trailers and/or shipping containers designed to provide adequate containment. Short-term laydown of hazardous materials for immediate use will be permitted with the same anti-spill precautions;
- All maintenance material, wastes, debris, sediment, rubbish, trash, fencing, etc., will be removed from the site once the Proposed Project is completed and transported to an authorized disposal area, as appropriate, in compliance with applicable federal, state, and local laws and regulations;
- Maintenance material will be covered every night and during any rainfall event (if applicable);
- Maintenance crews will reduce the amount of habitat disturbance within the project site to the minimum necessary to accomplish the project; and
- Avoidance measures will be taken to prevent construction water from entering the Bay

Well-maintained equipment will be used to perform construction work, and, except in the case of failure or breakdown, equipment maintenance will be performed off-site. Repair crews will check heavy equipment daily for leaks, and if leaks are discovered use of the equipment will be suspended until fixed. If leaks or spills are encountered, the source of the leak will be identified, material will be cleaned up, and the cleaning materials will be collected and properly disposed.
Vehicles and equipment that are used during the course of maintenance and removal activities would be fueled and serviced in a manner that would not affect federally protected species in the Action Area or their habitats.

Fueling of equipment will be conducted offsite with the exception of small amounts of oil/gas for small generators, and cranes on barges, using 55 gallon drums, etc. Fueling locations will be inspected after fueling to document that no spills have occurred. Any spills will be cleaned up immediately.

Fueling of marine-based equipment will be performed using proper fuel transfer procedures as per US Coast Guard required spill containment and fueling requirements. Fueling of land-based equipment will occur by mobile trucks in a staging area or over pavement, and the location will be inspected after fueling to document that no spills have occurred. Spills will be cleaned up immediately using spill response equipment.

Measures to prevent spills into the Bay associated with in-water fueling, if in-water fueling is required on some of the construction barges, would include:

- Secondary booms and/or pads, depending upon where fueling would take place on the vessel;
- Secondary containment on the deck of the vessel to contain the petroleum product;
- Specifying volume of petroleum products that will be on the vessel and potential for spills and include absorbent and cleanup materials (such as oil sorbent boom, heavy oil pads, OilDry Absorbent Floor, etc.) of sufficient quantity to clean up potential spill volume; and
- Identify location of properly permitted offsite locations where vessels will be fueled.
- Petroleum products, chemicals, fresh cement, saw water, or concrete or water contaminated by the aforementioned shall not be allowed to enter the water.

In-water and floating devices shall consist of materials that will not disintegrate; including concrete, steel, plastics or closed cell foam encapsulated polyethylene. No pilings or other wood structures that have been pressure treated with creosote shall be used. Additionally, existing piles in areas with known elevated contaminant levels will be cut instead of pulled.

9. Stormwater

Minimal ground disturbance is anticipated since the proposed Project activities focus on maintenance and repair of existing hard-surfaced structures. Where ground disturbance is necessary, construction crews will reduce the footprint of disturbance to the minimum necessary to complete the project.

Construction material that could wash or blow away will be covered every night and during any rainfall event. Adequate erosion control supplies (sandbags, wattles, shovels, etc.) shall be kept on-site during all construction activities, to ensure construction materials and debris are kept out of the Bay.
Construction materials will be stored in an area that does not freely drain to the Bay, free from standing water and wet soil, and protected from rain. If necessary, materials will be stored on skids or support timbers to keep them off the ground.

Adequate erosion control supplies (sand bags, wattles, shovels, etc.) shall be kept on site and during all construction activities to ensure materials are kept out of water bodies.

10. Materials and Treated Wood Selection

No pilings or other wood structures that have been treated with creosote will be used.

Any chemically treated wood material to be used (e.g., for pilings/decking/stringers) must be covered or wrapped with an impact resistant biologically inert substance. Decking may be of wood, plastic or non-resistant material. When decking is replaced, light-transmitting materials or measures will be used or considered whenever feasible.

Replacement piles will be limited to treated and wrapped wood piles. The Port will utilize treated wood products (e.g. piles and decking) that have been BMP certified through a third-party inspection process.

Treated wood products will be visually inspected upon arrival at the work site. Materials with visible residues or bleeding will be rejected. Wood products treated with an ammoniacal preservative (e.g., AZCA) will be rejected if there is a noticeable odor.

Treated wood decking that will be subject to vehicle or pedestrian traffic will be paved or otherwise protected from abrasion.

Cleaning and maintenance activities that can remove particles of treated wood (such as power washing, sanding and aggressive scrubbing) will be minimized.

The Port will consider feasible alternatives to treated-wood piles for projects involving more than 100 piles.

No materials will be fabricated at any in-water or above-water work site.

Cutting stations will be equipped with large tarps to capture debris and will be located well away from the water to minimize wind transport of sawdust.

If preservative treatments, water repellents or other coatings are applied at the work site (e.g. on cuts and boreholes), the treatment will be applied at the cutting station and allowed to dry or cure before the structure is moved to the over-water area.

If cutting or boring of treated wood or touch-up preservative applications must be performed over water, tarps, plastic tubs or similar devices will be used to catch sawdust, debris, and drips. Preservatives will not be applied in the rain, and any excess preservative will be wiped off.
Any debris that falls in the water will be promptly removed and handled as described under the avoidance and minimization measures for “Debris” and “Stormwater” above.

Floating devices will be composed of materials that will not disintegrate, including concrete, steel, plastics or closed cell foam encapsulated sun resistant polyethylene.

Most existing decking, and hence most replacement decking, will be composed of wood. However, the use of light-transmitting materials or measures will be used or considered whenever feasible.
SECTION 6
Species Accounts

6.1 ESA List of Species

6.1.1 Green Sturgeon-Southern DPS (*Acipenser medirostris*)

*Species Listing Status:* Threatened

**Life History:** This anadromous\(^{10}\) fish is the most widely distributed member of the sturgeon family and the most marine-oriented of the sturgeon species, entering rivers only to spawn. Juveniles rear in fresh water for as long as 2 years before migrating to sea. Green sturgeon are thought to spawn every 3 to 5 years in deep pools with turbulent water velocities and prefer cobble substrates but can use substrates ranging from clean sand to bedrock. Females produce 60,000 to 140,000 eggs that are broadcast to settle into the spaces between cobbles. Adult green sturgeon migrate into freshwater beginning in late February with spawning occurring in the Sacramento River in late spring and early summer (March through July), with peak activity in April and June. After spawning, juveniles remain in fresh and estuarine waters for one to four years and then begin to migrate out to the sea.\(^{11}\) The upper Sacramento River has been identified as the only known spawning habitat for green sturgeon in the southern distinct population segment.\(^{12}\) According to recent studies, green sturgeon adults begin moving upstream through the Bay during the winter.\(^{13}\) Adults in the San Joaquin Delta are reported to feed on benthic invertebrates including shrimp, amphipods and occasionally small fish\(^{14}\) while juveniles have been reported to feed on opossum shrimp and amphipods. Within the bays and estuaries, sufficient water flow is required to allow adults to successfully orient to the incoming flow and migrate upstream to spawning grounds. Subadult and adult green sturgeon occupy a diversity of depths within bays and estuaries for feeding and migration. Tagged adults and subadults within the San Francisco Bay-Delta have been observed occupying waters over shallow depths of less than 33 feet, either swimming near the surface or foraging along the bottom.

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\(^{10}\) Anadromous fish are those migrating from the sea to fresh water to spawn.

\(^{11}\) Moyle, P. B., R. M. Yoshiyama, J. E. Williams, and E. D. Wikramanayake, 1995. Fish Species of Special Concern in California. Second edition. Final report to California Department of Fish and Game, contract 2128IF.


**Distribution:** Green sturgeon, after outmigration from freshwater, disperse widely in nearshore coastal waters from Mexico to the Bering Sea and are common occupants of bays and estuaries along the western coast of the United States. Sturgeon that have been tagged in the Sacramento River have been reported captured in coastal and estuarine waters to the north of San Francisco Bay. Adults are found throughout the San Francisco Bay and Delta during periods of migration, while juveniles are present in the southern San Francisco Bay year-round, mostly south of the Dumbarton Bridge.

**Critical Habitat:** Critical habitat for the green sturgeon includes the Sacramento River, the Sacramento-San Joaquin Delta, and Suisun, San Pablo and all of San Francisco Bay below the higher high water.

**Occurrence in Action Area:** Green sturgeon have the potential to be present throughout all marine portions of the Action Area at any time of the year.

**Threats:** A principal factor in the decline of the Southern Distinct Population Segment (DPS) is the reduction of historic spawning area to a limited section of the Sacramento River. This remains a threat due to increased risk of extirpation due to catastrophic events. Insufficient freshwater flow rates in spawning areas, contaminants (e.g., pesticides), bycatch of green sturgeon in fisheries, potential poaching (e.g., for caviar), entrainment by water projects, influence of exotic species, small population size, impassable barriers, and elevated water temperatures likely pose a threat to this species. Additionally, green sturgeon may be susceptible to overfishing, as sexual maturity is not reached until 15 to 20 years of age.

### 6.1.2 Steelhead (Oncorhynchus mykiss), Central California Coast ESU

**Listing Status:** Threatened

**Life History:** Steelhead are anadromous (sea-run) forms of rainbow trout. Steelhead inhabiting California are classified as the coastal subspecies, *Oncorhynchus mykiss irideus*. Steelhead and populations of other Pacific salmonids are further divided into Evolutionarily Significant Units.

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An Evolutionarily Significant Unit or ESU is a distinctive group of Pacific salmon, steelhead, or sea-run cutthroat trout.¹⁹

Steelhead are nearly indistinguishable from resident rainbow trout that also reside in the same streams in which they spawn, with the exception of being larger when hatched.²⁰ Winter-run steelhead are at or near sexual maturity when they enter freshwater during late fall and winter, and spawn from late December through April, with the peak between January and March. Juvenile steelhead typically rear in freshwater for a longer time period than other salmonids, typically ranging from one to three years. The actual time however is highly variable with the individual. Throughout their range, steelhead typically remain at sea for one to four growing seasons before returning to freshwater to spawn.²¹

Steelhead typically enter the Bay in early winter, using the main channels in the Bay-Delta to migrate to upstream spawning habitat, as opposed to small tributaries. However, migrating steelhead may be seen in the San Francisco Bay and Suisun Marsh and Bay as early as August.²² Migrating fish require deep holding pools with cover such as underwater ledges and caverns. Coarse gravel beds in riffle areas are used for egg laying and yolk sac fry habitat once eggs have hatched. Because juvenile steelhead remain in the creeks year-round for several years while rearing, adequate flows, suitable water temperatures, and an abundant food supply are necessary to sustain steelhead populations. The most critical period is in the summer and early fall, when these conditions become limiting. Additionally, steelhead require cool, clean, well-oxygenated water, and appropriate gravel for spawning. Spawning habitat condition is strongly affected by water flow and quality, especially temperature, dissolved oxygen, shade, and silt load, all of which can greatly affect the survival of eggs and larvae.²³ Little is known about transit times and migratory pathways of steelhead within San Francisco Bay. Recent 2008-2009 study results from an ongoing study of outmigration and distribution of juvenile hatchery-raised steelhead released in the lower Sacramento River show that steelhead spend an average of 2.5 days in transit time within San Pablo and San Francisco Bays. The study concluded that transit time was greater in the upper estuary than in the lower estuary (San Francisco Bay).²⁴ This could be due to the lower

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salinity in the upper estuary that serves as a transition zone between fresh and salt water, allowing steelhead to transition from freshwater to saltwater. Once steelhead reach San Francisco Bay, salinities are similar to ocean water, which may lead steelhead to spend less time in this portion of the estuary. Although information on migratory pathways of juvenile steelhead were largely inconclusive, a positive correlation between smolt captures and water depth was observed between 3 and 37 feet suggesting that the deeper the water, the more fish were present (up to 37 feet deep). Studies conducted by NMFS and CDFW indicate that the primary migration corridor is through the northern reaches of Central San Francisco Bay (Raccoon Straight and north of Yerba Buena Island). Additionally, a recent study evaluating 30-years of Interagency Ecological Program (IEP) monthly mid-water fish trawl data and three-years of acoustic tag data of hatchery-raised salmonids suggests that the presence of out-migrating juvenile salmonids (steelhead and salmon) along the Port of San Francisco waterfront appeared to be more the result of capture by tidal flow rather than active foraging or intentional swimming to those areas of the Bay.

Steelhead are primarily drift feeders and may forage in open water of estuarine subtidal and riverine tidal wetland habitats. The diet of juvenile steelhead include emergent aquatic insects, aquatic insect larvae, snails, amphipods, opossum shrimp, and small fish. Adults may also feed on newly emergent fry. Steelhead usually do not eat when migrating upstream and often lose body weight.

**Distribution:** Includes coastal river basins from the Russian River south to Soquel and Aptos Creek, California (inclusive), and the drainages of San Francisco and San Pablo Bays, including the Napa River. They are also known to migrate to the South Bay, where they spawn in the Guadalupe River, Coyote Creek, and San Francisquito Creek. Also included are adjacent riparian zones, all waters of San Pablo Bay westward of the Carquinez Bridge, and all waters of San Francisco Bay from San Pablo Bay to the Golden Gate Bridge. Major river basins containing habitat comprise approximately 6,516 square miles. These basins are located within Alameda, Contra Costa, Marin, Mendocino, Napa, San Francisco, San Mateo, Santa Clara, Santa Cruz,

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25 (Klimley *et al.* 2009, *ibid.*
30 Moyle, 1976. *op. cit*
Solano, and Sonoma counties. Historically, most streams with suitable habitat within the San Francisco Bay Estuary supported steelhead populations. Current runs are estimated at fewer than 10,000 fish in San Francisco Bay tributaries.

**Critical Habitat:** Critical habitat includes all natal spawning and rearing waters, migration corridors, and estuarine areas that serve as rearing areas accessible to listed steelhead in coastal river basins, from the Russian River to Aptos Creek (inclusive), and the drainages of San Francisco and San Pablo Bays. Also included are adjacent riparian zones, all waters of San Pablo Bay west of the Carquinez Bridge, and all waters of San Francisco Bay to the Golden Gate. Specific to estuarine areas, NMFS requires that all estuarine areas be free of obstruction and excessive predation, maintain water quality, and salinity conditions supportive of juvenile and adult physiological transitions between fresh water and saltwater; that natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels be maintained; and maintenance of juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

**Occurrence in Action Area:** Primarily present during in-migration and out-migration periods. Suspected to forage in Central Bay shallow water areas (<30 feet) during in-migration and out-migration transits.

**Threats:** The largest factor limiting growth of this species is the placement of migration barriers that prevent access to spawning habitat (NMFS, 2007). Water diversions further reduce freshwater habitat quality throughout the range of these species. Other threats to steelhead include agricultural operations, forestry operations, gravel extraction, illegal harvest, streambed alteration, unscreened or substandard fish screens on diversions, suction dredging, urbanization, water pollution, potential genetic modification in hatchery stocks resulting from domestication selection, incidental mortality from catch-and-release hooking, climatic variation leading to drought, flooding, variable ocean conditions, and predation (NMFS, 2007). Secondarily, the quantity and quality of summer rearing habitat with cool water pools and extensive cover for older juvenile steelhead can be considered limiting factors for steelhead in California streams.

