# INCIDENTAL HARASSMENT AUTHORIZATION APPLICATION FOR THE NAVY'S FUEL PIER REPLACEMENT PROJECT AT NAVAL BASE POINT LOMA

Submitted to:

**Office of Protected Resources,**
**National Marine Fisheries Service,**
**National Oceanographic and Atmospheric Administration**

Prepared by:

**Naval Facilities Engineering Command**

For:

**Naval Base Point Loma**

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# TABLE OF CONTENTS

## LIST OF FIGURES

## LIST OF TABLES

# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ac | acre |
| ° C | Celsius |
| CALTRANS | California Department of Transportation |
| CFR | Code of Federal Regulations |
| CISS | cast-in-place steel shell |
| CSLC | California State Lands Commission |
| CV | Coefficient of Variation |
| cy | cubic yards |
| dB | Decibel |
| dBA | Decibel with A-weighting filter |
| DFSP | Defense Fuel Support Point |
| DFM | diesel fuel marine |
| DHS | Department of Homeland Security |
| DoD | Department of Defense |
| Navy | Department of the Navy |
| ESA | Endangered Species Act |
| °F | Fahrenheit |
| FOR | Fuel Oil Reclamation |
| ft. | Feet |
| Hz | Hertz |
| IHA | Incidental Harassment Authorization |
| in | inch |
| kHz | Kilohertz |
| km | Kilometer |
| lf | linear ft |
| lbs | pounds |
| m | meter |
| pmin | minute(s) |
| MHHW | mean higher high water |
| MLLW | mean lower low water |
| MOTEMS | Marine Oil Terminal Engineering and Maintenance Standards |
| MMO | Marine Mammal Observer |
| MMPA | Marine Mammal Protection Act |
| NAS | Naval Air Station |
| NAVFAC | Naval Facilities Engineering Command (SW = Southwest) |
| Navy | U.S. Department of the Navy |
| NBPL | Naval Base Point Loma |
| NEPA | National Environmental Policy Act |
| NMAWC | Naval Mine and Anti-Submarine Warfare Command |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanic and Atmospheric Administration |
| NRC | National Research Council |
| NRSW | Navy Region Southwest |
| NMSDD | Navy Marine Species Density Database |
| Pa | Pascal |

| | |
|---|---|
| POSD | Port of San Diego |
| PTS | Permanent Threshold Shift |
| rms | root mean square |
| SCB | Southern California Bight |
| SEL | Sound Exposure Level |
| sf | square ft |
| SPAWAR | Space and Naval Warfare Systems Command |
| SPL | Sound Pressure Level |
| SSC | SPAWAR Systems Center |
| TDI | Tierra Data, Inc. |
| TL | Transmission Loss |
| TS | Threshold Shift |
| TTS | Temporary Threshold Shift |
| μPa | microPascal |
| UFC | Unified Facilities Criteria |
| U.S. | United States |
| USACE | U.S. Army Corp of Engineers |
| USCG | U.S. Coast Guard |
| USEPA | U.S. Environmental Protection Agency |
| WSDOT | Washington State Department of Transportation |
| ZOI | Zone of Influence |

# EXECUTIVE SUMMARY

In accordance with the Marine Mammal Protection Act (MMPA) of 1972, as amended, the U.S. Navy (Navy) is applying for an Incidental Harassment Authorization (IHA) to initiate the Fuel Pier Replacement Project in the northern part of San Diego Bay at Naval Base Point Loma (NBPL) (MILCON P-151). For this IHA application, the Navy determined noise from pile driving and extraction is the only component of the action that has the potential to rise to the level of harassment under the MMPA.

Four species of marine mammals have a reasonable likelihood of occurrence during the project's timeline, and could thereby be exposed to sound pressure levels (SPLs) associated with vibratory and impulsive pile driving and the removal of existing pier pilings: the California sea lion (*Zalophus californianus*), harbor seal (*Phoca vitulina*), gray whale (*Eschrichtius robustus*), and the common (or coastal) bottlenose dolphin (*Tursiops truncatus*).

