Murray Street Bridge (# 36C-0108)
Seismic Retrofit Project

Essential Fish Habitat Assessment

Murray Street Bridge
Santa Cruz Yacht Harbor
City of Santa Cruz
Santa Cruz County, CA
Federal Project Number STPLX-5025 (048)

July 2010

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Approved By: _____ Date: 8/26/2010

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List of Abbreviated Terms

BMP	Best Management Practice
Caltrans	California Department of Transportation
CDFG	California Department of Fish and Game
CIDH	cast-in-drilled-hole
CISS	cast-in-steel-shell
dB	decibels
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
FHWA	Federal Highway Administration
FMP	Fishery Management Plan
Ft	foot/feet
HAPC	Habitat Area of Particular Concern
HBP	Highway Bridge Program
MHHW	Mean higher high water
NOAA Fisheries	National Oceanic and Atmospheric Administration, National Marine Fisheries Service
MSA	Magnuson Stevens Fishery Management and Conservation Act
PFMC	Pacific Fisheries Management Council
SEL	Sound Exposure Level
SFA	Sustainable Fisheries Act
SWPPP	Stormwater Pollution Prevention Plan
UCSC	University of California Santa Cruz
UPRR	Union Pacific Railroad

Introduction

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) requires federal agencies to consult with the National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA Fisheries) on all actions, or proposed actions, authorized, funded, or undertaken by the agency that may adversely affect Essential Fish Habitat (EFH) (MSA §305(b)(2)). The MSA established procedures designed to identify, conserve, and enhance EFH for those species regulated under a federal fisheries management plan. MSA was first enacted in 1976 and amended by the Sustainable Fisheries Act of 1996. The Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 was signed January 12, 2007 (NOAA 2007).

EFH means ***those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.*** Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (NOAA Fisheries 2002).

The purpose of this EFH assessment is to determine whether or not the Murray Street Bridge (Bridge # 36C-0108) Seismic Retrofit Project "may adversely affect" EFH designated by the National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA Fisheries), and the Pacific Fishery Management Council (PFMC). This assessment includes a description of the proposed action and an analysis of the potential direct, indirect, and cumulative effects on EFH for all managed fish species and their major food sources. The assessment also describes conservation measures proposed to avoid, minimize, or otherwise offset potential adverse effects to designated EFH resulting from the Murray Street Bridge (Bridge # 36C-0108) Seismic Retrofit Project.

Project Description

Project History

The existing Murray Street Bridge (Bridge # 36C-0108) crosses the Santa Cruz Small Craft Harbor in the City of Santa Cruz, California (Figure 1). Due to the structure's seismic vulnerability, the City in conjunction with the California Department of Transportation (Caltrans) has embarked upon development of retrofit design plans. The City also received approval from Caltrans to rehabilitate the bridge, including replacement of the deficient bridge barriers under the federal Highway Bridge Program (HBP), formerly the Highway Bridge Replacement and Rehabilitation Program. In order to bring the bridge up to current standards, the narrow shoulders will be widened as part of the project.

Project Description

The proposed project is located at the eastern edge of the City of Santa Cruz in the County of Santa Cruz. The project area includes the Murray Street Bridge which spans the Santa Cruz Harbor, portions of lands within the Santa Cruz Port District harbor area, portions of the harbor waters, and the area along the Murray Street road right-of-way, west of Lake Avenue (Figure 2).

The proposed project consists of a seismic retrofit of the existing Murray Street Bridge, which spans the Santa Cruz Small Craft Harbor and additional minor modifications to replace deficient bridge barriers (widening shoulders to standard widths and replacement and improvement of sidewalks and railings). The seismic retrofit project will provide the bridge with additional vertical support and resistance to lateral seismic forces by installing additional pilings and supplemental structural elements. In order to provide sufficient area for construction operations, some boats, Harbor facilities, and commercial businesses will require temporary relocation.

Bridge Seismic Retrofit. The nine-span bridge is supported by two abutments (identified as Abutments 1 and 10, located at the western and eastern ends of the bridge, respectively) and 8 "bents" (identified as Bents 2 through 9, located at 60-foot intervals between the abutments). The seismic retrofit project consists of the following basic elements:

(1) Installation of concrete infill walls at Bents 2, 3, 4, and 9. These walls will span the voids between the existing concrete support columns and will be anchored to the columns with bonded dowels.

(2) Installation of shear keys and seat extenders at Abutment 1 and Bents 2 through 9.

(3) Retrofit of foundations with 16-inch diameter CISS (cast-in-steel-shell) piles at Bent 9 and Abutment 10. These piles will extend to depths of approximately –55 feet to –85 feet at Bent 9 and to depths of approximately –30 feet to –50 feet at Abutment 10.

(4) Retrofit abutment with two 96-inch CIDH (cast-in-drilled-hole) piles behind Abutment 10 to a depth of -50 feet.

(5) Retrofit of both outriggers and bents with 30-inch diameter CISS piles at Bents 6, 7, and 8 and 30-inch diameter CIDH piles at Bent 5. These piles will extend to depths of approximately -55 feet to -80 feet at Bent 5 and at approximately –85 feet to –110 feet at Bents 6-8.

(6) Installation of fenders to protect new piles.

Figure 3 provides a cross section showing the abutment and bents and proposed improvements. The installation of new piles at Abutment 10 and Bents 5 through 9 will include two piles on each side for a total of 24 piles. Both the CISS piles and the CIDH piles will be installed at 1:12 angles.

Additional Bridge Improvements. The project also includes replacement of deficient bridge barriers. In order to bring the bridge up to current standards, the narrow shoulders will be widened to provide standard 5-foot shoulders. The shoulder widening will consist of approximately an additional 2 feet on the north side of the bridge and 5-6 feet on the south side of the bridge. It is not anticipated that any work other than an overhang extension will be required on the north side widening. In addition, the construction of new bridge railings is required to conform to current codes. Roadway lane widths will remain the same as currently exists.

The proposed project will include the following improvements:

(1) Removal of existing curbs, sidewalks, and barrier railings on the bridge.

(2) Installation of new girders, road foundations, and road surfacing along the entire southern edge of the bridge, providing 5.5 feet of additional width. (The girders will be supported by the new 30-inch piles at Bents 5 through 8 and the 16-inch piles at Abutments 1 and 10 and at Bents 2, 3, 4, and 9.

(3) Installation of a new cantilevered extension along the entire northern edge of the bridge, providing approximately two feet of additional width. (This will not require additional foundation work.)

(4) Repaving of the bridge surface, and construction of a new 7-foot, 6-inch wide sidewalk on the south side of the bridge. Class 2 bike lanes will be provided in the roadway shoulders.

(5) Installation of new metal bridge railings on both the southern and northern sides of the bridge.