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34 Leidy. 2000. *op. cit*
35 Leidy. 2000. *op. cit*
6.1.3 Steelhead (Oncorhynchus mykiss), California Central Valley ESU

Listing Status: Threatened

Life History: See discussion above for Central Coast Steelhead

Distribution: Central Valley steelhead historically occurred throughout the Sacramento and San Joaquin river systems: from the upper Sacramento/Pit River systems south to the Kings and possibly Kern River systems in wet years.\(^{38}\) Currently, the Central Valley steelhead ESU includes steelhead in all river reaches accessible to the Sacramento and San Joaquin Rivers and their tributaries in California.\(^{39}\) Also included are river reaches and estuarine areas of the Sacramento-San Joaquin Delta, all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait, all waters of San Pablo Bay westward of the Carquinez Bridge, and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. Excluded are areas of the San Joaquin River upstream of the Merced River confluence and areas above specific dams identified or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years).\(^{40}\) Presently, the Central Valley contains only winter steelhead. Based on Red Bluff Diversion Dam counts, hatchery counts, and prior natural spawning escapement estimates from the early 1990s,\(^{41}\) roughly estimated the total annual run size (hatchery and wild) for the entire system at no greater than 10,000 adult fish.

Critical Habitat: Critical habitat for the Central Valley steelhead was designated throughout the Central Valley on 16 September 2, 2005.\(^{42}\) Critical habitat for the species is divided into 22 hydrologic units by watersheds. None of these hydrologic units occur within San Francisco Bay. However, the primary migration corridor to these hydrologic units spawning areas is through Central Bay, North Bay, and San Pablo and Suisun Bays in the Delta. The primary migration corridor is similar to that used by migrating salmon in the Bay and occurs through Raccoon Straight north of Angel Island.

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\(^{40}\) NOAA. 2000. ibid.


**Occurrence in Action Area:** Primarily present during in-migration and out-migration periods. Suspected to forage in Central Bay shallow water areas (<30 feet) during in-migration and out-migration transits.

**Threats:** The largest factor limiting growth of this species is the placement of migration barriers that prevent access to spawning habitat.\(^{43}\) Water diversions further reduce freshwater habitat quality throughout the range of these species. Other threats to steelhead include agricultural operations, forestry operations, gravel extraction, illegal harvest, streambed alteration, unscreened or substandard fish screens on diversions, suction dredging, urbanization, water pollution, potential genetic modification in hatchery stocks resulting from domestication selection, incidental mortality from catch-and-release hooking, climatic variation leading to drought, flooding, variable ocean conditions, and predation (NMFS, 2007). Secondarily, the quantity and quality of summer rearing habitat with cool water pools and extensive cover for older juvenile steelhead can be considered limiting factors for steelhead in California streams.

### 6.1.4 Chinook Salmon, Sacramento winter-run (*Oncorhynchus tshawytscha*)

**Listing Status:** The Sacramento River winter-run Chinook salmon was federally listed as endangered on April 6, 1990, and the endangered status was affirmed on June 28, 2005.\(^{44}\)

**Life History:** The Chinook salmon is the largest and least abundant species of Pacific salmon.\(^{45}\) Like all salmonids, the Chinook is anadromous (a migratory fish that is born in fresh water and spends a portion of its life in the sea before returning to fresh water to spawn), but unlike steelhead, Chinook salmon are semelparous (*i.e.*, they die following a single spawning event). Pacific salmonids are divided into Evolutionarily Significant Units. An Evolutionarily Significant Unit (ESU) is a distinctive group of Pacific salmon, steelhead, or sea-run cutthroat trout. The Sacramento River winter run Chinook salmon ESU was listed as an endangered species on January 4, 1994,\(^{46}\) and includes all populations of winter-run Chinook salmon in the Sacramento River and its tributaries in California\(^{47}\).

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\(^{45}\) Behnke. 2002. op. cit.


\(^{47}\) NOAA. 1994. *ibid.*
Sacramento River winter-run Chinook salmon enter San Francisco Bay between November and May/June. Their migration into the Sacramento River begins in December and continues through early August, with the majority of the run occurring between January and May and peaking in mid-March. Adults enter freshwater in an immature reproductive state, similar to spring-run Chinook, but winter-run Chinook move upstream much more quickly and then hold in the cool waters below Keswick Dam for an extended period before spawning.

In general, winter-run Chinook spawn in the area from Redding downstream to Tehama from mid-April through August. However, the spawning distribution appears to be somewhat dependent on the operation of the gates at the Red Bluff Diversion Dam, river flow, and probably temperature. At present, winter-run Chinook salmon are found only in the Sacramento River below Keswick Dam. Fry and smolts emigrate downstream from July through March through the Sacramento River, reaching the Delta from September through June.

Historically, winter-run Chinook spawned in the upper reaches of Sacramento River tributaries, including the McCloud, Pit, and Little Sacramento Rivers. Shasta and Keswick dams now block access to the historic spawning areas.

It is believed that winter-run Chinook salmon, like all Central Valley Chinook, remain localized primarily in California coastal waters. Coded wire tag (CWT) returns indicate that only 4 percent of winter-run hatchery production recoveries from ocean waters occurred in Oregon (Regional Mark Information System [RMIS] database). The majority of ocean tag recoveries were from the Monterey Bay, San Francisco Bay, and North Coast regions. Out-migration through Central Bay follow a similar pattern to that described for Steelhead trout above. Although reported occurring throughout Central Bay waters during out migration periods, their presence in the shallower water areas of the Bay and along the San Francisco Port may be more the result of capture by tidal flow rather than active foraging or intentional swimming to those areas of the Bay.

Chinook salmon feed on aquatic and terrestrial invertebrates and salmon eggs in freshwater. In intertidal areas Chinook salmon feed on amphipods, insects, and fish larvae. During the oceanic life stage, Chinook salmon feed on fish, large crustaceans, and squid. Adult winter-run Chinook salmon return to freshwater during the winter but delay spawning until the spring and summer. Juveniles spend about 5 to 9 months in the river and estuary systems before entering the ocean. This life-history pattern differentiates the winter-run Chinook from other Sacramento River Chinook runs and from all other populations within the range of Chinook salmon.

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49 Jahn, 2011. op. cit.

50 Behnke, 2002. op. cit.

**Distribution:** Adults utilize the coastal waters of California, migrating through the golden Gate, Central Bay, North Bay, San Pablo Bay, Suisun Bay and into the Sacramento River. Outmigrating juveniles follow the same path in reverse. Studies conducted by NMFS\(^52\) and CDFW\(^53\) indicate that the primary migration corridor is through the northern reaches of Central San Francisco Bay (Raccoon Straight and north of Yerba Buena Island).

**Critical Habitat:** The Sacramento River from Keswick Dam, Shasta County (River mile 302) to Chipps Island (River mile 0) at the westward margin of the Sacramento-San Joaquin Delta; all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay (north of San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge.\(^54\)

**Occurrence in Action Area:** Primarily present during in-migration and out-migration periods. Suspected to forage in Central Bay shallow water areas (<30 feet) during in-migration and out-migration transits.

**Threats:** Loss and degradation of spawning habitat. Restricted access to spawning habitat from river and stream blockages.

### 6.1.5 Chinook Salmon, Central Valley (Sacramento) spring-run (*Oncorhynchus tshawytscha*)

**Listing Status:** The Central Valley spring-run Chinook salmon ESU was listed as a threatened species on September 16, 1999.\(^55\) This ESU includes all naturally spawned populations of spring-run Chinook salmon in the Sacramento River and its tributaries in California.\(^56\)

**Life History:** The spring-run Chinook salmon has a similar life history to the winter run salmon as discussed above, but begins its spawning migration to the Sacramento/San Joaquin Delta in late winter to spring. Adults are found in San Francisco Bay during the migratory period in the spring, and juveniles have the potential to inhabit the Bay in the fall, winter, and spring.

**Distribution:** Adults utilize the coastal waters of California, migrating through the golden Gate, Central Bay, North Bay, San Pablo Bay, Suisun Bay and into the Sacramento River. Outmigrating...
juveniles follow the same path in reverse. Studies conducted by NMFS\textsuperscript{57} and CDFW\textsuperscript{58} indicate that the primary migration corridor is through the northern reaches of Central San Francisco Bay (Raccoon Straight and north of Yerba Buena Island).

**Critical Habitat:** All river reaches accessible in the Sacramento River and its tributaries in California, all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay (north of San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge.\textsuperscript{59}

**Occurrence in Action Area:** Primarily present during in-migration and out-migration periods. Known to forage in Central Bay shallow water areas.

**Threats:** Loss and degradation of spawning habitat. Restricted access to spawning habitat from river and stream blockages.

### 6.2 Federal Candidate/CESA Listed Species

#### 6.2.1 Longfin Smelt (*Spirinchus thaleichthys*)

**Listing Status:** Longfin smelt are listed as threatened under the California ESA and are a candidate for listing under the Federal ESA.

**Life History:** The longfin smelt is a small, slender-bodied pelagic fish that measures about 3 inches in length as an adult. The species generally lives for two years although some three-year smelt have been observed.

Pre-spawning longfin smelt migrate upstream into the lower reaches of rivers during the late fall and winter. Smelt have adhesive eggs which are deposited on sand, gravel, rocks, submerged aquatic vegetation, and other hard substrates during spawning. Spawning typically occurs during the late winter and early spring (mid- to late February) but varies among years in response to factors such as seasonal water temperatures. During spawning each female produces approximately 5,000 to 24,000 eggs and it is estimated that total reproduction within a year is in the hundreds of millions of eggs or more (Moyle, 2002). As with most fish, mortality rates for eggs and larvae in longfin smelt are high. Those that survive to the planktonic larval stage are transported into the western Delta and Suisun Bay during the late winter and spring where juveniles rear.


\textsuperscript{58} Baxter et al., 1999. \textit{op. cit.}

Longfin smelt have a two year lifecycle and reside as juveniles and pre-spawning adults in the more saline habitats within San Pablo Bay and Central Bay during a majority of their life (Moyle, 2002). Movement patterns based on catches in CDFW fishery sampling suggest that longfin smelt actively avoid water temperatures greater than 22°C (72°F) (Baxter et al., 1999). These conditions occur within the Delta during the summer and early fall, when longfin smelt inhabit more marine waters further downstream in the bays and are not present within the Delta.

**Distribution:** Juvenile and subadult longfin smelt predominately inhabit brackish water areas of the San Francisco Bay estuary (San Pablo Bay and Central Bay) and nearshore coastal marine waters outside the Golden Gate (Baxter et al., 1999, Rosenfield and Baxter, 2007). Adult longfin smelt return to spawn in the freshwater regions of the lower Sacramento River, near or downstream of Rio Vista, and the lower San Joaquin River downstream of Medford Island.

**Occurrence in Action Area:** Primarily present in Central San Francisco Bay during the late summer months before migrating upstream in fall and winter. During winter months, when fish are moving upstream to spawn, high outflows may push many back into San Francisco Bay (Moyle, 2002).

**Threats:** Results of CDFW fishery surveys have documented a substantial decline in the abundance of a variety of pelagic species including longfin smelt. Threats to longfin smelt include a reduction in Delta outflows during the late winter and spring, entrainment losses to water diversions, climatic variation, exposure to toxic substances, and a loss in spawning and rearing habitat. Additionally, reduced food availability thought to be the result of reduced primary production due, in part, to a reduction in seasonally-inundated wetlands, competition for food resources with non-native fish and macroinvertebrates (e.g., filter feeding by the non-native Asian overbite clam *Corbula*), and competition among native and non-native zooplankton species have impacted smelt populations in recent years (Armor et al., 2006).

### 6.3 EFH Species

The Action Area of Central San Francisco Bay is included in the listing of essential fish habitat for a variety of pelagic, groundfish, and salmon species covered by the Coastal Pelagic Fish Management Plan (FMP), the Pacific Groundfish FMP, and the Pacific Coast Salmon FMP developed by the Pacific Fishery Management Council under the requirements of the Magnuson-Stevens Act. Table 6-1 lists those fish species covered by these plans identified as utilizing the Action Area, along with the life stage and relative occurrence within the Action Area as determined from CDFW unpublished IEP midwater trawl data for the years 2005-2009 (Appendix C).
<table>
<thead>
<tr>
<th>Fisheries Management Plan</th>
<th>Species, Common Name</th>
<th>Species, Scientific Name</th>
<th>Life Stage*</th>
<th>Abundance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coastal Pelagic</td>
<td>Northern anchovy</td>
<td>Engraulis mordax</td>
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<td>Abundant</td>
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<td>Jack mackerel</td>
<td>Trachurus symmetricus</td>
<td>E, L</td>
<td>Present</td>
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<td>Pacific sardine</td>
<td>Sardinops sagax</td>
<td>J, A</td>
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<td>Sand sole</td>
<td>Psuitichthys melanostictus</td>
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<td></td>
<td>Pacific sanddab</td>
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</tr>
<tr>
<td></td>
<td>Starry flounder</td>
<td>Platichthys stellatus</td>
<td>J, A</td>
<td>Present</td>
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<tr>
<td></td>
<td>Lingcod</td>
<td>Ophiodon elongatus</td>
<td>J, A</td>
<td>Present</td>
</tr>
<tr>
<td></td>
<td>Brown rockfish</td>
<td>Sebastes auriculatus</td>
<td>J</td>
<td>Present</td>
</tr>
<tr>
<td></td>
<td>Pacific whiting (hake)</td>
<td>Merluccius productus</td>
<td>E, L</td>
<td>Present</td>
</tr>
<tr>
<td></td>
<td>Kelp greenling</td>
<td>Hexagrammos decagrammus</td>
<td>J, A</td>
<td>Present</td>
</tr>
<tr>
<td></td>
<td>Leopard shark</td>
<td>Triakis semifasciata</td>
<td>J, A</td>
<td>Present</td>
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<td></td>
<td>Spiny dogfish</td>
<td>Squalus acanthias</td>
<td>J, A</td>
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<td>Raja spp.</td>
<td>J, A</td>
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<td>Soupfin shark</td>
<td>Galeorhinus galeus</td>
<td>J, A</td>
<td>Rare</td>
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<tr>
<td></td>
<td>Bocaccio</td>
<td>Sebastes paucispinis</td>
<td>J</td>
<td>Rare</td>
</tr>
<tr>
<td></td>
<td>Cabezon</td>
<td>Scorpaenichthys marmoratus</td>
<td>J</td>
<td>Present</td>
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<tr>
<td>Pacific Coast Salmon</td>
<td>Chinook salmon</td>
<td>Oncorhynchus tsawytscha</td>
<td>J, A</td>
<td>Seasonally Present</td>
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<tr>
<td></td>
<td>Coho salmon</td>
<td>Oncorhynchus kisutch</td>
<td>J, A</td>
<td>Historically Present, Current Occurrence unknown</td>
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NOTES: A = Adult; J = Juvenile; L = Larvae; E = Egg
6.4 Habitats of Particular Concern (HAPC)

6.4.1 Eelgrass (Zostera marina) Beds

Eelgrass (Zostera marina) is a native marine vascular plant indigenous to the soft-bottom bays and estuaries of the Northern Hemisphere. It has been afforded special management considerations by CDFW, USFWS, National Marine Fisheries Service (NMFS), EPA, and BCDC. The species is found from middle Baja California and the Sea of Cortez to northern Alaska along the west coast of North America, and is common in healthy, shallow bays and estuaries. The depth to which this species can grow is a function of light penetration. At greater depths, light is reduced to a level below which photosynthesis is unable to meet the metabolic demands of the plant to sustain net growth.