The Fuel Pier Replacement Project is needed to ensure the continuation of fueling operations at the pier, which is primary source of fuel for Navy vessels in southern California. This project replaces the aging and seismically deficient Fuel Pier (Pier 180) located at NBPL. The new pier project will, to the extent practicable, meet current California State Lands Commission - Marine Oil Terminal Engineering and Maintenance Standards (MOTEMS). An environmentally safe and improved fuel receipt and delivery capability at the Defense Fuel Support Point (DFSP), Fleet and Industrial Supply Center (FISC), San Diego will be provided. The Fuel Pier NBPL is an extremely valuable asset to the U.S. Navy as it is the only active fueling facility in the vicinity.

The Approach and North Segment of the pier were constructed in 1908. The South Segment and Quaywall were built in 1942. The average service life of concrete and steel structures in a marine environment is on the order of 50 years. The facility has outlived its anticipated useful service life, and is having difficulty in meeting its core requirements of fueling and de-fueling Fleet assets. Currently, the facility can only de-fuel barges and tankers and is turning away Navy assets. Navy ships are being forced to use other port operation facilities including commercial shipyards.

The proposed action will be phased over four years and include the demolition and removal of the existing T-shaped pier and associated pipelines and appurtenances, and replacement with a generally similar structure but which meets state standards for seismic strength, and is designed to better accommodate modern Navy ships. Existing wood and concrete piles will be extracted using a crane, vibratory hammer, water jet, and/or pneumatic chipper. The proposed action includes the installation of 77 48-in (in) diameter and 228 36-in diameter 1-in wall steel pipes; 165 24-in diameter by 1-in pre-stressed concrete piles; and 84 16-in diameter concrete-filled fiberglass piles at the new fuel pier for a total of 554 piles. The steel pilings would be installed using a vibratory hammer to refusal and then driven the last 10-15 ft with an impact hammer for structural stability. The concrete and fiberglass piles would be driven entirely with an impact hammer.

To avoid impacts to California least tern foraging habitat and per the Navy/USFWS MOU (NAVFAC SW 2004), all in-water demolition and construction activities that generate underwater noise and/or turbidity will be restricted to the non-nesting period (nominally 16 September to 31 March). Pile driving/extraction and related activities are forecast to occur at the beginning of the non-nesting season in September 2013 and last for up to 8 months. The IHA

Application only covers this time-frame of in-water work. Since the project will last for four years, the Navy will be re-applying annually for a new IHA until 2017.

The proposed action also includes temporary relocation of the Navy Marine Mammal Program (MMP) The Navy MMP, which is administered by Space and Naval Warfare Systems Command (SPAWAR) Systems Center (SSC), would be moved from the current location adjacent to the fuel pier. Although the Navy working mammals are not subject to MMPA, the Navy veterinarians are taking precautionary measures to ensure the mammals' safety. The only suitable location available is at the Naval Mine and Antisubmarine Warfare Center (NMAWC), approximately 3 kilometers (km) away. NMAWC is acoustically shadowed from the piling noise. To install marine mammal enclosures in their new location would require approximately 50 18-in square concrete guide piles to be driven at the NMAWC location. At the end of the fuel pier construction period, the Navy marine mammals and their floating enclosures would be moved back to the existing location and the 50 guide piles would be removed.

The proposed action also includes dredging a high spot west of the existing fuel pier to a depth of -40 ft mean lower low water level. Approximately 80,000 cubic yards of dredged sediments would be put to beneficial reuse through nearshore disposal at an existing receiver site south of the Imperial Beach Pier.