Temporary Harbor Facility Relocation. The temporary use of portions of the eastern harbor boat yard and the western parking lot for contractor staging, in combination with provision of construction access to the bridge from the waterway, will result in temporary disruptions of harbor activities including boat berths, boat storage, buildings, and businesses. A total of 12 recreational boat berths will be removed during construction, which includes removal of 2 berths from dock T with replacement at end of Phase 2 and removal of 10 berths from dock FF. To accommodate the removed berths, 11 new berths will be constructed on the west side of the harbor at Docks A through F. A temporary dock FF – with fewer berths – will be constructed at the southern end of the dock, which will accommodate 6 boats during construction. Affected portions of Dock FF will be restored at the end of Phase 4. Additionally, the berth for the commercial "Chardonnay" boat will be temporarily unavailable for a period of approximately two weeks during Phase 4 construction.

Although design plans have not yet been completed for the reinstalled berths, it is expected that the docks would be plastic, wood or concrete over polyethylene floats and would be anchored with pilings. Piles would be drilled into the harbor floor by mechanical hammer. There would be no dredging or placement of fill in Harbor waters with reinstallation of docks and both berths.

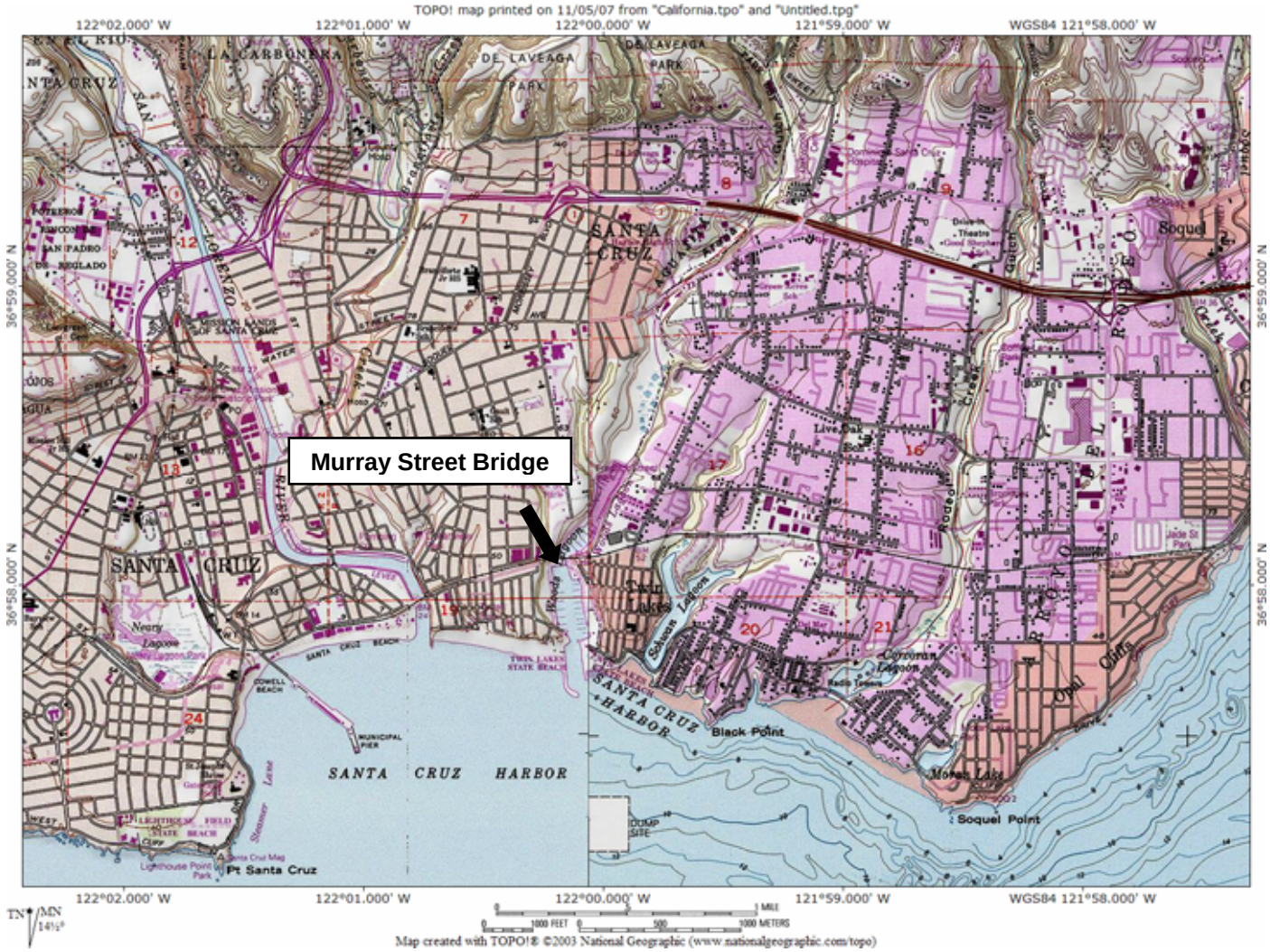
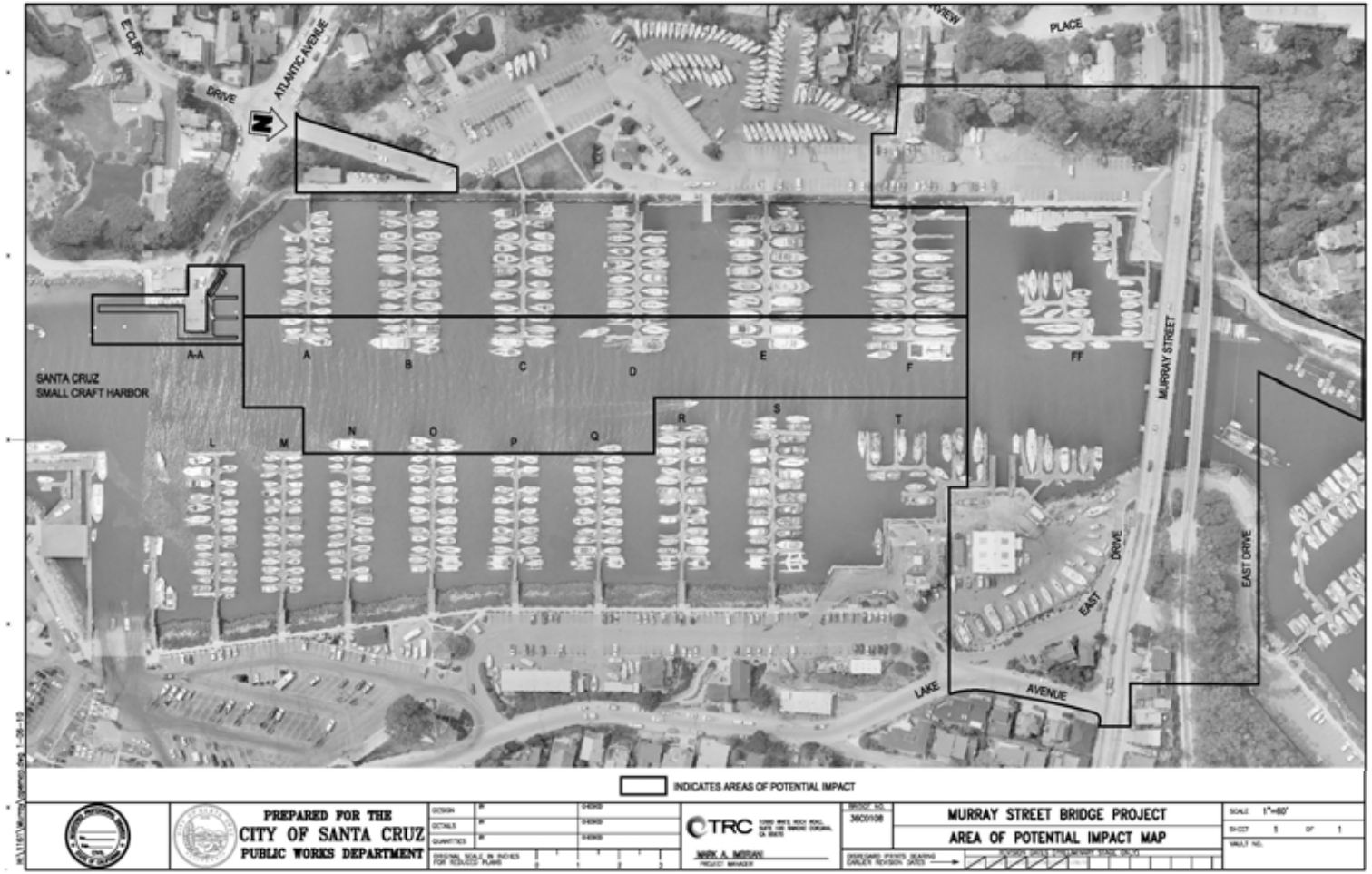