Eelgrass beds perform multiple functions within an estuarine ecosystem. They are considered a “habitat forming” species that creates unique biological environments for spawning Pacific herring60 (Clupea pallasi) and serve as nursery grounds for many important Bay fish including pacific herring, halibut, and English sole. They provide substrate for epibenthic algae, invertebrates, and crustaceans and important rearing habitat for invertebrate species such as shrimp (Palaeonsetus paludosus) and Dungeness crabs (Cancer magister). Eelgrass beds also provide important foraging areas for waterfowl such as black brandt (Branta bernicla nigricans)61 and American wigeon (Anas americana). Finally, Bay eelgrass beds provide critical spawning habitat for Pacific herring. The largest spawning aggregations in California occur in San Francisco Bay-Delta and Tomales Bay.

In addition to providing refugia for young fish, eelgrass beds stabilize shorelines by dampening wave energy, collecting sediments transported to the shore, and preventing shore erosion. They also improve water quality by collecting and filtering organic matter and sediments. This filtering also acts as a nutrient pump, transferring waterborne nutrients to the sediments and invertebrates.

Eelgrass is easily affected by changes in water quality and turbidity. Eelgrass beds are extremely dynamic, expanding and contracting by as much as several hectares per season depending on the quality of the site. Consequently, they serve as an indicator community for the overall health of an estuary.

The largest eelgrass beds in the estuary are in shallow subtidal regions of San Pablo and Richardson bays, with smaller beds scattered in shallow areas between the Carquinez Strait and Hayward. Within Central Bay, eelgrass beds are located in Richardson Bay, off the north and east shorelines of Treasure Island and within Clipper Cove between Treasure Island and Year Buena

60 NOAA. 2007a. op. cit.
Island, along the Tiburon peninsula and along the east shore of Angel Island. Eelgrass beds have also been observed within Horseshoe Cove at Ft. Baker. Comprehensive eelgrass surveys of the San Francisco Bay-Delta have been conducted in 1987, 2003, and 2009. The 1987 survey reported a total of 316 acres of eelgrass beds in San Francisco Bay-Delta. The 2003 and 2009 surveys, which employed both high resolution acoustic mapping and helicopter aerial imagery, reported 2,622 and 3,707 acres of eelgrass beds, respectively present in San Francisco Bay-Delta. Between 2003 and 2009, eelgrass beds Baywide have increased 28.7 percent and between the 1987 and 2009 surveys, almost 110 percent. This increase in bed densities and aerial extent as well as establishment in new areas of the Bay-Delta is in part the result of improved water clarity over the past decade and regulatory actions to protect and enhance eelgrass beds as an important natural resource of the San Francisco Bay-Delta marine ecosystem.

Threats to eelgrass beds in San Francisco Bay include activities associated with shipping and boating, which can disrupt seagrass beds directly through destruction of plants by boat propellers, anchors and anchor chains, dredging, and construction of facilities (e.g., docks, harbors, breakwaters, ports). Indirect effects arise through increased suspended sediments due to dredging and boat wakes, or shading from structures such as docks. Hardening of the shoreline can reflect waves, increasing wave action and limiting or destroying beds. Most of these threats apply to eelgrass in the San Francisco Estuary but are focused in localized areas. Impacts from dredging seem to have a limited spatial and temporal effect; damage from boat anchors, shoreline development, and ship wakes is also likely to be localized. Oil spills can inundate and smother eelgrass beds, particularly those in the intertidal or shallow subtidal zones. Eelgrass beds may respond to rising sea level by establishing closer to the present-day shoreline and dying out at greater depths. The dwindling sediment supply to the estuary may decrease turbidity, allowing eelgrass to grow at greater depths but possibly also promoting competing blooms of phytoplankton.

### 6.4.2 Native Olympia oysters (Ostrea lurida) Beds

The Olympia oyster (Ostrea lurida), also known as the “native oyster”, is native to most of Western North America and prior to overharvesting and increased siltation from hydraulic mining in the mid-19th Century, a component of the San Francisco Bay marine ecosystem. Olympia oysters inhabit brackish water conditions but prefer salinities above 22 ppt. In their natural state, Olympia oysters form sparse to dense beds in coastal bays and estuaries and in drought conditions will move up into channels and sloughs; dying off when wetter conditions

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64 Merkel & Associates. 2010. op. cit.


return. Olympia oysters are not reef builders like their East and Gulf coast cousin, *Crassostrea virginica*. Olympia oysters are known to provide high biodiversity habitat because they provide physical habitat structure sought by juvenile fish and crustaceans, worms, and foraging fish and birds. They also stabilize sediment, reduce suspended sediment, and improve light penetrations thereby improving the physical conditions that encourage the establishment of submerged aquatic vegetation, such as eelgrass beds. Additionally, a robust population of filter feeders can help modulate plankton blooms.

Naturally occurring populations of native oysters can be found throughout San Francisco Bay on natural and artificial hard substrate from Carquinez Strait to South Bay. Intertidally they occur between Point Pinole to south of the Dumbarton Bridge with the highest reported abundances of 80/m² in Central Bay. Oysters have appeared to do well subtidally in many manmade habitats such as on marina floats and in tidally restricted ponds, lagoons and saline lakes. Native oysters have been reported inhabiting the intertidal and subtidal rocks composing the rip rap shoreline of Treasure Island, on wharf pilings of the Port of San Francisco, and in Richardson Bay and along the Richmond, CA shoreline. Although thought to be extinct from the Bay since the mid-19th Century, native oysters have been observed in various locations in San Francisco Bay since 2000. Their presence in other rocky intertidal, rocky subtidal, and man-made habitats in Central San Francisco Bay, including Alcatraz and Angel Islands is expected.

Threats to Olympia oysters include predation from indigenous and non-native marine snails (*Acanthina spirata* and *Urosalpinx cinerea*, respectively), birds, bat rays, and crabs. Limited suitable hard substrate and physical water quality conditions are also important parameters. Olympia oysters do not appear to prosper in areas of high siltation.

73 San Francisco Bay Subtidal Habitat Goals Report: Appendix 7-1. 2010. *ibid.*
74 San Francisco Bay Subtidal Habitat Goals Report: Appendix 7-1. 2010. *ibid.*
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SECTION 7
Environmental Baseline

The current condition and local environment of listed species within the Action Area are described in the subsequent sections. In addition, cumulative effects, when considered in combination with other foreseeable actions (cumulative effects) have been also assessed. Cumulative effects under the ESA are those effects of future state or private activities, not involving federal activities that are reasonably certain to occur within the Action Area (50 CFR 402.02). Future federal actions that are unrelated (i.e., not interrelated or interdependent) to the proposed action are not considered in this assessment because they would be subject to separate consultation pursuant to Section 7 of the ESA.

7.1 Water Quality

Water quality in the San Francisco Bay Region of the Action Area is saline and predominated by ocean influences. However, during periods of significant runoff, especially from the Sacramento-San Joaquin River system, substantial freshwater migrates through San Pablo Bay and into San Francisco Bay. This inundation of freshwater can temporarily reduce the salinity of waters in the project vicinity to substantially less than ocean water. Additionally, when tidal current is impaired by a barrier or constricted, such as through the Golden Gate, the behavior of the current can influence the sedimentation and water quality characteristics within the Bay, thereby affecting circulation, flushing action, and water exchange. Various contaminants are transported into San Francisco Bay by an assortment of sources: urban uses, industrial outfalls, municipal wastewater outfalls, municipal stormwater, upstream farming, upstream historic and current mining discharges, legacy pollutants, and various other pollutant sources.

Suspended sediments are a key component of the estuarine system. The terms turbidity and suspended sediments are often used interchangeably. Turbidity refers to a number of different suspended particulates including plankton and sediments. Suspended sediments refer to the actual sediment component in the water column. Most near shore environments, and estuaries in particular, tend to have higher levels of turbidity or suspended sediment loads due to discharges


77 Legacy pollutants are water quality constituents that are considered harmful to human health or the environment, that were historically emitted by industry or other human activities, and that are in general banned or significantly restricted from current usage. Examples include mercury, lead, PCBs, and DDT.
from rivers, drainages and the relative shallow nature of the environment. Suspended sediment concentrations in San Francisco Bay tend to be extremely variable and strongly correlated to season and water depth.\textsuperscript{78,79,80} Several groups, including the San Francisco Estuary Institute (SFEI) and the U.S. Geological Survey (USGS), have monitored suspended sediment loads throughout the San Francisco Bay for many years. Suspended sediment concentrations can range from well over 1,000 milligrams per liter (mg/L) near the bottom, to as little as 10 mg/L in near surface measurements.\textsuperscript{81} The Action Area footprint for in-water maintenance along the San Francisco waterfront is in relatively shallow water. These locations are strongly influenced by nearshore discharges, vessel traffic and wind- and wave-generated sediment disruption.

Contaminants are introduced into Central San Francisco Bay primarily through runoff, combined sewer overflow, stormwater, spills and leaks, and remobilization from sediment into the overlying water column. SFRWQCB listed the Central Bay, which includes the Action Area, as an impaired water body. Under Section 303(d) of the Clean Water Act, impaired waters are defined as those that do not meet water quality standards, even after point and non-point sources of pollution have had pollution control technologies implemented. The pollutants listed for the Central Bay include chlordane, dichlorodiphenyltrichloroethane (DDT), dieldrin, dioxin compounds, exotic species, furan compounds, mercury, polychlorinated biphenyls (PCBs), and selenium.\textsuperscript{82} Pollutant concentrations vary seasonally and annually, dependent upon their specific source and degradation characteristics. Contaminants, such as ammonia, copper, and legacy pesticides, have decreased over recent years due to cleanup efforts and natural attenuation.\textsuperscript{83,84}

Since 1993, the Regional Monitoring Program (RMP) for Water Quality in the San Francisco Estuary associated with SFEI, collects water quality data and provides reports annually. The annual monitoring consists of conventional water quality parameters (ammonia, conductivity, dissolved oxygen, dissolved organic carbon, silicates, hardness, nitrate, nitrite, pH, phosphate, salinity, temperature, suspended solids, phaeophytin, and chlorophyll); trace elements (aluminum, arsenic, cadmium, cobalt, copper, iron, lead, manganese, mercury, methylmercury, nickel, selenium, silver, and zinc); trace organics (including polycyclic aromatic hydrocarbons (PAHs), PCBs, phthalates, polybrominated diphenyl ethers, and pesticides); and toxicity. Water quality pollutants contained in the Bay at detectable levels include trace metals, pesticides, PCBs, PAHs, algae blooms/low dissolved oxygen, and sediment contamination. The most recent annual

\textsuperscript{81} Buchanan and Ganju, 2006. \textit{ibid}.
\textsuperscript{82} SWRCB, 2007. \textit{op. cit.}
\textsuperscript{84} Bay Institute, 2003. \textit{op. cit.}
RMP report with data collected in 2009 indicates that, with the exception of PCBs, water quality conditions remain within water quality objectives established by the SFRWQCB for the parameters monitored.

Waters in San Francisco Bay are generally well oxygenated with typical concentrations of dissolved oxygen (DO) ranging from 9 to 10 mg/L during high periods of river flow, 7 to 9 mg/L during moderate river flow, and 6 to 9 mg/L during the late summer months when flows are lowest. DO levels in the San Francisco Bay are typically high and well oxygenated. Concerns about sediment disruption causing problems related to reductions in DO occur in areas with anoxic sediment conditions and water bodies with low DO.

Approximately 800 million gallons of wastewater carrying 60 tons of nitrogen enters the San Francisco Bay annually. Until the 1980s, nutrient enrichment was a major problem to the San Francisco Bay estuary. Prior to the 1980’s, concentrations of ammonia and nitrogen in Bay waters were in excess of 15 mg/L. This level of enrichment led to algal blooms and anoxic conditions in portions of the Bay with poor water circulation including large portions of the South Bay. Improvements in wastewater treatment caused a large decrease in nutrient loads entering the estuary. Concentrations today are less than 3 mg/L and no anoxic conditions are being recorded.

7.2 Sediment Quality

The sediment that accumulates along the San Francisco waterfront is characterized by the recent deposition of unconsolidated (loose) sediment. Sediment accretes or accumulates as a result of natural sediment inflows from rivers, creeks, surface runoff, and, especially, from re-settlement of sediment suspended in Bay waters by natural processes (i.e. tidal action, wind, etc.). The Port has been conducting maintenance dredging at multiple berths along its waterfront for over 5 decades. The general practice between 1940 through 1980s was for Port staff utilizing their own equipment to dredge from pier face to pier face to a depth of -40ft year round. In the 1990’s due to budget constraints the Port needed to reduce costs and ceased this practice. Sediments within Port of San Francisco berths consist predominantly of Younger Bay Mud, characterized as mostly soft, fine-textured, dark-colored sediments with a high silt and clay content. For each dredging episode, the Port follows stringent regulatory guidance through the LTMS and Dredge Material Management Office process for characterizing sediments proposed to be dredged.

85 SFEI, 2010. op. cit.
86 SFEI, 2010. op. cit.
87 SFEI (San Francisco Estuary Institute), 2008. Effects of Short-term Water Quality Impacts Due to Dredging and Disposal on Sensitive Fish Species in San Francisco Bay. SFEI Contribution 560. San Francisco Estuary Institute, Oakland, California.
89 USGS, 2011. op. cit.
90 San Francisco Planning Department, 2001. op. cit.
7.3 Marine Habitats

7.3.1 Open Water (Pelagic) Habitat

Because of its close proximity to the Pacific Ocean, the open water (pelagic zone) environment of the Central Bay is very similar to the open water coastal environment. Pelagic habitat is the predominant marine habitat in Central San Francisco Bay and includes the area between the water surface and the seafloor. The water column can be further subdivided into shallow-water/shoal and deepwater/channel areas. The pelagic water column habitat is predominantly inhabited by planktonic organisms that either float or swim in the water, fish, marine birds, and marine mammals.