One of the avoidance and minimization measures for the proposed action is the removal of the Everingham Brothers San Diego Bay Bait Barge, which consists of two barges, from the acoustic Zone of Influence. As discussed in the body of the IHA, the Bait Barge is a significant haul-out for sea lions in the Bay. The Bait Barge operation is a private business and operates under a lease with the Navy. Although the Navy is not relocating the Bait Barge and is not paying for any of the relocation costs, the Navy will assist the Bait Barge operation in determining viable Bait Barge relocation options and potential environmental impacts of relocating the Bait Barge in the P-151 EA. Following adoption of a Finding of No Significant Impact (FONSI) for this project, the Everingham Brothers Bait Company and the California State Lands Commission would be expected to execute a lease for a relocation site. Relocating the Bait Barge outside of the ZOI would reduce the exposure of sea lions to sound levels below Level A and B thresholds. Also, moving the Bait Barge would help avoid the potential damage to the commercial bait fish which are important to the local fishing industry. Prior to moving the barges, the barge owners would deter sea lions from hauling out on the barges with sprinklers or other non-injurious methods, which is permissible under Section 109(h) of the MMPA and would not constitute harassment. Otherwise, this related activity does not have the potential to affect the distribution or behavior of marine mammals in a way that would result in takings under the MMPA.

For pile driving activities, the Navy used National Marine Fisheries Service (NMFS) promulgated thresholds for assessing pile driving impacts (NMFS 2005, NMFS 2009), outlined in Section 6. Empirically measured source levels from similar pile driving events were used to estimate pile driving sound source levels for this project. For pile driving associated with fuel pier construction, the Navy worked with researchers from the University of Washington to develop a rigorous model of underwater transmission loss, taking into account site-specific bathymetry and shoreline characteristics. The transmission loss model was used to calculate the distance to each relevant zone of influence (ZOI) for potential marine mammal takes associated with pile driving for the new pier. For the marine mammal relocation site at NMAWC, the practical spreading loss equation was used to calculate ZOIs. The spherical spreading loss equation was used for airborne noise from pile driving.

Since data from marine mammal surveys conducted offshore Southern California are not representative of the abundance of the commonest species (California sea lion) in the action area, the density of that species within ZOIs is estimated from a large number of site-specific marine mammal surveys conducted by the Navy from 2007 through March 2012 in northern San Diego Bay and the adjacent offshore waters. Given extreme variability in the number of coastal bottlenose dolphins sighted in the same surveys, the regional density estimate developed in the Navy Marine Species Density Database (Hanser et al. 2012) was considered a more reliable indicator of the number of that species likely to be present during construction/demolition activities and has been used in this IHA application. Since pile driving (including steel, concrete and fiberglass piles) would only occur between September and April, only survey data obtained during that period were used. Recent observations of harbor seal and gray whale occurrence were used to identify the most likely scenarios and numbers of individuals that could occur within ZOIs.

California sea lions are by far the dominant marine mammal in the project area with the bulk of the population hauled out on or swimming next to the Bait Barge. It is anticipated that the sea lions will relocate to temporary haul outs at the mouth of the Bay to stay closer to their forage base. Some animals may attempt to follow the Bait Barge to the new location outside of the ZOI.

Potential exposures are calculated in Section 6. The calculations predict no Level A harassments (injuries) would be caused by pile driving activities. Navy monitoring will ensure that pile driving would not occur if a marine mammal is within the Level A ZOI. The modeling predicts a combined total of 1,406 non-injurious Level B behavioral harassments to California sea lions, harbor seals, gray whales, and bottlenose dolphins as shown in Table ES-1. Harassments are predominantly due to underwater sound caused by the use of the impact and/or vibratory pile drivers to drive steel piles, as well as vibratory extraction and pneumatic chipping of piles. The same individual harbor seals potentially subject to harassment by underwater sound may also be harassed by airborne sound associated with pile driving. California sea lions are not expected to occur within a distance where they would be harassed by airborne sound.

**Table ES-1. Number of Takes Requested per Species (Level B Harassments)**

| ***Species*** | ***Number of Level B Takes Requested*** |
|---|---|
| California sea lion | 994 |
| Harbor seal | 90 |
| Gray whale | 15 |
| Coastal bottlenose dolphin | 307 |
| ***Total*** | ***1,406*** |

The proposed action will include acoustic monitoring of pile driving operations as well as observational monitoring of marine mammal occurrences within ZOIs. This information will be used to validate and refine the take estimates for subsequent IHA applications.