Figure 1. Vicinity of the Murray Street Bridge (# 36C-0108) in the City of Santa Cruz, County of Santa Cruz, CA.



Source: TRC Engineers

Figure 2. Aerial Photo of Area Surrounding the Murray Street Bridge *(# 36C-0108)* and Area of Potential Impact, in the City of Santa Cruz, County of Santa Cruz, CA.

Description of Construction Activities.

Construction Schedule and Phasing. The Murray Street Bridge Retrofit project is tentatively proposed for construction in five partially overlapping phases. Generally, work will begin on the eastern side of the Harbor and progress to the western side. The timing of each phase and a brief description of work to be performed during each phase is provided in Table 1. Overall, the seismic retrofit work will be executed over a period of approximately 18 months within four construction phases as described in Table 1. The additional bridge improvements will be constructed over a period of approximately 6 months as part of Phase 5 of the construction. Due to need for large construction equipment and harbor access, as described in Table 1, there will be traffic control on Murray Street to include various measures such as temporary lane closures, temporary one-way traffic movement, and detours.

Construction Methods and Equipment. The proposed project includes the following construction activities and associated equipment.

- Demolition and Harbor Berth Removal/Replacement: The primary demolition activities include the removal of pilings at Bent 6, the temporary removal of the gangway under Bent 4, the removal of existing sidewalks and railings along the entire length of the bridge, the removal of pavement at both ends of the bridge, and the temporary removal of two berths at Dock T and 10 berths at the FF dock; approximately 17 piles will be removed. To accommodate removed boat berths, 11 new berths will be constructed on the west side of harbor with 12 associated piles, and 6 temporary berths with 6 piles will be relocated at Dock FF.

  Equipment: Demolition will require the use of equipment such as cranes, excavators, front-end loaders, dump trucks, concrete saws, and jackhammers. The dock piles will either be driven in with a vibratory pile driver or a pile driver if needed.

- Work Platforms within the Waterway: Work within the waterway will require either the use of barges or construction of trestles to provide work platforms. If barges are utilized, prefabricated modular units may be brought to the site and locked together. This type of platform can be installed, reconfigured, and removed relatively quickly, but the system is not suitable for areas that are too narrow to accommodate the modules. For example, footings from the Union Pacific Railroad Bridge to the north and footings from the Murray Street Bridge appear too close together to allow use of a modular barge between footings. In these areas, a trestle likely will need to be constructed.

  Construction of a trestle could vary depending on materials available to contractors. One possible trestle configuration would be 60-foot long steel girders over the Harbor navigation channel. The spans would be supported on falsework bents, perhaps constructed of steel piles which are a fairly common falsework material. Piles would be driven in the water by a crane sitting over the land. Preliminary estimates by the project engineer indicate that up to 120 12-inch steel beams would be required for a trestle spanning the bridge; vibratory drivers would be used. Approximately 6-8 of these small

size piles could be installed per day. All piles would be removed at the end of construction. The trestle could be made of "Bailey Bridge" panels that can be used to provide bents or towers. The deck might be made of heavy timbers or open-grid panels with a safety railing to keep people and materials on the deck.

- Pile Installation within the Waterway: The CISS piles at Bents 5 through 8 will be installed within the waterway by driving 30-inch steel casings either to refusal at rock or into a shaft drilled within rock (depending on the location). The shaft and/or casing will be dewatered and concrete will be poured into the casings, which will be left in place. The 30-inch CIDH piles at Bent 5 will also be constructed by pouring concrete into permanent steel casings; dewatering is not expected to be achievable at this location, and a "wet" installation is planned. The installation of new piles at Bents 5 through 8 will include two piles on each side for a total of 16 piles. Overall the installation of piles is expected to take approximately 2 days for each pile. The pile driving is not expected to occur concurrently.

  Equipment: The installation of these piles requires the use of a crane(s), a drilling rig, a pile driver, excavation and earthmoving equipment, concrete trucks and pumps, concrete vibrators, supply trucks, welding equipment, and other machinery. The piles will either be driven in with a pile driver or a vibrator.

- Pile and Anchor Installation outside the Waterway: The CISS piles at Bent 9 and Abutment 10 will be installed by driving 16-inch steel casing to depths of approximately –30 to –85 feet and filling them with concrete. These piles will be installed perpendicular to the ground surface. The 96-inch diameter anchor pile for Abutment 10 will require excavation and installation of a temporary steel casing, which will be filled with concrete. The anchor pile excavation will be dewatered by pumping, if necessary. The installation of new piles at Bent 9 and Abutment 10 include two piles on each side for a total of 8 piles. Overall the installation of piles is expected to take approximately 2 days for each pile. The pile driving is not expected to occur concurrently.

  Equipment: The installation of these piles will require the use of excavation equipment, soil tamper equipment, and the other construction equipment described above for installing piles within the waterway.

- Construction of Concrete Pile Caps, Infill Walls, Shear Keys, Bent Caps, etc.: This part of the project will include the installation and construction of various project features below the bridge roadway surface and above the piles. Sheet piling will be placed around the piles, the area dewatered and pile caps formed. Wooden forming supported from the piling would be placed for the pile caps. Wooden forming will be placed on existing footings to place infill walls. Forms would be placed atop pile caps for columns, and attached to the tops of columns for bent caps and shear keys.