1. Plankton

The plankton community is divided into phytoplankton (floating plants), zooplankton (free swimming omnivores) and meroplankton (invertebrate and vertebrate larvae). The phytoplankton community is dominated by diatoms, dinoflagellates and cryptophytes that are predominantly marine in composition as well as tolerant of broad temperature and salinity ranges and can be found throughout the Bay-Delta. Because of the high water flow rates typically present in Central Bay due to high tidal flow, plankton blooms do not regularly occur. The zooplankton community consists of small invertebrate organisms that spend all or a portion of their life cycle in the water column and will change seasonally, with a few species being present year-round. These include microzooplankton (tintinnids, rotifers, and copepod nauplii), larger copepods (small crustaceans), cladocerans (small crustaceans or water fleas), and the larvae of benthic and pelagic invertebrate animals and fish (meroplankton). Other components of the zooplankton community include larvaceans, such as Oikopleura dioica, barnacle nauplii, polychaete worm larvae, ghost shrimp larvae and krill, which are important forage for planktivorous fish species. The opossum shrimp (Neomysis mercedis) is an especially important zooplankton species found in Central Bay waters because of its dominant role as a preferred food for young fishes, including several protected species or species of concern like American shad, Striped bass, and green sturgeon. Bay meroplankton is dominated by the northern anchovy (Engraulis mordax), longfin smelt (Sprianchus thaleichthys), Pacific herring (Clupea pallasi), plainfin midshipman (Porichthys notatus), the shrimps Palaemon macropodus, Crangon franciscorum and C. nigricauda, and the mysid Neomysis kadiakensis. All of these species are common fish forage either in their larval or adult stages.

92 NOAA. 2007a. op. cit.
93 NOAA. 2007a. op. cit.
94 NOAA. 2007a. op. cit.
2. Pelagic Fish

Thirty-three species of fish have been documented inhabiting Central Bay pelagic waters (Appendix C) in the years 2005 through 2009. Of these 33 taxa, three species account for 99 percent of the total abundance of fish regularly sampled in both the deep water and shallow areas of Central Bay. Northern anchovy (*Engraulis mordax*) is the overwhelming dominant species, accounting for up to 94 percent of those fish inhabiting the water column. Pacific herring (*Clupea pallasi*) and jacksmelt (*Atherinopsis californiensis*), are the second and third most common fish taxa in Central Bay waters, which together account for an additional 5 percent of the fish sampled on an annual basis.

Seven species of marine mammals are known to currently occupy Central Bay waters. The most common and predominant are the harbor seal (*Phoca vitulina*), California sea lion (*Zalophus californianus*), harbor porpoise (*Phocoena phocoena*), and Eastern Pacific stock of the gray whale (a.k.a., California gray whale) (*Eschrichtius robustus*). Additionally, the stellar sea lion (*Eumetopias jubatus*), humpback whale (*Megaptera novaeangliae*), and the California sea otter (*Enhydra lutra*) are occasionally observed in the Bay.

In general, the presence of marine mammals in San Francisco Bay is related to distribution and presence of prey species and foraging habitat. Additionally, harbor seals and sea lions use various intertidal substrates that are exposed at low to medium tide levels for resting and breeding.\(^{98}\) California sea lions are noted for using anthropogenic structures such as floating docks, piers, and buoys to haul out of the water to rest.

7.3.2 Intertidal and Subtidal Habitats

1. Intertidal Habitats

Intertidal habitats, or the regions of the Bay that lie between low and high tides, in Central Bay include sandy beaches, natural and artificial rock (quarried rip rap), concrete bulkheads, concrete, composite and wood pier pilings and mud flats. These intertidal habitats provide highly diverse and varied locations for marine flora and fauna. The Central Bay’s proximity to the Golden Gate and Pacific Ocean has resulted in an intertidal zone inhabited by many coastal as well as estuarine species. The natural bluff and exposed rocky shorelines of Yerba Buena, Alcatraz, and Angel Islands, the Marin Headlands, Tiburon Peninsula, and portions of San Francisco’s north shoreline and area within the Golden Gate National Recreation Area, interspersed with sandy pocket beaches, provide a different assortment of ecological niches than the quarried riprap rock areas found along Treasure, Alcatraz, and Angel Islands, areas along the northern shoreline of San Francisco and southern shoreline of Marin County.

\(^{98}\) NOAA. 2007a. *op.cit.*
Little scientific documentation is available that describes the intertidal communities within the San Francisco Bay-Delta. However, in support of the Treasure Island Redevelopment Project, an intertidal community characterization study was performed along the artificial rocky rip-rap shoreline of Treasure Island and along the natural western shoreline of Yerba Buena Island. This study reported that the hard substrate intertidal regions of the project area support numerous marine and estuarine species of red and green algae, bryozoa, sponges, ectoprocts, barnacles, mussels, chitons, crabs, and anemones. As stated previously, because of its proximity to and influence by coastal ocean water flowing through the Golden Gate, Central Bay intertidal invertebrate and algae communities contain many coastal hard substrate taxa interspersed with typical estuarine taxa, as illustrated by the presence of both the hybridized bay mussel (Mytilus trossulus/galloprovencialis) and the coastal mussel (M. californianus). The intertidal biological communities in Central Bay also include both native and non-native species.

The angular and piled rip-rap rocks that have been placed to protect numerous shoreline locations in Central Bay have been observed to provide additional habitat for a more diverse invertebrate community than observed in natural hard substrate intertidal locations because of the increased and protected surface area created by the piled rocks. These protected pockets provide numerous havens in which assorted marine species are able to survive and flourish.

The concrete, wood, and composite pier and wharf pilings in Central San Francisco Bay also provide both intertidal and subtidal habitat for marine biota. A March 2011 reconnaissance survey of marine biota attached to Port pilings at locations to be used for the America’s Cup project observed multiple species of barnacles, chitons, limpets, mussels, bryozoans, and tunicates, along with the native oyster (Ostrea lurida) and the sea star (Pisaster ochraceus). Observed algae included the green algae Ulva spp., the brown algae (Egregia menziesii), and the red algae (Polyneura latissima). Additional species of algae are expected to be present but were difficult to identify to the season of the survey. Both the hybridized bay mussel (Mytilus trossulus/galloprovencialis) and the coastal mussel (M. californianus) were observed.

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99 City and County of San Francisco Planning Department, Treasure Island/Yerba Buena Island Redevelopment Project Draft EIR. 2010 Case No. 2007.0903E Final Draft dated March 16, 2011
101 AMS. 2009b.
103 AMS. 2009b.
104 AMS. 2009b.
105 AMS. 2011. op. cit.
106 AMS. 2011. op. cit.
Pocket sand beaches in Central California are typically inhabited by polychaetes, oligochaetes, and nematodes with oligochaetes generally found in the higher intertidal. Additionally, seasonal pulses of harpacticoid copepods and archiannelid worms have been reported.\textsuperscript{107}

2. Subtidal Habitats

Central San Francisco Bay contains both soft sediment and hard substrate subtidal (below the low tide) habitat. Soft bottom substrate ranges between soft mud with high silt and clay content and areas of coarser sand. These latter tend to occur in locations subjected to high tidal or current flow. Soft mud locations are typically located in areas of reduced energy that enable deposition of sediments that have been suspended in the water column, such as in protected slips, under wharfs, and behind breakwaters and groins.

The Central Bay region has the largest accumulation of natural hard substrate in the Bay-Delta. The hard substrate benthos in San Francisco Bay consists of both natural and artificial surfaces. Natural substrates include boulders, rock face outcrops, and low relief rock. Artificial hard substrate includes submerged concrete breakwalls, bulkheads, vessel structures, pilings, riprap, and pipelines. Pilings, riprap, and pipelines can be found in every San Francisco Bay region and are a dominant feature along the Port’s waterfront. The western portion of Central Bay, between Alcatraz Island and the Golden Gate are four submerged rocks or pinnacles, including Arch Rock, Harding Rock, Shag Rock, and Blossom Rock. Several of these rise to within 40 feet of the sea surface. Most of these rock features were flattened to minimize navigation hazards when transiting the Bay. As a result, each of these natural features is surrounded by rubble and boulder fields.

These hard substrate areas provide habitat for an assemblage of marine algae, invertebrates and fishes, similar to the hard substrate in the intertidal zone of Central Bay. Submerged hard bottom substrate is typically covered with a mixture of turf organisms that is dominated by hydroids, bryozoans, tunicates, encrusting sponges, encrusting diatoms, and anemones. In the intertidal and near subtidal zones, the barnacles Balanus glandula, Amphibalanus amphitrite and A. impravisus are commonly present along with the Bay mussel, Mytilus trossulus/galapovincialis, the invasive Asian mussel Musculista senhousia, and the native or Olympia oyster Ostrea lurida. Barnacles can also be found subtidally on pier pilings, exposed rock outcropping and debris.\textsuperscript{108} At least six species of sponges, seven species of bryozoans, and the hydrozoans Ectopleura croea and G. franciscana are found inhabiting both natural and man-made hard substrate.\textsuperscript{109} Commonly observed isopods and amphipods include the surface deposit feeders Gnorimosphaeroma, sp., and Synidotea laevidorsalis, the algae grazers Ampithoe valida, Sphaeroma quoianum, and Eogammarus confervicullos, the carnivore Hopkinsia plana, and Incisocalliope derzhavini, Jassa marmorata and Stenothe.\textsuperscript{110}


\textsuperscript{108} NOAA. 2007a. op. cit.

\textsuperscript{109} NOAA. 2007a. op. cit.

\textsuperscript{110} NOAA. 2007a. op. cit.
In addition, three species of caprellids (i.e., detritivores, carnivores, and deposit feeders) are commonly observed only in Central Bay.\textsuperscript{111} Pacific rock crab (\textit{Cancer antennarius}) and the red rock crab (\textit{C. productus}) inhabit rocky, intertidal and subtidal areas in the Pacific Ocean, and likely use San Francisco Bay as an extension of their coastal habitats.\textsuperscript{112} Adult (age 1+) Pacific rock crabs are most commonly found in Central Bay in both the fall and spring months. Juveniles are most common in Central Bay from January to May and in South Bay from July to December.\textsuperscript{113} Pacific rock crabs move seasonally from channels (January to April) to shoals (June to December).\textsuperscript{114} The Pacific and red rock crabs are frequent targets of sport anglers from piers and jetties.

The predominant seafloor habitat in the project area is unconsolidated soft sediment composed of combinations of mud/silt/clay (particles 0.001 to 0.062 mm in diameter), sand (particles 0.062 to 2.0 mm in diameter), and pebble/cobble (particles 2 to 256 mm in diameter), with varying amounts of intermixed shell fragments. Exposure to wave and current action, temperature, salinity, and light penetration determine the composition and distribution of organisms within these soft sediments.\textsuperscript{115} Based on many geologic and marine biological studies conducted within the Bay-Delta, unconsolidated sediments are present throughout the Bay-Delta and are the predominant substrate type.

The unconsolidated gravel, sand and silt sediments of Central Bay can be subdivided into deepwater channels, slough channels, harbor, and shallow subtidal topographies, each exhibiting different sediment and ecological compositions and associated biological communities.\textsuperscript{116} Subtidal habitats in the western portion of Central Bay are characterized as coarse sand and gravel with shifting sands, muddy-sand and sandy-mud in the lee of the islands, and sand and sandy mud in the shallows and Port areas.\textsuperscript{117}

The muddy-sand benthic community of Central Bay consists of a diverse polychaete community represented by several subsurface deposit feeding capitellid species, a tube dwelling filter feeding species (\textit{Euchone limnicola}), a carnivorous species (\textit{Exogone lourei}), and the maldanid polychaete \textit{Sabaco elongatus}. There are also several surface deposit feeding \textit{Ameana} spp. persisting throughout the year.\textsuperscript{118}

The harbor and main channel areas of Central Bay are characterized as a mix of the benthic communities from surrounding areas (deep and shallow-water and slough marine communities) and include the obligate amphipod filter-feeder \textit{Ampelisca abdita} and the tube dwelling polychaete \textit{Euchone limnicola}. As a result of increased water flow and sedimentation in the harbor areas of

\textsuperscript{111} NOAA. 2007a. \textit{op. cit.}
\textsuperscript{113} Hieb. 1999. \textit{ibid.}
\textsuperscript{114} Hieb. 1999. \textit{ibid}
\textsuperscript{115} NOAA. 2007a. \textit{op. cit.}
\textsuperscript{116} NOAA. 2007a. \textit{op. cit.}
\textsuperscript{117} NOAA. 2007a. \textit{op. cit.}
\textsuperscript{118} NOAA. 2007a. \textit{op. cit.}
Central Bay, the majority of the species reported inhabiting seafloor sediments in this region of the Bay-Delta are deposit and filter feeders, including the amphipods *Grandidierella japonica*, *Monochythium acherusium*, and *Monocorophium alienense*, and the polychaetes *Streblospio benedicti* and *Psuedopolydora diopatra*. There is also a relatively high number of subsurface deposit feeding polychaetes and oligochaetes in these areas including *Tubificidae* spp., *Mediomastus* spp., *Heteromastus filiformis*, and *Sabaco elongatus*. There is also sufficient community complexity and abundance to support relatively high abundances of three carnivorous polychaete species: *Exogone louveri*, *Harmothoe imbricata*, and *Glycinde armigera*.

A recent assessment of benthic infauna inhabiting Central Bay sand mining leases\(^{119}\), reported a low diversity, low abundance community composed of 107 taxa that appeared to be heavily influenced by natural and anthropogenic sediment disturbance and instability.\(^{120}\) This sediment instability appeared to be the result of high currents in the area that characterize the portion of Central Bay near the Golden Gate. The study reported observing a region-wide community where the benthic infauna community was dominated by nematodes, polychaetes, oligochaetes and nemerteans, all which are worms, and amphipods. Other dominant taxa reported included several native and introduced bivalves (clams) and the holothurian (sea cucumber) *Leptosynapta* spp. Total animal density was estimated at about 2,000 individuals per m\(^2\).