Pursuant to the MMPA Section 101(a)(5)(D)[1], the Navy submits this application to the NMFS for an IHA for the incidental, but not intentional, taking of four marine mammal species during pile driving and extraction activities as part of the Fuel Pier Replacement Project, for the 8-month period beginning 1 September 2013. The taking would be in the form of non-lethal, temporary harassment and is expected to have a negligible impact on these species. In addition, the taking would not have an unmitigable adverse impact on the availability of these species for subsistence use.

Regulations governing the issuance of incidental take under certain circumstances are codified at 50 Code of Federal Regulations (CFR) Part 216, Subpart I (Sections 216.101 – 216.108). Section 216.104 sets out 14 specific items that must be addressed in requests for take pursuant to Section 101 (a)(5)(D) of the MMPA. These 14 items are addressed in Sections 1 through 14 of this IHA application.

[1] 16 U.S.C. § 1371(a)(5); 50 CFR Part 216, Subpart I.

# 1 DESCRIPTION OF ACTIVITIES

*A detailed description of the specific activity or class of activities that can be expected to result in incidental taking of marine mammals.*

## 1.1 Introduction

Naval Base Point Loma (NBPL), California, is located on the peninsula of Point Loma near the mouth and along the northern edge of San Diego Bay (Figure 1-1). NBPL provides berthing and support services to United States (U.S.) Department of the Navy (Navy) submarines and other fleet assets. The entirety of NBPL is restricted from general public access, although the adjacent waters of San Diego Bay are heavily used by the public as well as the Navy. The Proposed Action (Figure 1-2) would involve demolition of the aging and seismically deficient fuel pier (Pier 180) at NBPL; construction of a new enhanced fuel pier with optimum capability to support current and projected fueling needs of the Navy and Department of Homeland Security (DHS); performance of associated dredging, and the beneficial reuse of dredged sediments; the temporary relocation of the Navy's Marine Mammal Program, which is administered by the Space and Naval Warfare Systems Command (SPAWAR) Systems Center (SSC), to avoid potential effects of construction noise on SSC's working mammals; and the relocation of a commercial Bait Barge to reduce potential construction noise effects on California sea lions (*Zalophus californianus*) (which are attracted to the Bait Barge) and on the bait fish, which are an important resource for the local fishing community. Project demolition, construction, and dredging would occur simultaneously, and would commence in 2013 and be completed in 2017. Sections 1.2 and 1.3 describe the proposed activities to be conducted in detail. The proposed activities with the potential to affect marine mammals within the waterways adjacent to NBPL that could result in harassment under the Marine Mammal Protection Act (MMPA) of 1972, as amended in 1994, are pile installation by impact and vibratory pile drivers, and vibratory pile removal. Whereas this section provides an overview of the entire project, Section 2 provides more specific details on activities proposed to occur during the period of this IHA.

## 1.2 Proposed Action

### 1.2.1 Background

The existing fuel pier (Figure 1-3) serves as a fuel depot for loading and unloading tankers, U.S. Navy underway replenishment vessels that refuel ships at sea ("oilers") fueling Navy, DHS, Department of Defense (DoD), and foreign Navy vessels, as well as transferring fuel to the local replenishment vessels and other small craft operating in San Diego Bay. The fuel pier at NBPL Defense Fuel Support Point (DFSP) is critical to the mission of the Navy and is the only active Navy fueling facility in southern California. More than 42 million gallons of fuel are stored at NBPL DFSP and more than 11 million gallons of fuel are issued and received every month to an average of 43 ships including the Military Sealift Command, Expeditionary Warfare Training Groups, three carrier strike groups, National Oceanic and Atmospheric Administration (NOAA), DHS, foreign and small craft. The approach (portion that connects to shore) and north segments are over 100 years old (constructed in 1908 as La Playa Coaling Wharf). The south segment was constructed in 1942. The average design service life of this kind of structure in a marine environment is typically considered to be about 50 years (Navy 2010a). The pier, as such, is significantly past its design service life. Further, the pier does not meet current California State Lands Commission (CSLC) - Marine Oil Terminal Engineering and Maintenance Standards (MOTEMS) Level 1 (operational) and Level 2 (survival) seismic criteria (Navy 2010a, b).