  Equipment: Equipment required for this part of the project would include a crane to place sheet piling, pumps for dewatering, light duty equipment to place wooden forming, concrete trucks and a concrete pump to place concrete, welding equipment, supply trucks and other machinery/equipment.

- Superstructure Construction: This part of the project will include the installation of new girders on the southern edge of the bridge, the installation of a cantilevered extension along the northern edge of the bridge, and the construction of barrier railings.

  Equipment: Equipment required for this part of the project would include a crane, concrete trucks and pumps, paving equipment, trucks to haul supplies, welding equipment, and other machinery.

- Roadway Approach Construction: Excavation of existing road approaches will be performed. Gravel base and asphalt concrete will be placed to match the new widened bridge deck. The roadway approach work will be limited to less than 200 feet from each end of the bridge. Sidewalks, guardrails and streetlights will be constructed.

  Equipment: Equipment used will be typical paving equipment including graders, loaders, bulldozers, sheep's-foot rollers, dump trucks, and a paving machine.

Contractor Staging. Contractor staging activities for Phases 1 and 2 of the project will take place in an approximately 8,000 square-foot portion of an existing boat yard beneath the eastern edge of the bridge. At the end of Phase 2, the boat yard will be restored. Contractor staging activities for Phases 3, 4, and 5 of the project will take place in the northern portion (approximately 11,000 square feet) of a parking lot situated at the western edge of the bridge. Adjacent existing offices, bathroom facilities, and storage areas will be relocated, as described below. This staging area will be used through the end of Stage 5, when original facilities will be restored.

Temporary Harbor Facility Relocation. The temporary use of portions of the eastern harbor boat yard and the western parking lot for contractor staging as described above, in combination with provision of construction access to the bridge from the waterway, will result in temporary disruptions of harbor activities including boat berths, boat storage, buildings, and businesses. As discussed above, 12 recreational boat berths will be removed and replaced. The contractor staging area on the east side of the Harbor will require that nine boats in the boat yard be temporarily relocated to boat storage for approximately four months. On the west side, 60 rowing boats stored under the existing Murray Street bridge will be temporarily relocated to a recently constructed onland dry boat storage facility near docks A and B. An additional 200± square feet of storage area would be constructed to accommodate the temporary row boat storage. Row boats stored under Span 2 and University of California Santa Cruz (UCSC) Rowing Facility boats under Span 1 will be temporarily relocated to the U.S. Coast Guard parking lot and fenced.

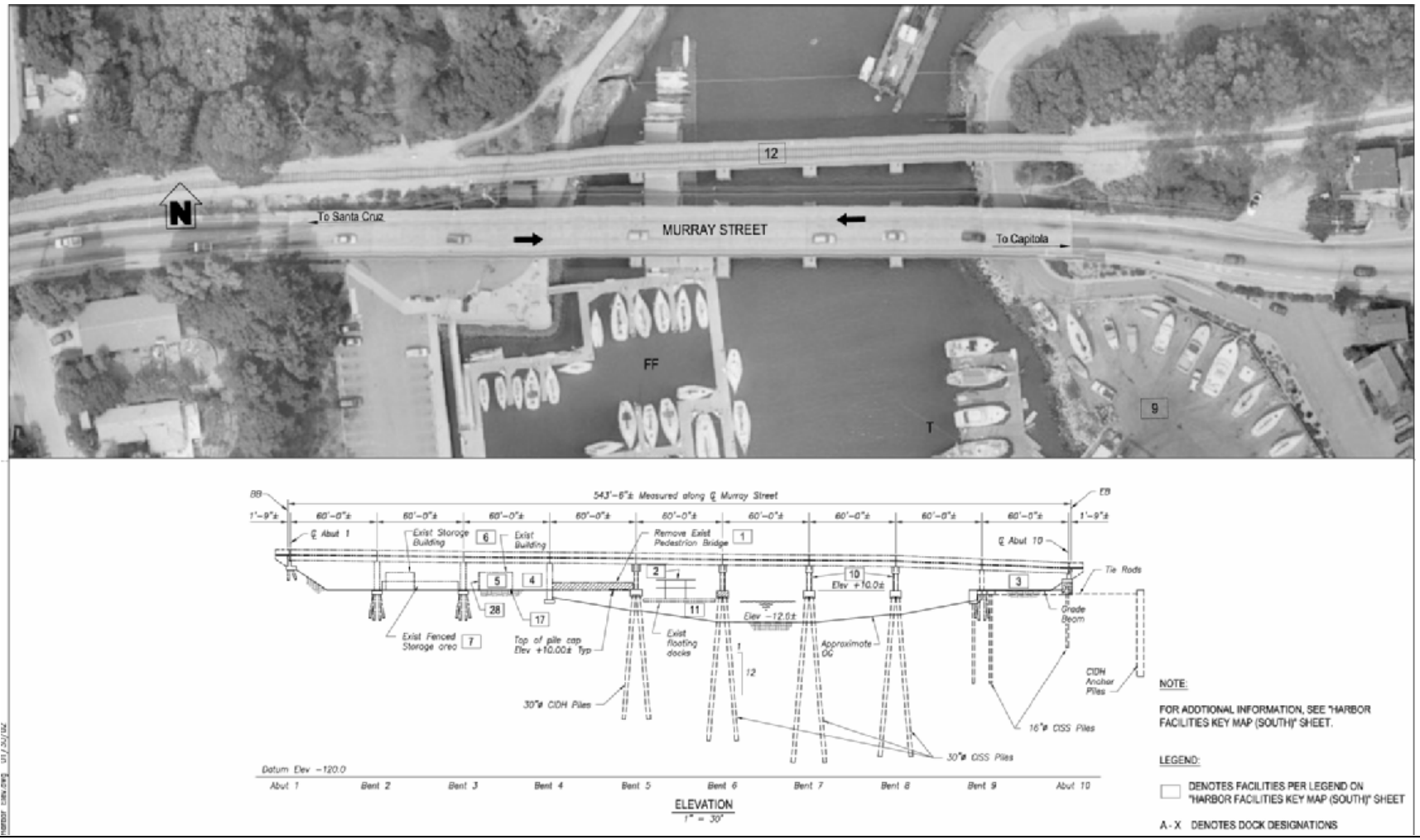
Existing offices, bathroom facilities, and storage areas located north of the western staging area (and within the City's right-of-way) will be displaced during Phases 3, 4, and 5 of the project. These facilities include: the UCSC storage building, the Lighthall Yacht Charters office, rowing equipment storage, the Santa Cruz Rowing Club Oar House, the Chardonnay Sailing Charters

office, the Pacific Yachting Sailing School Charters office, and men's and women's restrooms. The buildings will be protected during construction, and a temporary 600 square foot facility (modular) will be installed on the U.S. Coast Guard parking area for a period of approximately six months, which will temporarily house these businesses. An existing memorial bench and plaque will be removed, properly stored, and reinstalled in the West Harbor upon completion of construction.