The most common large mobile benthic invertebrate organisms in the Central Bay include blackspotted shrimp (*Crangon nigromaculata*), the bay shrimp (*Crangon franciscorum*), Dungeness crab (*Metacarcinus magister*), and the slender rock crab (*Cancer gracilis*). Although other species of shrimp are present in the Central Bay, their numbers are substantially lower when compared to the number of bay and blackspotted shrimps present.\(^{121}\) All of these mobile invertebrates are present throughout the Central Bay and provide an important food source for carnivorous fishes, marine mammals, and birds in San Francisco Bay’s food web. Dungeness crabs use most of the Bay as an area for juvenile growth and development prior to returning to the ocean as sexually mature adults.\(^{122}\)

Subtidal plants and Submerged Aquatic Vegetation (SAV) occur throughout Central Bay on both soft and hard substrate. On the shallow unconsolidated subtidal habitat within the Central Bay, such as in Clipper Cove and along the intertidal mudflats in Richardson Bay, the green algae, *Ulva/Enteromorpha*, *Gracillaria verrucosa*, *Ruppia maritime*, *Potamogeton pectinatus* and *Zostera marina* (eelgrass) frequently occur.\(^{123}\) *Zostera*, is a shallow subtidal as well as intertidal flowering plant found inhabiting bays, estuaries, and the leeside of islands, such as Treasure, Angel, Yerba Buena, and Alcatraz Islands.\(^{124}\) Bed locations and size are determined by water depth and turbidity. Eelgrass can only become established in those areas of the Bay-Delta where water


\(^{120}\) AMS. 2009a. *op. cit.*

\(^{121}\) NOAA. 2007a. *op. cit.*


\(^{123}\) NOAA. 2007. *op. cit.*

depth and turbidity allow light to penetrate to the seafloor. In addition to the eelgrass beds present along the major islands in Central Bay, extensive eelgrass beds are also located throughout Richardson Bay, in Clipper cove between Yerba Buena and Treasure Islands, along the southern shoreline of the Tiburon peninsula, such as in Kiel cove, within Horsehoe Cove, and along the East Bay shorelines of Richmond, San Leandro, Oakland, and Alameda. The eelgrass beds located throughout Richardson Bay are the largest in Central Bay and the second largest in the entire Bay-Delta. The Richardson Bay bed covers approximately 675 acres. Several studies have demonstrated that fauna in eelgrass beds is enhanced in numbers, species, and standing crop compared to unvegetated soft bottom habitat. Elgrass abundance and density is dynamic and fluctuates from year to year as a result of fluctuating physical conditions including, but not limited to, high freshwater and sediment discharge from the Delta and Bay watersheds, increased turbidity, extensive and violent storms, and water temperatures. SAV beds and plants are also primary spawning habitat for many invertebrate and vertebrate species in San Francisco Bay, most notably, Pacific herring.

In addition to eelgrass beds discussed above, because of the strong ocean influence in Central Bay, additional species of red and brown algae are found attached to submerged and intertidal hard substrate, including pier pilings. These include Cladophora serice, Codium fragile, Fucus gardneri, Laminaria sinclairii, Egregia, Halkymenia schizymenioides menziesii, Sargassum muticum, Polynura latissima, Cryptopleura violacea, and Gelidium coulteri. In addition, the species Codium fragile subspecies tomentosoides, Bryopsis hypnoides, Chondracanthus (formerly Gigartina) exasperata, Almfeiopsis (formerly Gymnogongrus) leptophyllus can be found inhabiting either hard or soft substrate. Oceanic species decline in numbers and presence the further east you go in the bay where the salinities can typically be much higher than oceanic species can tolerate. The only flowering plant found in the Bay is surfgrass (Phyllospadix), found only at the entrance to the Bay no further than Fort Baker and Fort Point on either side of the Golden Gate Bridge. All submerged aquatic vegetation in the Central Bay is considered critical essential fish spawning habitat for Pacific herring.

3. Demersal Fish

Many different fish species spend all or part of their life cycle in association with the demersal or (bottom) zone including flatfish, gobies, poachers, eelpouts, and sculpins, who all live in close

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129 NOAA. 2007a. op. cit.
130 NOAA. 2007a. op. cit.
131 NOAA. 2007a. op. cit.
132 NOAA. 2007a. op. cit.
133 NOAA. 2007a. op. cit.
134 NOAA. 2007a. op. cit.
135 The Magnuson-Stevens Act defines “essential fish habitat” as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.
association with the benthos during their sub-adult and adult life. Others, such as salmon, steelhead, longfin smelt, and other fish species will use the benthos for foraging.

In total, fifty-three demersal fish species have been collected from CDFW IEP monthly bottom trawl fish collections between 2005 and 2009 (Appendix C). Of these species, 12 constitute 98 percent of the species commonly inhabit the seafloor and immediately adjacent waters in both the deep and shallow water regions of Central Bay. The remaining forty-one taxa account for less than 0.1 percent each. Bay goby (Lepidogobius lepidus), English sole (Parophrys vetulus), speckled sanddab (C. stigmatas), plainfin midshipmen (P. notatus), Pacific staghorn sculpin (Leptocottus armatus), shiner perch (C. aggregata), cheekspot goby (Lepidogobius notatus), longfin smelt (S. thaleichthys), white croaker (G. lineatus), bonyhead sculpin (Arctedius notospilotus), Pacific sanddab (Citharinichthys sordidus), and bay pipefish (Syngnathus leptorhynchos) account for 98 percent of the species present over the past five years and dominate the community structure.

Managed, protected, or other fish species of concern or special significance observed inhabiting Central Bay seafloor areas include Pacific sardine (S. sagax), English sole (P. vetulus), Pacific sanddab (C. sordidus), lingcod (Ophiodon elongates), Brown rockfish (S. auriculatus), Kelp greenling (Hexagrammos decagrammus), Leopard shark Triakas seminascens, spiny dogfish shark (Squalus acantias), skates (Raja spp.), cabezon (Scopaeichthys marmaratus), and Pacific herring (C. pallasii) (Appendix C). Anadromous species use San Francisco Bay estuary on their way up rivers to spawn and as a rearing area for juveniles on their way down from their birthplace in the river to the open ocean. Native anadromous species include Chinook salmon (O. tsawytscha), steelhead trout (Oncorhynchus mykiss gairdneri) and both green and white sturgeon (Acipenser medirostris and A. transmontanus).

### 7.4 Non-native and Invasive Species

The introduction of non-native and invasive species represents a substantial threat to San Francisco Bay-Delta marine subtidal and intertidal habitats. California has the largest number of known introduced estuarine and marine animals. It has been reported that over 230 taxa have been introduced to the San Francisco Bay-Delta, which has been described as the most invaded estuary in North America. Introduced species now dominate all benthic communities within the Bay-Delta and make up more than 95 percent of the biomass and total abundance of organisms. New species of estuarine and marine animals are inadvertently or intentionally introduced into California waters regularly. It is currently estimated that a new aquatic species is introduced into the San Francisco Bay-Delta every 14 weeks, whereas prior to 1960 the rate was

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138 NOAA. 2007. op. cit.
139 Often referred to as invasive, introduced, non-indigenous, alien, non-native, or exotic species.
once every 55 weeks.\textsuperscript{142} Estuaries and sheltered coastal areas, such as San Francisco Bay, appear to be among the most invaded habitats as a result of being naturally disturbed, low-diversity systems with historic anthropogenic disturbance from shipping, industrial development, and urbanization.\textsuperscript{143} Historically, the principal mechanism of introduction into the Bay has been fouling, boring, and release of ballast dwelling organisms from boats and ships. In addition, many invasive species, such as striped bass (\textit{Morone saxatilis}), channel catfish (\textit{Ictalurus punctatus}), white catfish (\textit{Ameiurus catus}), and giant pacific oysters (\textit{Crassostrea gigas}), have been deliberately introduced into California waters. Introduced species within San Francisco Bay include snails, shrimp, plankton, fish, and crabs.

The introduction of non-native species into the Bay-Delta ecosystems can result in drastic, large-scale changes to the aquatic community. While most invasive species fail to survive and become established, posing little or no threat to native ecosystems or biological communities, a few have the potential to severely disrupt local ecosystems, fisheries, and human infrastructure.\textsuperscript{144} A few of the most damaging in the San Francisco Bay-Delta include the Chinese mitten crab (\textit{Eriocheir sinensis}), the European green crab (\textit{Carcinus maenas}), the Asian clam (\textit{Corbula amurensis}), and the isopod \textit{Sphaeroma quoyanum}. The Asian clam \textit{Corbula} has completely changed the subtidal benthic infaunal community in the western Delta and because of its voracious feeding on bacterioplankton, phytoplankton, and copepod larvae, it has significantly reduced the phytoplankton community in the North Bay and western Delta, resulting in reduced zooplankton and fish abundances and distributions.\textsuperscript{145,146,147} It is one of the contributing factors to population declines in the delta and longfin smelt populations in the Bay-Delta.\textsuperscript{148}

Invasive organisms are introduced by a variety of methods, the most prevalent being shipping, of which the largest single source is ballast water. Other methods of introduction relevant to the proposed Project include fouling organisms (such as the Asian kelp, \textit{Undaria pinnatifida}) that have attached themselves to ship hulls, navigation buoys, anchors and anchor chains.\textsuperscript{149} Additionally, invasive species may be located in ship bilges, drains, through-hull connections, and other locations on visiting boats.

\textsuperscript{143} Ray, G. 2005 ibid.
\textsuperscript{144} Ray, G. 2005 ibid.
\textsuperscript{145} Ray, G. 2005. \textit{op. cit.}
\textsuperscript{147} Thompson, J.K. and F. Parchaso. 2003. The immigration of an Asian bivalve \textit{Potamocorbula} in San Francisco Bay and the subsequent environmental change.
\textsuperscript{149} Ray, G. 2005 \textit{op. cit.}
SECTION 8
Effects of the Action

In general, direct effects are those which physically contact the species being analyzed, such as physical damage to an individual as in the case of barotraumas, entrainment, or the complete physical loss of a spawning or foraging habitat, a blocked migration corridor, or harassment of an animal species to the point where it abandons part of its normal range. Indirect effects would include ecosystem type changes that would primarily affect food web dynamics as would occur with decreased suitability of foraging habitat, temporary noise or physical disturbance that results in avoidance behavior, and the reduced food-web value of foraging habitat as the result of the introduction of non-native invasive species.

Potential direct and indirect effects from the proposed action are discussed by type of ecological effect expected and the activity causing the potential effect below. Because potential effects to marine mammals protected under the MMPA would be avoided and minimized, the Port will not seek an Incidental Harassment Authorization. Additionally, because the entirety of the in-water maintenance work will occur in areas designated as EFH under the Magnuson-Stevens Fishery Conservation and Management Act, the effects of the proposed Action analyzed in the following sections are discussed as they relate to impacts to such habitat.

8.1 Effects from In-water Maintenance Activities

8.1.1 Water/Sediment Quality Effects

The proposed Action would include the replacement and/or repair of approximately 1,000 piles per year, as well as the permanent removal of aging and dilapidated piles. As stated in Section 4.3 Proposed Project Activities, piles would be removed by either pulling them out using a barge mounted crane, or vibrated out using a vibratory hammer. Removal of a pile would result in short-term disturbance of bottom sediments and resuspension of sediments. Disturbed or resuspended sediments could increase the exposure of chemical concentrations to aquatic receptors in the localized area and could result in adverse water quality and biological effects.

Debris or portions of degraded creosote piles may be encountered during pile replacement. Piles that are not recommended for pulling due to known contaminant levels in the surrounding substrate will be cut two feet below the mudline, to the extent feasible, by divers using waterproof chainsaws. Creosote is an effective wood preservative in a marine environment but also contains organic compounds toxic to marine organisms. Although removal of creosote
pilings may release some organic substances, removal of degraded or old pilings would improve the localized and eventually long-term water and sediment quality.

Typically, removal of piles causes only temporary resuspension of sediments. Suspended sediments in the water column can lower levels of dissolved oxygen, increase salinity, increase concentrations of suspended solids, and possibly release chemicals present in the sediments into the water column. The concentration of suspended sediments will vary based on the production rate of removal, the number of piles and duration of the construction activity, and would depend also on the methods used, the quality of equipment, and care of the operator. In all cases, increased turbidity levels would be relatively short-lived and generally confined to within a few hundred yards of the activity. After initially high turbidity levels, sediments would disperse and background levels would be restored within hours of disturbance.

The potential effects of suspended sediment within the water column on fish include gill lacerations, increased “coughing” behavior, decreased feeding success, and avoidance behaviors (Wilber and Clarke, 2001). Sediment plumes that may be caused by pile removal are expected to be extremely small in area and short in duration. Based on studies of recent projects by the Corps, it is estimated that any potential impact due to resuspended sediments would be limited to a distance up and down current of approximately 100 feet (Corps, 2004). Recent studies by the San Francisco Estuary Institute (SFEI, September 2008) determined that the short term effects of dredging on sensitive fish species due to dredging activities would be minor. Considering that the volume of sediment being disturbed by pile removal would be a significantly smaller fraction (orders of magnitude) of that disturbed by even a small scale dredging operation, and the limited duration of discrete maintenance activities, it can be assumed that the water quality impacts of pile removal would be smaller still and well below the threshold of concern.

Contaminants bound to suspended sediments could also degrade water quality by reducing dissolved oxygen concentrations in the water column and contaminants could leach into the water from the sediments. Substantially depressed oxygen levels (i.e., below 5.0 mg/l) may cause respiratory stress to aquatic life, and levels below 3.0 mg/l may cause mortality. However, oxygen level depression resulting from Action Area maintenance activities is not expected to remain depressed for long periods. First, tidal flushing would be expected to ameliorate depressed oxygen levels by the ongoing introduction of oxygenated water into the Action Area. Second, releases of anoxic (oxygen-poor) sediment would occur for relatively short time periods.

While the majority of water and sediment quality impacts from the proposed Action will result from pile removal and replacement, other in-water actions could produce similar effects. The maintenance and reconfiguration of existing bulkheads and breakwaters may also result in temporary increases in suspended sediment. However, any water quality impacts related to the reconfiguration of existing structures would occur at a lesser magnitude than the in-water pile work; which itself is expected to generate effects well below the thresholds of concern.

Additionally, the maintenance and repair of existing unarmored and armored shorelines may create temporary impacts to water quality. While most of the maintenance work will occur from
land, some of the installation and replacement of rip-rap and concrete features is expected to occur in-water. These activities have the potential to cause impacts to sediment quality on a small scale similar to the effects from the maintenance of existing bulkheads and breakwaters. These effects are expected to be isolated, temporary, and of low overall impact to fish.

The general maintenance of pier structures, docking facilities, bollards, cranes and other small appendages will occur above, not within water, and is unlikely to result in significant effects to water quality or sediment. Temporary increases in shading will be offset by the long-term net reduction in overwater structures.

As stated above, increased turbidity levels associated with in-water maintenance and removal activities would be relatively short-lived and generally confined to within a few hundred yards of the activity. After initially high turbidity levels, sediments would disperse and background levels would be restored within hours of disturbance. In addition, normal circulation and strong currents along the San Francisco waterfront rapidly circulate and disperse water temporarily affected by construction activities. Turbidity plumes would disperse within a matter of hours, and the particulate concentrations would be diluted to levels that would pose no major threat to water quality or aquatic wildlife.

8.1.2 Noise Effects from Pile Driving

1. Background

Concrete, wood, and steel piles that are driven within the water column can produce high-intensity noise resulting in damage to soft tissues, such as gas bladders or eyes (barotraumas) and/or result in harassment of fish and marine mammals such that they alter swimming, sleeping, or foraging behavior or abandon temporarily forage habitat. Protected and managed fish species, including salmon, steelhead, longfin smelt, Pacific herring, anchovies, mackerel, sardine, soles, sanddab, green sturgeon, and other bottom fish as well as harbor seal and California sea lion use the waters adjacent to the Port for foraging and as a transit corridor between the open ocean (via the Golden Gate) and South Bay. However, the Port’s proposed pile maintenance activities will not include the driving of steel or concrete piles, and will be limited to wood pile driving only; generally underwater noise generated by driving wood and concrete piles is less intensive than for comparable steel piles (Table 8-1).