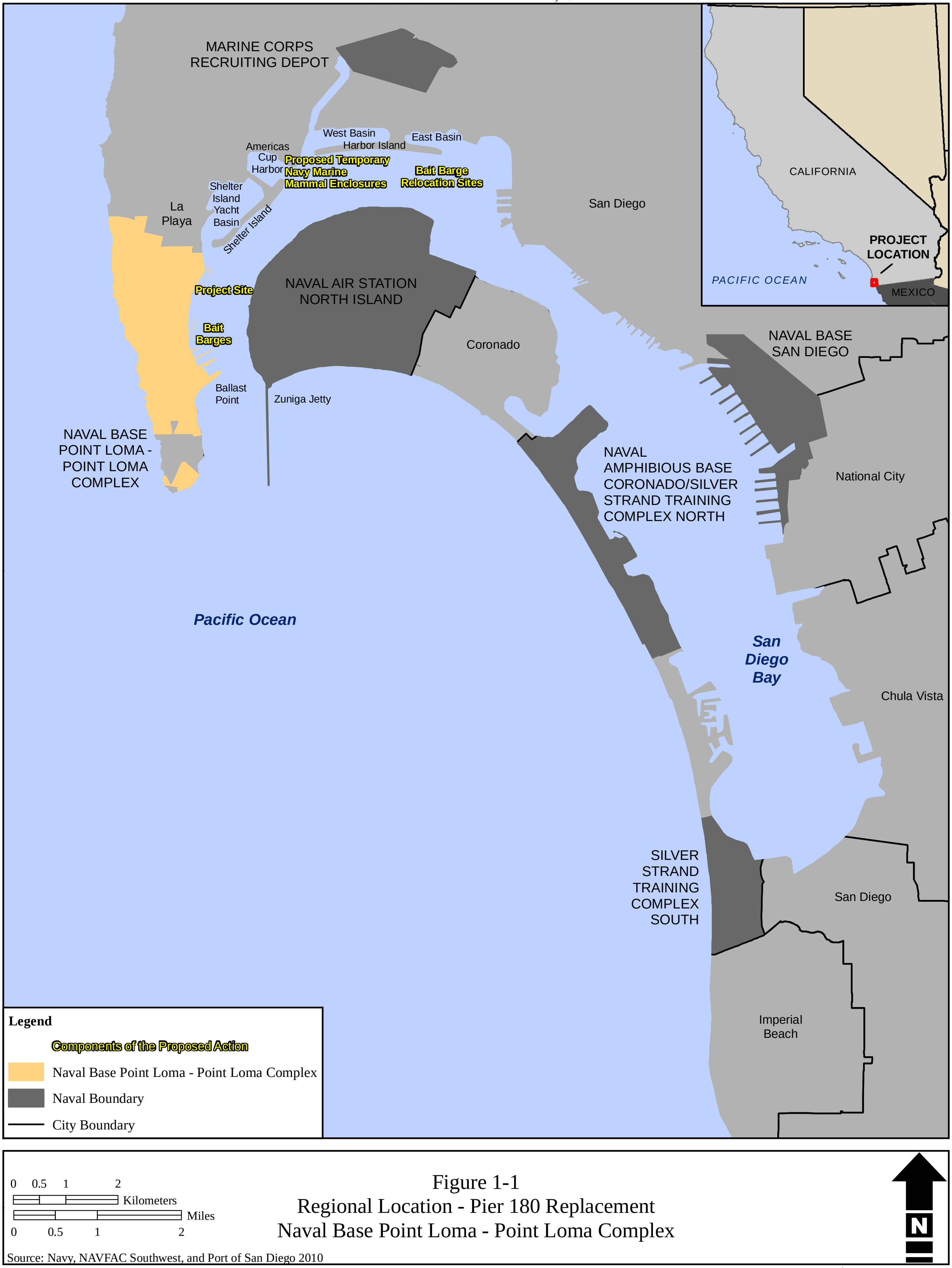



Figure 1-1
Regional Location - Pier 180 Replacement
Naval Base Point Loma - Point Loma Complex