In addition, as indicated above, traffic on Murray/Eaton will be subject to temporary controls. A portion of Lake Avenue may be also be subject to temporary traffic controls during setup of the construction staging area on the east side of the Harbor. The existing pedestrian path on both sides of the Harbor, the western concrete stairway, and the access ramp to Dock FF also will be closed during certain phases of construction. Approximately 30-50 Harbor parking spaces (for permit users) on the west side of the Harbor will be temporarily unavailable when the construction staging area is setup in that location.

Railroad Right-of-Way Encroachment. The Union Pacific Railroad (UPRR) maintains a bridge and track located approximately 20 to 30 feet north of the Murray Street Bridge (as measured from edge of deck to edge of deck, with the distance increasing west to east). Construction on the northern side of the bridge will require railroad flaggers for the protection of workmen and railroad traffic. The UPRR tracks and right-of-way border Murray Street on the north and are within the Area of Potential Impact. It appears that a northwestern sliver of Murray Street is within the railroad right-of-way. Any encroachment into the right-of-way during project construction will need to be coordinated with and approved by UPRR and potentially the California Public Utilities Commission.

Figure 3. Cross Section of the Murray Street Bridge *(# 36C-0108)* in the City of Santa Cruz, County of Santa Cruz, CA



able 1. Murray Street Bridge Retrofit Project: Construction Phasing & Approximate Schedule.

Work Tasks	Effects on Harbor and Road Operations
Phase 1: Construction in East Zone	
2 months [1]	
* Temporarily relocate overhead utilities north of bridge	* Install traffic control system with alternating 1-way traffic
* Prepare construction staging area (8,000 sq.ft.) at harbor boat yard	* Close Murray for 7 days for driving anchor piles
* Retrofit Bent 9 & Abutment 10; install anchor piles	* Temporary relocation (dry storage) of 9 dry-docked boats from boat yard
* Erect Girder Span 9	* Traffic controls along Lake Avenue during construction staging area setup
* Remove existing south rail	* Close east walkway under bridge
	* Close bridge sidewalk
Phase 2: Construction in Eastern Waterway	
5 months	
* Construct new berths (8) at ends of docks A through F	* Temporary relocation of 2 boats from Dock T to AA or new dock N-Q
*Remove berths (12) at docks T and FF	* Temporary closure of East Drive & part of harbor boat yard
* Construct work platform(s) (trestle or barge) for Stage 2 work [2]	* Availability of only one boat channel under the bridge for 6 non-consecutive half-days
* Retrofit Bents 7 & 8 (includes installing anchor piles at Bents 7 & 8)	
* Erect Girder Spans 7 & 8 and construct Deck Spans 7, 8, & 9	
* Construct north and south rails (optional) [3]	
* Restore boat yard; reopen pedestrian path	
* Remove east work platform	
* Replace berths (2) at Dock T upon construction in the eastern waterway and only between July and mid-November	
Phase 3: Construction in West Zone	
6 months	
* Install row boat storage at docks A/B & USCG area	* Closure of West Path, western concrete stairway and access ramp to Dock FF
* Install temporary building at USCG area	* Temporary relocation of affected facilities (offices, storage, restrooms, etc.)
* Temporarily relocate existing offices and row boats to above [2]	
* Close portion of western parking lot [2]	
* Construct temporary access ramp to Dock FF	
* Retrofit Abutment 1 and Bents 2, 3, & 4	
* Erect Girder Spans 1, 2, & 3 [and construct Deck Spans 1, 2, & 3]	

Phase 4: Construction in Western Waterway

5 months

* Construct modifications to Dock FF; move 7 boats to new Dock FF
* Construct work platform(s) (trestle or barge) for Stage 4 work
* Retrofit Bents 5 & 6 (including installation of anchor piles)
* Erect Girder Spans 4, 5, & 6 [and construct Deck Spans 4, 5, & 6]
* Construct north and south rails [3]
* Remove work platform(s)
* Closure of West Path, western concrete stairway and access ramp to Dock FF
* Temporary relocation of affected facilities (offices, storage, restrooms, etc.)
* Temporary relocation of 8 boats from Dock FF
* Availability of only one boat channel under the bridge for 6 non-consecutive half-days

Phase 5: Construction of Superstructure and Barrier Rails

[no timing provided]

* Remove sidewalks & temporary barrier rails
* Construct new barrier rails
* Restore Dock FF, parking lot, existing offices and related facilities
* Restore all remaining facilities to original condition
* Repair deck

Footnotes:

[1] Note that construction phases overlap; the sum of the construction periods specified is therefore greater than the total period indicated by start and finish dates.

[2] These tasks could be initiated and/or completed during the prior stage.

[3] [These tasks could be completed either in Phase 2 or 4.

[4] Temporary closure of Murray Street bridge roadway to all traffic is possible during any phase for a short duration. The alternating one-way traffic with sign control will occur during the construction, but not during the full duration of construction activities.

Managed Fisheries, Species, and EFH

The EFH mandate applies to ***all species managed under a federal Fishery Management Plan (FMP)***. In California, there are three FMPs, covering groundfish, coastal pelagic species, and Pacific salmon that surface transportation projects may affect depending on the nature of a project. This chapter summarizes the federally-managed fish species that exhibit EFH designations for all or part of their life cycles within the proposed Project location.

Habitat Areas of Particular Concern (HAPCs) are a subset of the much larger area identified as EFH, that play a particularly important ecological role in the fish life cycle or that are especially sensitive, rare or vulnerable. HAPCs are identified differently from EFH. EFH is identified for each species and life stage; in contrast, HAPCs are identified on the basis of habitat level considerations: 1) The importance of the ecological function provided by the habitat, 2) The extent to which the habitat is sensitive to human-induced environmental degradation 3) Whether and to what extent development activities are or will be stressing the habitat, and; 4) The rarity of the habitat type. Estuaries, sea grass beds, canopy kelp, rocky reefs, and other "areas of interest" (*e.g.*, seamounts, offshore banks, canyons) are designated HAPC for managed groundfish species (PFMC 2006).

Project Site Overview

Santa Cruz Harbor waters support a variety of benthic and pelagic fish species. The intertidal environment is characterized by shore bottom substrates and rocky shores. The floating docks also provide some substrate. Sandy and muddy shores are populated with burrowers and mobile surface dwellers. The bottom substrate is affected by seasonal deposition of silt from streams that flow into the harbor. Although recent species inventories have not been conducted, species that have been observed in the Harbor include green algae, barnacles, and cancer crabs. Other species that have been found in Harbor waters include periwinkles, limpets, mussels, chitons, black turban snails, various shore crabs, anemones, sea sponges, and worms. Fish species that have been found in the Harbor include white croaker, speckled sandperch, jacksmelt, varieties of surfperch and rockfish, and starry flounder. The Harbor also experiences periodic invasion by large schools of northern anchovies, which can deplete food and oxygen supplies (Santa Cruz Port District 1980).