The striking of a pile by a pile-driving hammer creates a pulse of sound that propagates through the pile, radiating out through the water column, seafloor, and air. Sound pressure pulses, as a function of time are referred to as a waveform. Peak waveform pressure underwater is typically expressed in decibels (dB) referenced to 1 microPascal (μPa). Sound levels are generally reported as peak levels (peak) and sound exposure levels (SEL). In addition to the pressure pulse of the waveform, the frequency of the sound, expressed in Hertz (Hz) is also important to evaluating the potential for sound impacts. Low frequency sounds are typically capable of traveling over greater distances with less reduction in the pressure waveform than high frequency sounds.
TABLE 8-1
SINGLE-STRIKE SOUND LEVELS ASSOCIATED WITH DIFFERENT PILES
(MEASURED AT 10 METERS FROM PILE)\(^1\)

<table>
<thead>
<tr>
<th>Pile Size/Type</th>
<th>Peak Pressure (dB)</th>
<th>RMS Sound Pressure (dB)</th>
<th>Sound Exposure Level (dB)(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-inch Wood drop</td>
<td>177</td>
<td>165</td>
<td>157</td>
</tr>
<tr>
<td>18-inch Concrete impact</td>
<td>185</td>
<td>166</td>
<td>154</td>
</tr>
<tr>
<td>12-inch Cast-in-shell steel (CISS) impact</td>
<td>190</td>
<td>180</td>
<td>165</td>
</tr>
</tbody>
</table>


\(^2\) SEL- for 1 second of continuous driving.

Vibratory pile drivers work on a different principal than pile-driving hammers and therein produce a different sound profile. A vibratory driver works by inducting particle motion to the substrate immediately below and around the pile causing liquefaction of the immediately adjacent sediment, allowing the pile to sink downward or removed. Vibratory pile driving is only suitable where soft substrate is present. Sound levels are typically 10-20 dB lower in intensity relative to the higher, pulse-type noise produced by an impact hammer.\(^{150}\)

The Port’s proposed pile maintenance activities would be limited to driving wood piles, the majority of which would be 12 inch diameter wood piles. Table 8-2 below provides a summary of the anticipated underwater noise levels from installation of wood pilings using an impact hammer. There has been limited opportunity for the measurement of sound levels associated with wood pile driving in situ; however, Caltrans was able to measure the underwater sound pressure levels for the impact driving of four wood piles as part of marina construction in Alameda, California. Primary measurements were made at 10 meters from the piles, where peak sounds pressure levels were generally in the range of 170-180 dB and RMS sounds pressure levels ranged from 160-168 dB\(^{151}\). A cushion block was used between the hammer and pile when peak sound levels exceeded 180 dB. These levels are below the established sound threshold of 183 dB for potential impact to fish < 2 grams and 187 dB for fish > 2 grams.

2. Noise Effects to Fish

Scientific investigations on the potential effect of noise on fish indicate that sound levels below 187 dB do not appear to result in any acute physical damage or mortality to fish (barotraumas)\(^{152}\). Table 8-3 provides a summary of known acute and sub-lethal effects of noise on fish. Noise levels

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\(^{150}\) Caltrans 2009. *op. cit.*

\(^{151}\) Caltrans 2009. *op. cit.*

\(^{152}\) Dalen, J. and G.M. Knutsen. 1986. Scaring effects of fish and harmful effects on eggs, larvae and fry from offshore seismic explorations. ICA Associated Symposium on Underwater Acoustics, 16-18 July, Halifax, Canada
TABLE 8-2

ESTIMATED IMPACT HAMMER PILE DRIVING SOUND LEVELS
AND DISTANCES TO CRITERIA LEVELS

<table>
<thead>
<tr>
<th>Pile Type</th>
<th>Measured Sound Levels¹ (dB)</th>
<th>Distance Required to Reach Sound Level Thresholds² (meters)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Peak Sound Level</td>
<td>SEL</td>
</tr>
<tr>
<td>12-inch Wood</td>
<td>177</td>
<td>157</td>
</tr>
</tbody>
</table>

¹ The distance at which sound levels were measured was 10-meters

TABLE 8-3

POTENTIAL EFFECTS TO FISH AT VARYING NOISE LEVELS

<table>
<thead>
<tr>
<th>Taxa</th>
<th>Sound Level (dB)</th>
<th>Effect</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fish</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All fish &gt; 2 grams in size</td>
<td>206 peak 187 (SEL)</td>
<td>Acute Barotraumas</td>
<td>Fisheries Hydroacoustic Working Group, 2008</td>
</tr>
<tr>
<td>All fish &lt; 2 grams</td>
<td>186 (SEL)</td>
<td>Acute Barotraumas</td>
<td>Fisheries Hydroacoustic Working Group, 2008</td>
</tr>
<tr>
<td>Pacific herring</td>
<td>180-186</td>
<td>Avoidance behavior</td>
<td>Dales and Knudsen, 1986</td>
</tr>
<tr>
<td>Salmon, steelhead</td>
<td>166</td>
<td>Avoidance behavior</td>
<td>Loeffelman et al. 1991</td>
</tr>
<tr>
<td>Salmon, Steelhead</td>
<td>140-160</td>
<td>Startle response</td>
<td>San Luis and Delta Mendota Water Authority and C.H. Hanson. 1996</td>
</tr>
</tbody>
</table>

¹ Level A harassment is defined as any act of pursuit, torment, or annoyance with has the potential to injure a marine mammal or marine mammal stock in the wild.
² Level B harassment is defined as any act of pursuit, torment, or annoyance with has the potential to disturb a marine mammal or marine mammal stock in the wild.

that result in startle responses in steelhead trout and salmon have been documented to occur at sound levels as low as 130 dB at a frequency of 100 Hz and between 180 and 186 dB in Pacific herring.¹⁵³ Any disturbance to ESA listed fish species that results in altered swimming, foraging, movement along a migration corridor, or any other altered normal behavior is considered harassment.

The use of vibratory hammers to install the 12-inch wood piles is expected to generate sounds lower than 187 dB for a short period of time.\textsuperscript{154,155} During pile driving activities, fish are not expected to be present within this zone, since the movement of the wood pile through the shallow water and initial contact with the Bay floor will result in any fish that are present to quickly leave the immediate area. Any salmon, steelhead, green sturgeon, longfin smelt, Pacific herring, or MSA-managed fish species swimming near pile driving activities are therefore not expected to experience any acute effects or barotraumas from vibratory pile driving.

During the very limited use of the impact hammer, sound levels generated from driving wood piles, typically 12” diameter, are not expected to exceed 187 dB and pose little risk to fish (Table 8-3). Small fish such as herring, sardines, and anchovies as well as salmon, steelhead and sturgeon may be forced to modify their foraging and/or normal swimming behaviors in response to increased sound levels, however, the use of BMPs such as cushion blocks and a “soft start” technique can be expected to reduce transmitted sounds levels and the distance over which potentially deleterious sounds levels will travel. Additionally, monitoring for Pacific herring during the spawning season of December 1 – February 28 and avoiding in water work during the presence of a spawn will avoid impacts on Pacific herring.

In summary, the potential for noise effects to salmon, steelhead, green sturgeon, longfin smelt, Pacific herring, and MSA-managed fish species from installation of 12-inch wood piles by vibratory hammers is extremely minimal. The potential for noise effects from the use of an impact hammer for the final installation of the piles would still be minimal, based upon Caltrans data of observed underwater noise effects from wood pile driving. Finally, the implementation of the proposed avoidance and minimization measures and standard BMPs (such as cushion blocks and a “soft start” technique, as enumerated in Section 5 above) would further reduce potential effects.

8.2 Effects to Wetlands and Special Aquatic Sites

Essential Fish Habitat in San Francisco Bay includes aquatic resources such as eelgrass beds and native oyster beds; both of which are protected as Special Aquatic Sites. Potential effects to eelgrass beds and native oyster beds are considered below.

Based on the findings of the Ecological Limits, Viability, and Sustainability (ELVS) Predictive Model and focused eelgrass surveys on the San Francisco waterfront (Merkel, 2010), no eelgrass impacts are anticipated in work areas that are located within the Action Area north of Mission Creek.

The ELVS model showed a narrow potential for the occurrence of eelgrass in isolated shoreline pockets between Mission Creek and Heron’s Head Park. However, subsequent inspection of these areas did not identify eelgrass in the area (Merkel, 2010). Based on these findings, no impacts are anticipated to eelgrass between Mission Creek and Heron’s Head Park in waters deeper than 2 m or beneath existing structures, including piers and wharves. It is possible, based

\textsuperscript{154} URS. 2011. \textit{op. cit.}
\textsuperscript{155} NMFS. 2011 \textit{op.cit.}
on the potential presence of modeled habitat that sparse undiscovered stands of eelgrass may be present between Mission Creek and Heron’s Hear Park in waters shallower than 2 m and could be impacted by activities. However, review of the Merkel (2010) survey, bathymetry profiles provided in the Merkel report, and historic aerial photographs of the San Francisco waterfront at various tidal stages suggest that eelgrass is in fact absent from these areas. Based on the above, potential impacts to eelgrass are expected to be negligible to none.

It is anticipated that few oysters would be affected during the proposed maintenance activities, such as the repair and/or replacement of piles and hardscape, and that replacement piles and hardscape would provide comparable habitat to removed features. It is anticipated that few oysters may also be affected during the proposed permanent removal of some aging and dilapidated piles and associated pile-supported structures (which are no longer serviceable). However, the permanent removal is proposed to a lesser degree than other maintenance activities. Furthermore, the permanent removal of these aging structures would result in removal of an in-water contaminant source (the majority of these older wood piles are creosote-treated), thereby improving water quality and overall habitat health.

### 8.3 Cumulative Effects (Future State, Tribal, Local, and Private Actions)

Cumulative effects under the ESA are those effects of future state or private activities, not involving federal activities, that are reasonably certain to occur within the Action Area (50 CFR 402.02). Future federal actions that are unrelated (i.e., not interrelated or interdependent) to the proposed action are not considered in this assessment because they will be subject to separate consultation pursuant to Section 7 of the ESA.

The majority of Actions which might be considered to result in cumulative impacts involve ongoing development and restoration along the Central San Francisco Bay waterfront. Most of these actions have limited in-water work or activities. Also, all will be subject to future Section 7 consultation for any in-water work involving dredging, pile driving, and increased vessel traffic. The completion of the new eastern span of the Bay Bridge and Phase 3A of the Golden Gate Bridge Seismic Retrofit of the North Anchorage create and have had impacts, but have already undergone Section 7 consultation and thus are considered part of baseline conditions. Other recently completed projects that could be biologically linked to this project include the Brannan Street Wharf Public Open Space, the redevelopment of Treasure Island, the construction and operation of a 400-berth marina in Clipper Cove, Exploratorium project at Pier 15, Alcatraz landing improvements at Piers 31-33, Port of San Francisco maintenance dredging, Corps channel maintenance dredging, the Transbay Tube and Ferry Terminal seismic improvements (Tube Vibro), the San Francisco Marina renovation, construction activities related to the America’s Cup, and continued aggregate sand mining on subtidal leases of the State of California in Central Bay. All of these projects can be expected to have (or have had) similar potential direct and indirect effects on marine biological resources as the Port maintenance (temporary water quality impairment, noise impacts to fish and marine mammals), but also may be subject to a future Section 7 consultation.
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SECTION 9
Conclusion and Determination

This section discusses the conclusions of this BA that were formulated using the discussion of potential species present, habitat presence and suitability, and project effects discussed in previous sections.

9.1 ESA Section 7

The proposed Action’s in-water project components consist of maintenance, repair, replacement, and debris removal activities along the San Francisco waterfront from Pier 40 to India Basin. Project actions could, but are not expected to, adversely affect green sturgeon, longfin smelt, Central California Coast ESU and California Central Valley ESU River steelhead trout, and Sacramento Chinook Salmon (spring-run and winter-run). These effects would be the result of potential:

- Water quality impairment, and
- Underwater noise effects to fish and foraging habitat.

Implementation of proposed conservation measures are expected to result in either avoidance or minimization of these potential effects as discussed below.

9.1.1 Water Quality Impairment

Localized water quality impairment can be expected to occur during pile installation and removal, as well as during other in-water maintenance and removal activities proposed under the Project. This impairment would primarily include short-term increases in turbidity. The high tidal flushing and water exchange present in the waters adjacent to the Port’s jurisdiction and the naturally-occurring suspension of sediments would result in short-term increases in suspended sediments/turbidity within the area of construction only, and are not expected to result in any catastrophic or chronic adverse effects to considered species. No permanent loss or impairment of critical habitat for any of the considered species is expected as a result of predicted water quality impairments from pile installation and removal or the other maintenance and removal activities proposed.

9.1.2 Noise

The installation and removal of 12-inch wood pilings can be expected to generate noise levels over short distances that could result in disturbance to species of concern (Chinook salmon,
Steelhead trout, longfin smelt, and green sturgeon). This disturbance would be expected to result in short-term and temporary altered swimming and foraging behavior as well as exclusion from some foraging areas immediately adjacent to surrounding the pile driving activity. Vibratory hammers would be used for all pile installation and removal. Vibratory pile driving is documented to produce sound levels that do not result in acute barotrauma effects or direct mortality. Additionally, the natural avoidance behavior of fish from the noise and disturbance caused by the placement of the wood pile on the seafloor prior to vibratory pile driving can be expected to limit the presence of any species of concern.

Impact hammering may also be necessary to finish installing the 12-inch wood piles. As detailed in Section 8 above, sound levels resulting from impact hammering would not result in acute barotrauma effects or direct mortality.

In summary, the proposed Action would not result in permanent impacts to ESA- and EFH-managed species or candidate species, based on: (a) the avoidance and minimization measures proposed in this BA; (b) the specific avoidance and minimization measures proposed for pile driving activities; and (c) the relatively small percentage of habitat and temporary nature of most Action activities that would be involved. The proposed Action may, however, result in:

- Minor temporary impacts to individual green sturgeon and longfin smelt, primarily through disturbance and habitat avoidance;
- Minor temporary impacts to individual adult and juvenile Central California Coast ESU and California Central Valley ESU steelhead trout, primarily through disturbance and habitat avoidance, when pile driving occurs during their migration and foraging in Central Bay;
- Minor temporary impacts to migrating and foraging adult and juvenile Central Valley Chinook Salmon (spring-run and winter-run) if pile driving occurs during their migration period; and
- Potential temporary impacts to designated critical habitat for adult and juvenile Central California Coast ESU and California Central Valley ESU steelhead trout, Central Valley Chinook Salmon (spring-run and winter-run), and green sturgeon, primarily through short-term turbidity and noise-related disturbance.

For convenience, the impacts on species and habitats protected under the ESA are summarized in Tables 9-1 and 9-2 at the end of this section.