Source: Navy, NAVFAC Southwest, and Port of San Diego 2010

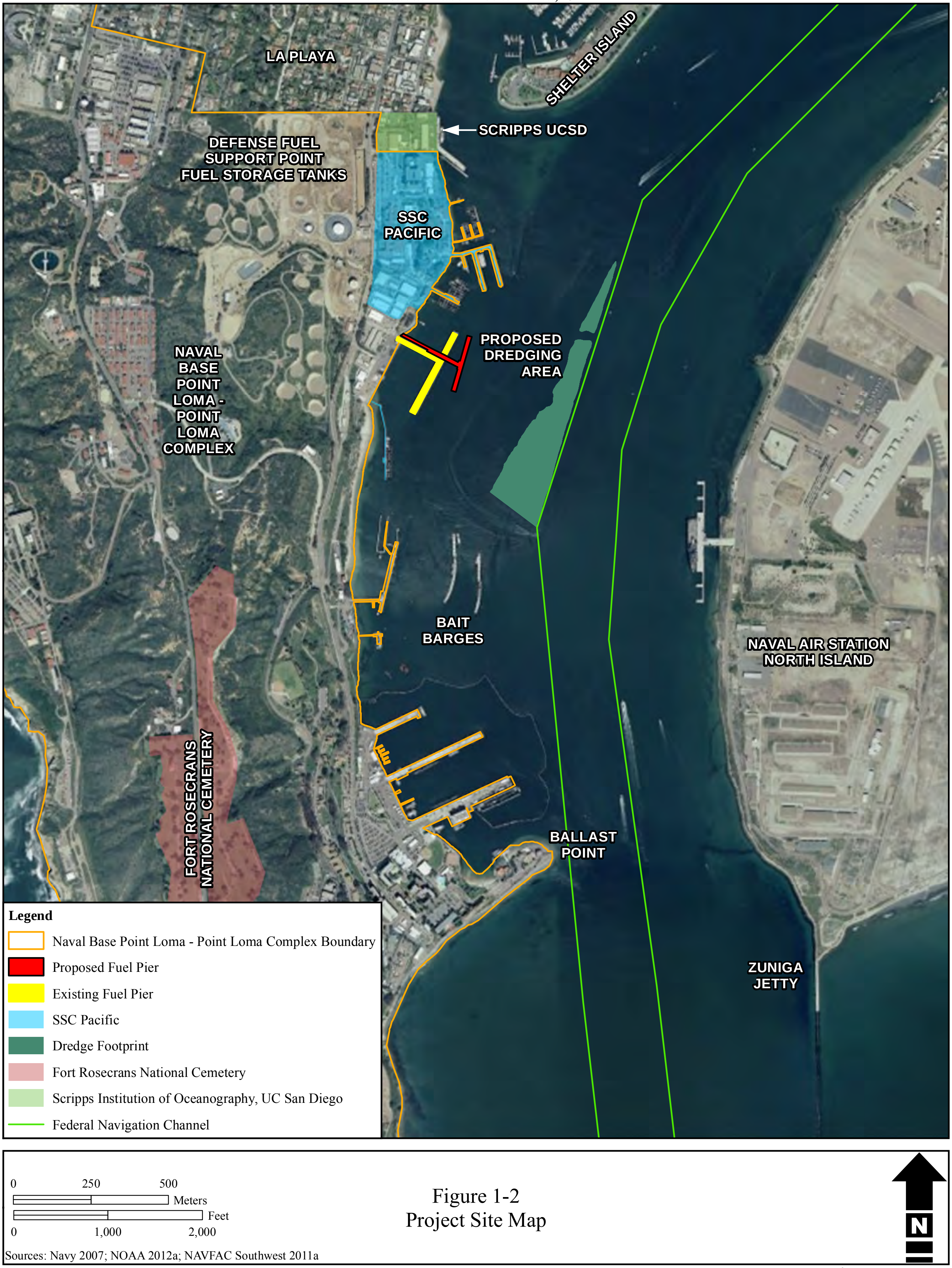



Figure 1-2
Project Site Map

Sources: Navy 2007; NOAA 2012a; NAVFAC Southwest 2011a


a) Aerial View of Existing Fuel Pier 180

b) View of Existing Fuel Pier 180 to the northeast

**Figure 1-3 Views of Existing Fuel Pier 180**

Because of the structural deficiencies, significant damage in a moderate earthquake is considered likely, with potential failure of the pile foundations occurring in a major seismic event.