The Santa Cruz Harbor is located within areas designated as EFH for various life stages of marine and estuarine fish species managed under the following FMPs: Pacific Coast Salmon FMP, Coastal Pelagic Species FMP, and Pacific Coast Groundfish FMP. However, the Santa Cruz Harbor is not located within a designated HAPC.

Pacific Coast Salmon FMP and EFH

Three species are managed under the Pacific Coast Salmon FMP: Chinook salmon (*Oncorhynchus tshawytscha*), Coho salmon (*O. kisutch*), and pink salmon (*O. gorbuscha*). Of these, Chinook salmon and coho salmon are known to occur within the vicinity of the proposed Project site.

The Pacific coast salmon fishery EFH includes those waters and substrate necessary for salmon production needed to support a long-term sustainable salmon fishery and salmon contributions to a healthy ecosystem. In the estuarine and marine areas, salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (EEZ) (200 nautical miles) offshore of Washington, Oregon, and California north of Point Conception (PFMC 2003). Designated estuarine EFH for adult and juvenile Chinook and coho salmon may be affected by the proposed project.

Chinook salmon

Chinook are the largest of the salmon species. Historically, juvenile Chinook salmon have been reported in coastal streams as far south as the Ventura River in southern California. Currently, they spawn in suitable rivers from the Sacramento-San Joaquin system northward. Chinook salmon are divided into four distinct races, or runs, according to spawning migration timing and reproductive behavioral differences: winter run, spring run, fall run, and late fall run. Fall-run Chinook salmon are the most numerous salmon in California today. They arrive in spawning areas between September and December, depending upon the river system, but peak arrival time is usually during October and November. Under current ocean harvest rates, the fall Chinook runs are dominated by three-year-old fish followed by jacks and four-year-olds. Five-year-old fish are rare. Spawning occurs in the main stem of rivers, as well as in tributaries, from early October through December. In general, there is a large outmigration of fry and fingerlings from the spawning areas between January and March. An additional outmigration from the spawning areas, consisting primarily of smolts, occurs from April through June. The juveniles enter the ocean as smolts between April and July (CDFG 2001).

Coho salmon

In California, coho salmon spawn in suitable streams from northern Monterey Bay northward, but they rarely enter the Sacramento-San Joaquin River system. Coho salmon enter many small coastal streams that are not utilized by Chinook salmon, but they also

spawn in some larger river systems where Chinook salmon occur. Compared to Chinook salmon, there are relatively few coho salmon in California today. Most California streams utilized by coho salmon are short in length, but some coho do make relatively long migrations, particularly into the Eel River system. Many smaller coastal rivers have runs of coho salmon that enter during brief periods after the first heavy fall rains and move upstream. Within California river systems, coho salmon populations include only one race, or run, which is generally consistent as to spawning area used and time of spawning. Most spawning occurs between December and February. The juveniles usually spend a little more than a year in fresh water before migrating to the ocean; a few spend two years. Most coho mature at the end of their third year of life. Coho salmon older than three years are relatively rare. A few males, or grilse, mature at age two (CDFG 2001).

California represents the southern margin of the species' natural distribution and coastal streams of Santa Cruz County constitute the very southern extent of the coho salmon range. Historically, coho salmon are believed to have used all or most of the accessible coastal streams along the San Mateo and Santa Cruz County coastline. However, habitat destruction and degradation, water diversions as well as changes in oceanic conditions, among other reasons, have brought coho salmon to the brink of extinction in this area (CDFG 1998).

Coastal Pelagic Species FMP and EFH

Four fish species, Pacific sardine (*Sardinops sagax*), northern anchovy (*Engraulis mordax*), Pacific mackerel (*Scomber japonicus*), and Jack mackerel (*Trachurus symmetricus*), and one invertebrate species, California market squid (*Loligo opalescens*), are managed under the Coastal Pelagic Species FMP. All five species are known to occur in Monterey Bay and have the potential to occur within the Project area.

The EFH designation for coastal pelagic species groups the managed species into one complex due to similarities in their life histories and habitat requirements. EFH is based upon a thermal range bordered within the geographic area where a coastal pelagic species occurs at any life stage, where the species has occurred historically during periods of similar environmental conditions, or where environmental conditions do not preclude colonization by the coastal pelagic species (PFMC 1998a). Designated estuarine EFH for all life stages of the five species managed under Coastal Pelagic Species FMP may be affected by the proposed Project.

Pacific sardine

The northern population of Pacific sardine occurs primarily off central and southern California and Baja California, but extends as far north as Vancouver, British Columbia. Spawning occurs in loosely aggregated schools in the upper 165 feet of the water column, probably year-round, with peaks from April to August. The main spawning area for the northern subpopulation is between San Francisco and San Diego, out to about 150 miles offshore, with evidence of spawning as far as 350 miles offshore (CDFG 2001).

Maximum sustained yield of Pacific sardine in the historical northern subpopulation was estimated to be 250,000 tons or about 22 percent per year, far less than the catch of sardines during the height of the commercial fishery (CDFG 2001).

Northern anchovy

Northern anchovy are distributed from the Queen Charlotte Islands, British Columbia to Magdalena Bay, Baja California. The population is divided into northern, central, and southern subpopulations or stocks. The central subpopulation ranges from approximately San Francisco, California to Punta Baja, Baja California, with the bulk being located in the Southern California Bight. Northern anchovies are small, short-lived fish typically found in schools near the surface. They rarely exceed four years of age and seven inches total length. Anchovy are all sexually mature at age two. Northern anchovy spawn during every month of the year, but spawning increases during late winter and early spring and peaks during February to April. Individual females spawn batches of eggs throughout the spawning season at intervals as short as seven to 10 days. Eggs and larvae are both found near the surface (CDFG 2001).

Total anchovy harvests and exploitation rates since 1983 have been below the theoretical levels for maximum sustained yield, and stock biomass estimates are unavailable for recent years but, based on abundance index data, the stock is thought to be stable at a modest biomass level. The size of the anchovy resource is now being determined mostly by natural influences such as ocean temperature (CDFG 2001).

Pacific mackerel

Pacific mackerel occur worldwide in temperate and subtropical coastal waters. They are common from Monterey Bay to Cape San Lucas, Baja California, but are most abundant south of Point Conception. Pacific mackerel usually occur within 20 miles of shore. Adults occur from the surface to 1,000 feet deep. Sub-adult and adult Pacific mackerel in the

northeastern Pacific move northward along the coast during the summer. There is an inshore-offshore migration off California, with increased abundance inshore from July to November and increased abundance offshore from March to May. Pacific mackerel are typically found near shallow banks, and juveniles are commonly found off sandy beaches, around kelp beds, and in open bays. Off California, spawning occurs from late April to July at depths to 300 feet. Individual fish may spawn eight times or more per year and release at least 68,000 eggs per spawning. Some Pacific mackerel mature as one-year olds, although most are not sexually mature until age two or three (CDFG 2001).