### 9.2 Magnuson-Stevens Fishery Conservation and Management Act (Essential Fish Habitat)

The proposed Action will temporarily modify EFH within localized portions of the San Francisco waterfront; however, effects will not result in permanent habitat loss or more than short-term displacement of MSA-managed species and habitat. The proposed Action may affect EFH in the following ways (as discussed in more detail in Section 8 – Effects of the Action, above):
• Localized and temporary turbidity impacts caused by the installation and removal of pilings.

• Disturbance of benthic foraging habitat during the installation and removal of pilings.

• Potential temporary exclusion from occupied habitat associated with the avoidance of increased noise levels generated during pile driving.

Potential impacts to EFH will be minor and generally limited to the immediate area of piles that will be removed and/or replaced during the project. Pile removal will generate a small, localized sediment plume around each removal site that will dissipate quickly, due to typical shoreline hydrodynamics. The installation of wood piles will temporarily displace some fish during active pile driving; however, the installation of wood piles does not cause acute barotrauma (i.e., tissue damage) and temporary displacement of fish will be short lived. Likewise, disturbed benthic sediment will quickly be recolonized by benthic and inbenthic invertebrates and should resemble pre-project conditions within 6 months to 1 year following disturbance. The implementation of the proposed avoidance, minimization, and conservation measures will significantly reduce the relative impact to EFH, and in conjunction with local hydrology, reduce the duration and footprint of disturbance.
9. Conclusion and Determination

TABLE 9-1
SUMMARY OF EFFECTS FOR FEDERALLY LISTED AND CANDIDATE SPECIES OF CONCERN

<table>
<thead>
<tr>
<th>Individual Taxa</th>
<th>Effect</th>
<th>Take – Death or Injury</th>
<th>Potential risk of Death or Injury</th>
<th>Impact Avoidance and Minimization Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green Sturgeon, Southern DPS (Acipenser medirostris)</td>
<td>May Affect, Not Likely to Adversely Affect</td>
<td>Injury or death from pile driving noise</td>
<td>Negligible to none</td>
<td>Vibratory Pile driving Pile Driving BMPs</td>
</tr>
<tr>
<td>Steelhead, Central California Coast ESU (Oncorhynchus mykiss)</td>
<td>May Affect, Likely to Adversely Affect</td>
<td>Injury or death from pile driving noise</td>
<td>Negligible to none</td>
<td>Vibratory Pile driving Pile Driving BMPs</td>
</tr>
<tr>
<td>Steelhead, California Central Valley ESU (Oncorhynchus mykiss)</td>
<td>May Affect, Likely to Adversely Affect</td>
<td>Injury or death from pile driving noise</td>
<td>Negligible to none</td>
<td>Vibratory Pile driving Pile Driving BMPs</td>
</tr>
<tr>
<td>Chinook Salmon, Central Valley (Sacramento) spring-run (Oncorhynchus tshawytscha)</td>
<td>May Affect, Likely to Adversely Affect</td>
<td>Injury or death from pile driving noise</td>
<td>Negligible to none</td>
<td>Vibratory Pile driving Pile Driving BMPs</td>
</tr>
<tr>
<td>Chinook Salmon, Central Valley (Sacramento) winter-run (Oncorhynchus tshawytscha)</td>
<td>May Affect, Likely to Adversely Affect</td>
<td>Injury or death from pile driving noise</td>
<td>Negligible to none</td>
<td>Vibratory Pile driving Pile Driving BMPs</td>
</tr>
<tr>
<td>Longfin Smelt (Spirinchus thaleichthys)</td>
<td>May Affect, Likely to Adversely Affect</td>
<td>Injury or death from pile driving noise</td>
<td>Negligible to none</td>
<td>Vibratory Pile driving Pile Driving BMPs</td>
</tr>
</tbody>
</table>
### TABLE 9-2
SUMMARY OF EFFECTS ON CRITICAL HABITAT FOR FEDERALLY LISTED SPECIES OF CONCERN

<table>
<thead>
<tr>
<th>Critical Habitat</th>
<th>Likely to Destroy or Adversely Modify</th>
<th>Not Likely to Destroy or Adversely Modify</th>
<th>Direct Effect</th>
<th>Indirect Effect</th>
<th>Impact Avoidance and Minimization Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green sturgeon, Southern DPS, critical habitat</td>
<td>X</td>
<td></td>
<td>None</td>
<td>None; recovery of habitat expected within months; very small area of comparable habitat within Action Area; Limited potential for introduction and spread of invasive taxa</td>
<td>Minimized maintenance footprint; No new in-water construction</td>
</tr>
<tr>
<td>Steelhead, Central California Coast ESU critical habitat</td>
<td>X</td>
<td></td>
<td>None</td>
<td>None; recovery of habitat expected within months; very small area of comparable habitat within Action Area; Limited potential for introduction and spread of invasive taxa</td>
<td>Minimized maintenance footprint; No new in-water construction</td>
</tr>
<tr>
<td>Steelhead, California Central Valley ESU critical habitat</td>
<td>X</td>
<td></td>
<td>None</td>
<td>None; recovery of habitat expected within months; very small area of comparable habitat within Action Area; Limited potential for introduction and spread of invasive taxa</td>
<td>Minimized maintenance footprint; No new in-water construction</td>
</tr>
<tr>
<td>Chinook Salmon, Central Valley (Sacramento) spring-run critical habitat</td>
<td>X</td>
<td></td>
<td>None</td>
<td>None; recovery of habitat expected within months; very small area of comparable habitat within Action Area; Limited potential for introduction and spread of invasive taxa</td>
<td>Minimized maintenance footprint; No new in-water construction</td>
</tr>
<tr>
<td>Chinook Salmon, Central Valley (Sacramento) winter-run</td>
<td>X</td>
<td></td>
<td>None</td>
<td>None; recovery of habitat expected within months; very small area of comparable habitat within Action Area; Limited potential for introduction and spread of invasive taxa</td>
<td>Minimized maintenance footprint; No new in-water construction</td>
</tr>
</tbody>
</table>
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SECTION 10

References


References


City and County of San Francisco Planning Department, Treasure Island/Yerba Buena Island Redevelopment Project Draft EIR. 2010 Case No. 2007.0903E Final Draft dated March 16, 2011


Miller and Kaplan. 2001. Petition to list the North American Green Sturgeon (Acipenser medirostris) as an endangered or threatened species under the Endangered Species Act. Prepared by the Environmental Protection Information Center, Center for Biological Diversity, and Waterkeepers Northern California.


SFEI (San Francisco Estuary Institute), 2008. Effects of Short-term Water Quality Impacts Due to Dredging and Disposal on Sensitive Fish Species in San Francisco Bay. SFEI Contribution 560. San Francisco Estuary Institute, Oakland, California.


APPENDIX A

Special-Status Fish and Marine Mammal Species that May Occur Within the Bay Waters of the Proposed Project
### TABLE A-1
SPECIAL-STATUS FISH AND MARINE MAMMAL SPECIES THAT MAY OCCUR WITHIN THE BAY WATERS OF THE PROPOSED PROJECT

<table>
<thead>
<tr>
<th>Common Name Scientific Name</th>
<th>Listing Status</th>
<th>Potential for Species Occurrence Within Project Site</th>
<th>General Habitat</th>
<th>Time Period Present in Project Waters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sacramento River winter-run ESU Chinook salmon</td>
<td>FE/-</td>
<td>P</td>
<td>Ocean waters, Sacramento and San Joaquin Rivers; Migrates from Ocean through San Francisco Bay-Delta to freshwater spawning grounds</td>
<td>Adults - November and December Juveniles – fall and winter</td>
</tr>
<tr>
<td>Oncorhynchus tshawytscha</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central Valley spring run ESU Chinook salmon</td>
<td>FT/-</td>
<td>P</td>
<td>Ocean waters, Sacramento and San Joaquin Rivers; Migrates from Ocean through San Francisco Bay-Delta to freshwater spawning grounds</td>
<td>Adults - late winter to spring Juveniles - fall though spring</td>
</tr>
<tr>
<td>O. tshawytscha</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central Valley fall run/late fall run Chinook salmon</td>
<td>FSC/-</td>
<td>P</td>
<td>Ocean waters, Sacramento and San Joaquin Rivers; Migrates from Ocean through San Francisco Bay-Delta to freshwater spawning grounds</td>
<td>Adults - June through September Juveniles - winter through summer</td>
</tr>
<tr>
<td>O. tshawytscha</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central California coast ESU Coho salmon</td>
<td>FE/-</td>
<td>P</td>
<td>Ocean waters, Sacramento and San Joaquin Rivers; Migrates from Ocean through San Francisco Bay-Delta to freshwater spawning grounds</td>
<td>Adults - fall and winter Juveniles - spring through fall</td>
</tr>
<tr>
<td>Oncorhynchus kisutch</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central Valley DPS steelhead trout</td>
<td>FT/-</td>
<td>P</td>
<td>Ocean waters, Sacramento and San Joaquin Rivers; Migrates from Ocean through San Francisco Bay-Delta to freshwater spawning grounds</td>
<td>Adults - winter and spring Juveniles-Year round</td>
</tr>
<tr>
<td>O. mykiss</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central California coast DPS steelhead trout</td>
<td>FT/-</td>
<td>P</td>
<td>Ocean waters, Sacramento and San Joaquin Rivers; Migrates from Ocean through San Francisco Bay-Delta to freshwater spawning grounds</td>
<td>Adults – winter Juveniles - Year round</td>
</tr>
<tr>
<td>O. mykiss</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green Sturgeon (Southern DPS) Acipenser medirostris</td>
<td>FT/-</td>
<td>C</td>
<td>Marine and estuarine environments and Sacramento River; All of San Francisco Bay-Delta</td>
<td>Year round</td>
</tr>
<tr>
<td>Tidewater goby Eucyclogobius newberryi</td>
<td>FE/-</td>
<td>N/A</td>
<td>Coastal lagoons, estuaries, and marshes in coastal California from the Smith River (Del Norte County) to Aqua Hedionda Lagoon (San Diego County)</td>
<td>NP- species presumed to be extirpated from San Francisco Bay-Delta</td>
</tr>
<tr>
<td>Delta smelt Hypomesus transpacificus</td>
<td>FT/-</td>
<td>N/A</td>
<td>Sacramento-San Joaquin Delta, Suisun Bay, San Pablo Bay, river channels and sloughs in Delta</td>
<td>NA</td>
</tr>
</tbody>
</table>


Port of San Francisco RGP for Shoreline Maintenance
Biological Assessment
A-2

April 2015
### TABLE A-1 (Continued)
**SPECIAL-STATUS FISH AND MARINE MAMMAL SPECIES THAT MAY OCCUR WITHIN THE BAY WATERS OF THE PROPOSED PROJECT**

<table>
<thead>
<tr>
<th>Common Name Scientific Name</th>
<th>Listing Status</th>
<th>General Habitat</th>
<th>Potential for Species Occurrence Within Project Site</th>
<th>Time Period Present in Project Waters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longfin smelt <em>Spirinchus thaleichthys</em></td>
<td>FC/-CT</td>
<td>Throughout the nearshore coastal waters and open waters of San Francisco Bay-Delta including the river channels and sloughs of the Delta</td>
<td>C</td>
<td>Year round</td>
</tr>
<tr>
<td>Pacific harbor seal <em>Phoca vitulina</em></td>
<td>-/FP</td>
<td>Coastal waters, and throughout Bay-Delta</td>
<td>C</td>
<td>Year round</td>
</tr>
<tr>
<td>California sea lion <em>Zalophus californianus</em></td>
<td>-/FP</td>
<td>Coastal waters, and throughout Bay-Delta</td>
<td>C</td>
<td>Year round</td>
</tr>
<tr>
<td>Harbor porpoise <em>Phocoena phocoena</em></td>
<td>-/FP</td>
<td>An inshore species inhabiting shallow, coastal waters and occasional large rivers, including San Francisco Bay-Delta</td>
<td>C</td>
<td>Year round</td>
</tr>
<tr>
<td>Gray whale <em>Eschrichtius robustus</em></td>
<td>FDL/FP</td>
<td>Predominantly coastal waters although occasional individuals enter the Bay-Delta and have been observed swimming up the Sacramento River and into south Bay.</td>
<td>P</td>
<td>December to April, during migration from Alaska to Baja California, occasionally enter Bay-Delta, transient</td>
</tr>
<tr>
<td>Humpback whale <em>Megaptera novaeangliae</em></td>
<td>FE/FD</td>
<td>Predominantly coastal waters although occasional individuals enter the Bay-Delta</td>
<td>P</td>
<td>April to December, during migration, occasionally enter Bay-Delta, transient</td>
</tr>
</tbody>
</table>

**SOURCE CODES:**

- Federal (U.S. Fish and Wildlife Service [USFWS]):
  - FDL = Delisted
  - FT = Listed as Threatened (in danger of extinction) by the federal government.
  - FP = Proposed for Listing as Endangered or Threatened.
  - FC = Candidate to become a proposed species.
  - FSC = Former Federal Species of Concern. The USFWS no longer lists Species of Concern but recommends that species considered to be at potential risk by a number of organizations and agencies be addressed during project environmental review. *NMFS still lists Species of Concern.
  - CR = Candidate for threat assessment.

- State (California Department of Fish and Game [CDFW]):
  - CE = Listed as Endangered by the State of California.
  - CT = Listed as Threatened by the State of California.
  - CR = Listed as Rare by the State of California (plants only).
  - CSC = California Species of Special Concern.