The existing fuel pier is not consistent with the modern standards set out in the MOTEMS regulations which the Navy looks to for guidelines, although the MOTEMS are not literally applicable to or enforceable against the Navy. The poor condition of the existing fuel pier has been noted in the Navy Region Southwest (NRSW), Port Operations Shore Infrastructure Plan, dated April 2009 (Navy 2010a).

Per the Defense Readiness Reporting System an overall rating of "F4" has been assigned to the existing fuel pier facility. This translates into: "Facility has deficiencies that prohibit or severely restrict use of its designated functions." The Port Operations Shore Infrastructure Plan has listed P-151 "Replace Pier 180" as a planned project affecting Port Operations for NRSW. Additionally, the existing fuel pier is situated in waters where the natural bottom depth is 30 to 40 feet (ft) thus requiring maintenance dredging because San Diego Bay has an open hydrologic circulation system that causes infill around piers and infrastructure. Dredging occurred most recently in 1999 to keep the pier accessible for larger vessels.

To support the fueling needs of the Navy and DHS, the NBPL DFSP must be able to provide adequate services, i.e., receive and issue fuel, to multiple ships at a time. To meet this requirement, ships and barges are received on both the inboard and outboard sides of the existing pier. The inboard south side of the pier is primarily used for fuel issues to small cutters, mine sweepers, and barges. The inboard north side is used for fueling small craft. The outboard side of the pier is currently used to issue and receive fuel from large ships, i.e., tankers, oilers, transport ships, dock landing ships, ocean going barges, and various other Navy and DHS vessels. When included with scheduling requirements, the demand of the existing pier has exceeded the facility capacity. In addition, the existing fuel pier has reached a maximum capacity for the deeper outer berth, resulting in the need to turn vessels away due to lack of available docking and mooring space.

It is anticipated future classes of ships would generally be more multi-purpose, require more frequent fueling, and further increase the fuel capacity loading requirement for the new replacement fuel pier (Navy 2010a). The existing fuel pier lacks deep water berthing capability and is therefore limited in the range of vessels that can be accommodated (Navy 2010a).

## 1.3 Description of Pile Installation and Other Construction Activities

In addition to demolition and construction, which are described in more detail below, the Proposed Action would include the following key elements.

- ***Temporary Relocation of the Marine Mammal Program.*** Before the pier replacement activities begin, the Navy Marine Mammal Program, which is administered by Space and Naval Warfare Systems Command (SPAWAR) Systems Center (SSC), would be moved to the Naval Mine and Anti-submarine Warfare Command (NMAWC), (Figure 1-4). SSC's working mammals are being relocated so that they will not be affected by noise and vibrations associated with demolition/construction-related activities. The only suitable location available is at the Naval Mine and Antisubmarine Warfare Center (NMAWC), approximately 3 kilometers (km) away. NMAWC is also acoustically shadowed from the piling noise. Per 10 U.S. Code (USC) 645 Section 7524, the Navy's authorization to hold marine mammals applies without regard to the provisions of the