It is estimated that the maximum long-term yield of Pacific mackerel might be 29,000 to 32,000 tons under management systems similar to that in current use. It is difficult to assess the effects on the catch of recent warm temperatures, possible changes in availability of young fish, and deteriorating markets for the species (CDFG 2001).

Jack mackerel

Jack mackerel are actually members of the jack family, Carangidae, and are not true mackerel. They are widely distributed throughout the northeastern Pacific Ocean, where young fish (up to six years and 12 inches long) are found schooling over shallow rocky reefs, generally less than 200 feet deep, and along rocky shorelines of the coast and islands off southern California and Baja California. Large fish (16 years and older and 20 long) are found offshore and farther north, east of a line that goes from Cabo San Lucas to the eastern Aleutian Islands, and includes the Gulf of Alaska. Jack mackerel spawn in the offshore waters (60 – 300 miles) between Punta Eugenia and Point Conception from March through July. The center of offshore spawning activity moves north as the season progresses, but little is known about the seasonal and geographic limits of the offshore and northern spawning areas. Like anchovy and Pacific mackerel, jack mackerel appear to be multiple spawners, with females spawning on average every five days and 25 times per year. Eggs float free in the ocean for three to five days before hatching (CDFG 2001).

There has been a decrease in the percentage of older fish (three to six years) in the catch since the 1960s, which has caused some concern. It is unclear whether this change is due to a decrease in the number of older fish or to a change in the distribution of these fish (CDFG 2001).

California market squid

The California market squid ranges from southeastern Alaska to Baja California, Mexico. This pelagic mollusk attains a length of 12 inches, including its eight arms and two feeding tentacles. Several other squid species occur off the California coast, but these are normally associated with deeper offshore waters. Spawning market squid tend to congregate in semi-protected bays, usually over a sand bottom with rocky outcroppings. Mass spawning starts around April in central California waters and ends about November. The eggs are laid within elongated, cigar-shaped capsules, each of which may contain as many as 300 eggs embedded in a gelatinous matrix. Each female produces from 20 to 30 egg capsules, attaching one end of each capsule to the sea floor or other suitable site (CDFG 2001).

Little is known about the present size, structure or status of the population, but historical evidence from research cruises, as well as recent catch data, indicate the biomass is large. Commercial fishing of market squid in California targets only spawning populations and in limited geographic areas, mostly in central and southern California (CDFG 2001).

Pacific Coast Groundfish FMP and EFH

A total of 82 species of groundfish, consisting primarily of rockfish, flatfish, roundfish, and sharks/skates, are managed under the Pacific Coast Groundfish FMP. The managed groundfish species range throughout the EEZ and occupy diverse habitats at all stages in their life histories. Some species are broadly dispersed during specific life stages, especially those with pelagic eggs and larvae. The distribution of other species and/or life stages may be relatively limited, as with adults of many nearshore rockfish which show strong affinities to a particular location or substrate type.

Of the 82 managed groundfish species, the following 23 species are identified within the estuarine composite EFH (PFMC 1998b) (see below) and are most likely to be found in Project area: leopard shark (*Triakis semifasciata*), soupfin shark (*Galeorhinus zyopterus*), spiny dogfish (*Squalus acanthias),* California skate (*Raja inornata*), ratfish (*Hydrolagus colliei*), lingcod (*Ophiodon elongates*), cabezon (*Scorpaenichthys marmoratus*), kelp greenling (*Hexagrammos decagrammus*), Pacific cod (*Gadus macrocephalus*), Pacific whiting (*Merluccius productus*), sablefish (*Anoplopoma fimbria*), black rockfish (*Sebastes melanops*), bocaccio (*Sebastes paucispinis*), brown rockfish (*Sebastes auriculatus*), calico rockfish (*Sebastes dallii*), California scorpionfish (*Scorpaena guttata*), copper rockfish (*Sebastes caurinus*), kelp rockfish (*Sebastes atrovirens*), quillback rockfish (*Sebastes maliger*), English sole (*Parophrys vetulus*), Pacific sanddab (*Citharichthys sordidus*), Rex

sole (*Glyptocephalus zachirus*), and starry flounder (*Platichthys stellatus*). Detailed accounts of the distributions and life histories of these species can be found in Appendix B, Part 2 of the Pacific Coast Groundfish FMP (PFMC 2005). Life stages of these 23 species with a potential to occur within the project area are listed in Table 2, based on information provided by PFMC (1998b).

Table 2: Federally managed groundfish species and life stages within the Estuarine Composite EFH (PFMC 1998b) potentially occurring within the Project Area

Managed Groundfish Species		Life Stage Estuarine Composite EFH				
Common Name	**Scientific Name**	**Eggs**	**Larvae**	**Juvenile**	**Adult**	**Spawning**
Leopard Shark	*Triakis semifasciata*	X		X	X	X
Soupfin shark	*Galeorhinus zyopterus*	X		X	X	X
Spiny dogfish	*Squalus acanthias*	X		X	X	
California skate	*Raja inornata*	X		X	X	X
Ratfish	*Hydrolagus colliei*			X	X	X
Lingcod	*Ophiodon elongates*	X	X	X	X	X
Cabezon	*Scorpaenichthys marmoratus*	X	X	X	X	X
Kelp greenling	*Hexagrammos decagrammus*	X	X	X	X	X
Pacific cod	*Gadus macrocephalus*	X	X	X	X	X
Pacific whiting	*Merluccius productus*	X	X	X	X	X
Sablefish	*Anoplopoma fimbria*			X		
Black rockfish	*Sebastes melanops*			X	X	
Bocaccio	*Sebastes paucispinis*		X	X		
Brown rockfish	*Sebastes auriculatus*	X		X	X	X
Calcico rockfish	*Sebastes dallii*			X	X	
California scorpionfish	*Scorpaena guttata*	X				
Copper rockfish	*Sebastes caurinus*	X		X	X	
Kelp rockfish	*Sebastes atrovirens*			X		
Quillback rockfish	*Sebastes maliger*	X	X	X	X	
English sole	*Parophrys vetulus*	X	X	X	X	X
Pacific sanddab	*Citharichthys sordidus*	X	X	X		
Rex sole	*Glyptocephalus zachirus*				X	
Starry flounder	*Platichthys stellatus*	X	X	X	X	X

SOURCE: PFMC 1998b.

EFH for Pacific coast groundfish is defined as the aquatic habitat necessary to allow for groundfish production to support long-term sustainable fisheries for groundfish and for groundfish contributions to a healthy ecosystem. Descriptions of groundfish EFH for each of the 82 species and their life stages result in more than 400 EFH identifications. When these EFHs are taken together, the groundfish EFH includes all waters from the mean higher high water line, and the upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon and California seaward to the boundary of the U.S. EEZ.