- Likelihood of occurrence in the waters of the project site:
  - C = Confirmed
  - P = Potentially may occur
  - NP = Not present
APPENDIX B

U.S. Fish and Wildlife Service Species Lists
U.S. Fish & Wildlife Service
Sacramento Fish & Wildlife Office
Federal Endangered and Threatened Species that Occur in
or may be Affected by Projects in the Counties and/or
U.S.G.S. 7 1/2 Minute Quads you requested
Document Number: 150203050114
Current as of: February 3, 2015

Quad Lists

Listed Species

Invertebrates

*Euphydryas editha bayensis*
  bay checkerspot butterfly (T)
  Critical habitat, bay checkerspot butterfly (X)

*Haliotes cracherodii*
  black abalone (E) (NMFS)

*Haliotes sorenseni*
  white abalone (E) (NMFS)

*Icaricia icarioides missionensis*
  mission blue butterfly (E)

*Incisalia mossii bayensis*
  San Bruno elfin butterfly (E)

*Speyeria callippe callippe*
  callippe silverspot butterfly (E)

*Speyeria zerene myrtleae*
  Myrtle’s silverspot butterfly (E)

Fish

*Acipenser medirostris*
  green sturgeon (T) (NMFS)

*Eucyclogobius newberryi*
  tidewater goby (E)

*Hypomesus transpacificus*
  delta smelt (T)

*Oncorhynchus kisutch*
  coho salmon - central CA coast (E) (NMFS)
  Critical habitat, coho salmon - central CA coast (X) (NMFS)

*Oncorhynchus mykiss*
  Central California Coastal steelhead (T) (NMFS)
  Central Valley steelhead (T) (NMFS)
  Critical habitat, Central California coastal steelhead (X) (NMFS)
  Critical habitat, Central Valley steelhead (X) (NMFS)

*Oncorhynchus tshawytscha*
  Central Valley spring-run chinook salmon (T) (NMFS)
  Critical habitat, winter-run chinook salmon (X) (NMFS)
  winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

*Rana draytonii*
  California red-legged frog (T)
  Critical habitat, California red-legged frog (X)
Reptiles

*Caretta caretta*
loggerhead turtle (T) (NMFS)

*Chelonia mydas (incl. agassizi)*
green turtle (T) (NMFS)

*Dermochelys coriacea*
leatherback turtle (E) (NMFS)

*Lepidochelys olivacea*
olive (=Pacific) ridley sea turtle (T) (NMFS)

*Masticophis lateralis euryxanthus*
Alameda whipsnake [=striped racer] (T)

*Thamnophis sirtalis tetrataenia*
San Francisco garter snake (E)

Birds

*Brachyramphus marmoratus*
marbled murrelet (T)

*Charadrius alexandrinus nivosus*
western snowy plover (T)

*Coccyzus americanus occidentalis*
Western yellow-billed cuckoo (T)

*Diomedea albatrus*
short-tailed albatross (E)

*Pelecanus occidentalis californicus*
California brown pelican (E)

*Rallus longirostris obsoletus*
California clapper rail (E)

*Sternula antillarum (=Sterna, =albifrons) browni*
California least tern (E)

Mammals

*Arctocephalus townsendi*
Guadalupe fur seal (T) (NMFS)

*Balaenoptera borealis*
sei whale (E) (NMFS)

*Balaenoptera physalus*
finback (=fin) whale (E) (NMFS)

*Eubalaena (=Balaena) glacialis*
right whale (E) (NMFS)

*Eumetopias jubatus*
Critical Habitat, Steller (=northern) sea-lion (X) (NMFS)
Steller (=northern) sea-lion (T) (NMFS)

*Physeter catodon (=macrocephalus)*
sperm whale (E) (NMFS)

*Reithrodontomys raviventris*
salt marsh harvest mouse (E)

Plants

*Arctostaphylos hookeri ssp. ravenii*
Presidio (=Raven’s) manzanita (E)

*Arenaria paludicola*
marsh sandwort (E)  
*Chorizanthe robusta var. robusta*
 robust spineflower (E)

*Clarkia franciscana*  
Presidio clarkia (E)

*Hesperolinon congestum*  
Marin dwarf-flax (=western flax) (T)

*Holocarpha macradenia*  
Santa Cruz tarplant (T)

*Layia carnosa*  
beach layia (E)

*Lessingia germanorum*  
San Francisco lessingia (E)

*Pentachaeta bellidiflora*  
white-rayed pentachaeta (E)

*Suaeda californica*  
California sea blite (E)

*Trifolium amoenum*  
showy Indian clover (E)

**Proposed Species**

**Plants**

*Arctostaphylos Franciscana*  
Critical Habitat, Franciscan Manzanita (X)

**Quads Containing Listed, Proposed or Candidate Species:**

HUNTERS POINT (448A)
SAN FRANCISCO SOUTH (448B)
SAN FRANCISCO NORTH (466C)
OAKLAND WEST (466D)

---

**County Lists**

**San Francisco County**

**Listed Species**

**Invertebrates**

*Euphydryas editha bayensis*  
bay checkerspot butterfly (T)  
Critical habitat, bay checkerspot butterfly (X)

*Haliotes cracherodii*  
black abalone (E) (NMFS)

*Haliotes sorenseni*  
white abalone (E) (NMFS)

*Icaricia icarioides missionensis*  
mission blue butterfly (E)

*Incisalia mossii bayensis*  
San Bruno elfin butterfly (E)
Speyeria callippe callippe
callippe silverspot butterfly (E)

Speyeria zerene myrtleae
Myrtle’s silverspot butterfly (E)

Fish

Acipenser medirostris
green sturgeon (T) (NMFS)

Eucyclogobius newberryi
critical habitat, tidewater goby (X)
tidewater goby (E)

Hypomesus transpacificus
delta smelt (T)

Oncorhynchus kisutch
coho salmon - central CA coast (E) (NMFS)
Critical habitat, coho salmon - central CA coast (X) (NMFS)

Oncorhynchus mykiss
Central California Coastal steelhead (T) (NMFS)
Central Valley steelhead (T) (NMFS)
Critical habitat, Central California coastal steelhead (X) (NMFS)
Critical habitat, Central Valley steelhead (X) (NMFS)

Oncorhynchus tshawytscha
California coastal chinook salmon (T) (NMFS)
Central Valley spring-run chinook salmon (T) (NMFS)
Critical habitat, winter-run chinook salmon (X) (NMFS)
winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

Rana draytonii
California red-legged frog (T)
Critical habitat, California red-legged frog (X)

Reptiles

Caretta caretta
loggerhead turtle (T) (NMFS)

Chelonia mydas (incl. agassizi)
green turtle (T) (NMFS)

Dermochelys coriacea
leatherback turtle (E) (NMFS)

Lepidochelys olivacea
olive (=Pacific) ridley sea turtle (T) (NMFS)
Masticophis lateralis euryxanthus  
Alameda whipsnake [=striped racer] (T)  
Critical habitat, Alameda whipsnake (X)

Thamnophis sirtalis tetrataenia  
San Francisco garter snake (E)

**Birds**

*Brachyramphus marmoratus*  
Critical habitat, marbled murrelet (X)  
marbled murrelet (T)

*Charadrius alexandrinus nivosus*  
western snowy plover (T)

*Coccyzus americanus occidentalis*  
Western yellow-billed cuckoo (T)

*Diomedea albatrus*  
short-tailed albatross (E)

*Pelecanus occidentalis californicus*  
California brown pelican (E)

*Rallus longirostris obsoletus*  
California clapper rail (E)

*Sternula antillarum (=Sterna, =albifrons) browni*  
California least tern (E)

**Mammals**

*Arctocephalus townsendi*  
Guadalupe fur seal (T) (NMFS)

*Balaenoptera borealis*  
sei whale (E) (NMFS)

*Balaenoptera musculus*  
blue whale (E) (NMFS)

*Balaenoptera physalus*  
finback (=fin) whale (E) (NMFS)

*Enhydra lutris nereis*  
southern sea otter (T)

*Eubalaena (=Balaena) glacialis*  
right whale (E) (NMFS)

*Eumetopias jubatus*  
Critical Habitat, Steller (=northern) sea-lion (X) (NMFS)
Steller (=northern) sea-lion (T) (NMFS)

*Physeter catodon (=macrocephalus)*
  sperm whale (E) (NMFS)

*Reithrodonomys raviventris*
  salt marsh harvest mouse (E)

**Plants**

*Arctostaphylos hookeri ssp. ravenii*
  Presidio (=Raven’s) manzanita (E)

*Arctostaphylos pallida*
  pallid manzanita (=Alameda or Oakland Hills manzanita) (T)

*Arenaria paludicola*
  marsh sandwort (E)

*Calochortus tiburonensis*
  Tiburon mariposa lily (T)

*Castilleja affinis ssp. neglecta*
  Tiburon paintbrush (E)

*Chorizanthe robusta var. robusta*
  robust spineflower (E)

*Clarkia franciscana*
  Presidio clarkia (E)

*Hesperolinon congestum*
  Marin dwarf-flax (=western flax) (T)

*Holocarpha macradenia*
  Critical habitat, Santa Cruz tarplant (X)
  Santa Cruz tarplant (T)

*Layia carnosa*
  beach layia (E)

*Lessingia germanorum*
  San Francisco lessingia (E)

*Pentachaeta bellidiflora*
  white-rayed pentachaeta (E)

*Streptanthus niger*
  Tiburon jewelflower (E)

*Suaeda californica*
  California sea blite (E)
Trifolium amoenum
    showy Indian clover (E)

Proposed Species
Plants
Arctostaphylos Franciscana
    Critical Habitat, Franciscan Manzanita (X)

Key:
(E) Endangered - Listed as being in danger of extinction.
(T) Threatened - Listed as likely to become endangered within the foreseeable future.
(P) Proposed - Officially proposed in the Federal Register for listing as endangered or threatened.
(NMFS) Species under the Jurisdiction of the National Oceanic & Atmospheric Administration Fisheries Service. Consult with them directly about these species.
Critical Habitat - Area essential to the conservation of a species.
(PX) Proposed Critical Habitat - The species is already listed. Critical habitat is being proposed for it.
(C) Candidate - Candidate to become a proposed species.
(V) Vacated by a court order. Not currently in effect. Being reviewed by the Service.
(X) Critical Habitat designated for this species

Important Information About Your Species List

How We Make Species Lists
We store information about endangered and threatened species lists by U.S. Geological Survey 7½ minute quads. The United States is divided into these quads, which are about the size of San Francisco.

The animals on your species list are ones that occur within, or may be affected by projects within, the quads covered by the list.
- Fish and other aquatic species appear on your list if they are in the same watershed as your quad or if water use in your quad might affect them.
- Amphibians will be on the list for a quad or county if pesticides applied in that area may be carried to their habitat by air currents.
- Birds are shown regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regardless of whether they appear on a quad list.

Plants
Any plants on your list are ones that have actually been observed in the area covered by the list. Plants may exist in an area without ever having been detected there. You can find out what's in the surrounding quads through the California Native Plant Society's online Inventory of Rare and Endangered Plants.

Surveying
Some of the species on your list may not be affected by your project. A trained biologist and/or botanist, familiar with the habitat requirements of the species on your list, should determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list. See our Protocol and Recovery Permits pages.
For plant surveys, we recommend using the Guidelines for Conducting and Reporting Botanical Inventories. The results of your surveys should be published in any environmental documents prepared for your project.

Your Responsibilities Under the Endangered Species Act

All animals identified as listed above are fully protected under the Endangered Species Act of 1973, as amended. Section 9 of the Act and its implementing regulations prohibit the take of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such animal.

Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of two procedures:

- If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a formal consultation with the Service. During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a biological opinion by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.

- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an incidental take permit. The Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project.

Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compensates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as critical habitat. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Boundary descriptions of the critical habitat may be found in the Federal Register. The information is also reprinted in the Code of Federal Regulations (50 CFR 17.95). See our Map Room page.

Candidate Species

We recommend that you address impacts to candidate species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning
process you may be able to avoid the problems that could develop if one of these candidates was listed before the end of your project.

Species of Concern
The Sacramento Fish & Wildlife Office no longer maintains a list of species of concern. However, various other agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts.

Wetlands
If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6520.

Updates
Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be May 04, 2015.
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APPENDIX C
CDFW Fish Data for Central Bay for Years 2005 Through 2009
TABLE C-1
PELAGIC (WATER COLUMN) FISH COMMUNITY COMPOSITION AND ESTIMATED SPECIES DENSITY FOR CENTRAL SAN FRANCISCO BAY FOR YEAR 2005 THROUGH 2009 BASED ON MONTHLY MIDWATER TRAWLING DATA FROM THE INTERAGENCY ECOLOGICAL PROGRAM AT STATIONS 110, 211, 212, 213, AND 214

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Mean # Fish/Hectare-Meter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2005</td>
</tr>
<tr>
<td>Engraulis mordax</td>
<td>Northern anchovy</td>
<td>377</td>
</tr>
<tr>
<td>Clupea pallasi</td>
<td>Pacific herring</td>
<td>8</td>
</tr>
<tr>
<td>Atherinopsis californiensis</td>
<td>Jacksmelt</td>
<td>1</td>
</tr>
</tbody>
</table>

Additional species present include: topsmelt, shiner perch, California grunion, walleye surfperch, Pacific pompano, Pacific sardine, white croaker, plainfin midshipman, bay goby, American shad, Chinook salmon, longfin smelt, bat ray, Pacific staghorn sculpin, California halibut, English sole, surf smelt, threadfin shad, white seaperch, Pacific electric ray, brown smoothhound, big skate, striped bass, starry flounder, speckled sanddab, bay pipefish, Pacific tomcod, unidentified rockfish, Pacific chub mackerel, and redtail surfperch.


TABLE C-2
DEMERSAL (SEAFLOOR) FISH COMMUNITY COMPOSITION AND ESTIMATED SPECIES DENSITY FOR DEEPWATER AND SHALLOW WATER LOCATIONS IN CENTRAL SAN FRANCISCO BAY FOR YEARS 2005 THROUGH 2009 BASED ON MONTHLY BOTTOM TRAWLING DATA FROM THE INTERAGENCY ECOLOGICAL PROGRAM AT STATIONS 110, 211, 212, 213, AND 214

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Mean # Fish/Hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2005</td>
</tr>
<tr>
<td>Lepidogobius Lepidus</td>
<td>Bay goby</td>
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<tr>
<td>Parophrys vetulus</td>
<td>English sole</td>
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<tr>
<td>Citharichthys stigmaeus</td>
<td>Speckled sanddab</td>
<td>136</td>
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<tr>
<td>Porichthys notatus</td>
<td>Plainfin midshipman</td>
<td>96</td>
</tr>
<tr>
<td>Leptocottus armatus</td>
<td>Pacific staghorn sculpin</td>
<td>17</td>
</tr>
<tr>
<td>Cymatogaster aggregata</td>
<td>Shiner perch</td>
<td>60</td>
</tr>
<tr>
<td>Illeipsis gilberti</td>
<td>Cheekspot goby</td>
<td>10</td>
</tr>
<tr>
<td>Spirinchus thaleichtys</td>
<td>Longfin smelt</td>
<td>19</td>
</tr>
<tr>
<td>Genyonemus lineatus</td>
<td>White croaker</td>
<td>13</td>
</tr>
<tr>
<td>Artedius notospilatus</td>
<td>Bonyhead sculpin</td>
<td>7</td>
</tr>
<tr>
<td>Citharichthys sordidus</td>
<td>Pacific sanddab</td>
<td>16</td>
</tr>
<tr>
<td>Synagnathus leptorhynchos</td>
<td>Bay pipefish</td>
<td>5</td>
</tr>
</tbody>
</table>

Additional species present include: Pacific tomcod, California tonguefish, California halibut, showy smalsh, Pacific herring, brown smoothhound, Pacific sardine, pygmy poacher, saddleback gunnel, bat ray, yellowfin goby, lingcod, chameleon goby, sand sole, big skate, river lamprey, Pacific sand lance, spotted cusk-eel, starry flounder, curlfin sole, spiny dogfish, black perch, arrow goby, white seaperch, brown rockfish, walleye surfperch, leopard shark, rubberlip seaperch, diamond turbot, scalyhead sculpin, thornback, threadfin shad, American shad, cabezon, kelp greenling, barred surfperch, onespot fringehead, spotfin surfperch, striped bass, and yellowtail rockfish.