The Pacific Coast Groundfish FMP (PFMC 2006) divides EFH into seven composite habitats including their waters, substrates, and biological communities, and includes:

Estuarine - Those waters, substrates and associated biological communities within bays and estuaries of the EEZ, from mean higher high water level (MHHW, which is the high tide line) or extent of upriver saltwater intrusion to the respective outer boundaries for each bay or estuary as defined in 33 CFR 80.1 (Coast Guard lines of demarcation).

Rocky Shelf - Those waters, substrates, and associated biological communities living on or within ten meters (5.5 fathoms) overlying rocky areas, including reefs, pinnacles, boulders and cobble, along the continental shelf, excluding canyons, from the high tide line MHHW to the shelf break (~200 meters or 109 fathoms).

Non-rocky Shelf - Those waters, substrates, and associated biological communities living on or within ten meters (5.5 fathoms), overlying the substrates of the continental shelf, excluding the rocky shelf and canyon composites, from the high tide line MHHW to the shelf break (~200 meters or 109 fathoms).

Canyon - Those waters, substrates, and associated biological communities living within submarine canyons, including, the walls, beds, seafloor, and any outcrops or landslide morphology, such as slump scarps and debris fields.

Continental Slope/Basin - Those waters, substrates, and biological communities living on or within 20 meters (11 fathoms) overlying the substrates of the continental slope and basin below the shelf break (~200 meters or 109 fathoms) and extending to the westward boundary of the EEZ.

Neritic Zone - Those waters and biological communities living in the water column more than ten meters (5.5 fathoms) above the continental shelf.

Oceanic Zone - Those waters and biological communities living in the water column more than 20 meters (11 fathoms) above the continental slope and abyssal plain, extending to the westward boundary of the EEZ.

Furthermore, estuaries, sea grass beds, canopy kelp, rocky reefs, and other “areas of interest” (*e.g*., seamounts, offshore banks, canyons) are designated HAPC for managed groundfish species.

Historically, the Santa Cruz Harbor (formerly known as Woods Lagoon) likely provided a productive, albeit small, estuarine environment for Pacific groundfish species. In its current form, the Santa Cruz Harbor is a highly modified and degraded version of estuarine habitat. Canopy kelp and rocky reef HAPCs have been identified in close proximity to Santa Cruz Harbor, but no HAPC designations occur within the Harbor or the Project Area.

Potential Adverse Effects of Proposed Project

Adverse effect means any impact, which reduces quality and or quantity of EFH, and may include direct (*e.g.*, contamination or physical disruption), indirect (*e.g.*, loss of prey or reduction in species fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Adverse effects include: 1) Direct or indirect physical, chemical, or biological alterations of the waters or substrate; and, 2) Loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH.

The proposed project area is located within an area identified as EFH for Pacific coast salmon, coastal pelagic species, and Pacific coast groundfish. The potential adverse effects of the proposed project are essentially identical for all three groups of species and are discussed collectively below.

Construction activities would result in localized, temporary adverse effects to EFH through disturbance of water quality, if not properly managed. Project construction may result in temporary increases in ambient turbidity levels. Accidental spills of hazardous materials such as equipment fuels and fluids may temporarily affect water quality. Water quality effects may temporarily reduce quality of EFH, including disturbance to or loss of foraging prey, during the construction phase.

Similarly, underwater sound pressures produced during pile driving activities would temporarily reduce the quality of EFH during construction activities through disturbance or loss of prey species and creating habitat conditions that may prove to be distracting, disorienting, and otherwise unsuitable for FMP-managed species.

The proposed project would also result in permanent but minor adverse effect to EFH due to installation of 24 30-inch steel casing piles to support and reinforce Murray Street Bridge. The piles would cover a total of approximately 430 square feet. Although this alteration would be permanent, the project would not appreciably diminish the value of EFH within the proposed project area. Existing conditions of fish habitat within Santa Cruz Harbor are considered highly disturbed because the area has been dredged in the past and it is continually utilized by recreational boaters. Dredging of the harbor entrance area has occurred since 1965, and periodic dredging of the inner harbor has occurred since 1983. Additionally, the area to be permanently occupied by piles is minimal compared to the remaining harbor waters that cover over 30 acres. The piles would not result in obstruction to fish passage or migration.

Conservation Measures

The following measures will be implemented to minimize the potential adverse effects to designated EFH described above.

- Based on the geotechnical site characteristics, the permanent bridge piles will be partially or entirely vibrated into the Harbor substrate rather than driving them by means of “hammering”; a vibratory driver will be used for the dock piles and temporary trestle piles, if a construction trestle is erected. Vibratory pile driving does not generate peak sound pressure levels that cause direct impacts to fish species.
- Pile driving activities that rely on impact hammers rather than vibratory techniques shall be designed to assure compliance with the interim criteria for Sound Exposure Levels (SEL) less or equal to 187 decibels (dB) in any single strike, and peak sound pressure less or equal to 208 dB in any single strike, measured at a distance of 32.8 feet from the source. In addition, to reduce sound pressure levels to the greatest extent feasible, a cushioning block between hammer and pile shall always be used.
- Bubble curtains shall be used at all piles driven by impact hammers.
- Incorporate Best Management Practices (BMPs) into construction specifications, including, but not limited to:
    - To protect water quality, require all excavated soils, fill and construction materials be stored and contained in a designated area away from Harbor waters, and cover stockpiled soils to prevent release of sediments.
    - Prohibit fueling, cleaning, or maintenance of equipment except in designated areas located as far from Harbor waters as possible. As a precaution, require contractor to maintain adequate materials onsite for containment and clean-up of any spills.
    - Install temporary erosion and sedimentation control devices.
    - Locate equipment and spoils in designated staging areas.
    - Control of dewatering process to limit turbidity.
    - Prepare and implement a Stormwater Pollution Prevention Plan (SWPPP) that further details measures for erosion, sediment and water quality control.
    - All fill material would be clean material that would meet applicable water quality standards.

Conclusion

Construction of the proposed project would result in minor, temporary adverse impacts to EFH for Pacific coast salmon, coastal pelagic species, and Pacific coast groundfish through localized effects to water quality (e.g., increased turbidity, accidental spills of hazardous materials). Similarly, underwater sound pressures produced during pile driving activities would temporarily reduce the quality of EFH during construction activities. However, implementation of the proposed avoidance and minimization measures would reduce the likelihood, extent, and duration of these impacts.

The proposed project would also result in the minor but permanent alteration of EFH through the construction of bridge support piles that would eliminate approximately 430 square feet of currently available habitat. However, existing conditions of fish habitat within Santa Cruz Harbor are considered highly disturbed and the area to be permanently occupied by piles is minimal compared to the remaining harbor waters.

Caltrans believes that the proposed action will not adversely affect EFH for Pacific coast salmon, coastal pelagic species, and Pacific coast groundfish due to the localized and temporary nature of construction-related impacts and the minor extent of permanent habitat loss.

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