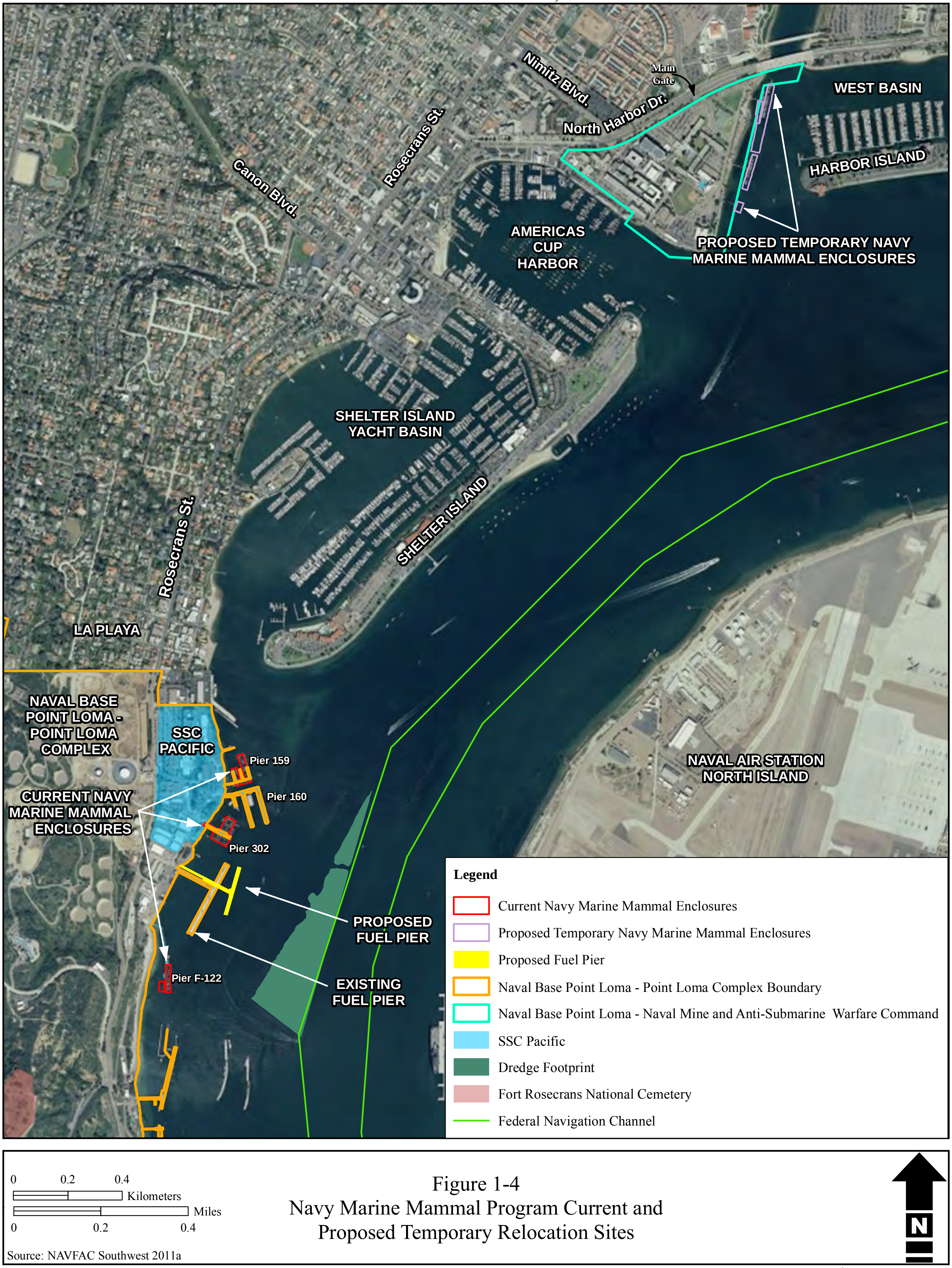



Figure 1-4
Navy Marine Mammal Program Current and Proposed Temporary Relocation Sites

Source: NAVFAC Southwest 2011a

MMPA. Construction of the temporary facility would include driving 50 18-in square concrete piles; this component of the action is analyzed herein for potential effects on wild marine mammals. After completion of the new fuel pier the Marine Mammal Program would move back to its original location adjacent to the fuel pier, and the temporary facilities at NMAWC would be removed.

- ***Regulated Navigation Zones***. Amendments to the existing navigation zones are needed because the proposed replacement pier would not fit with the existing boundaries of the U.S. Army Corps of Engineers (USACE) Restricted Area and the U.S. Coast Guard (USCG) Security Zone.
- ***Dredging and Sediment Disposal***. Dredging and sediment disposal are needed to deepen an existing turning basin, so that the basin can safely accommodate current and future deep draft berthing capabilities. An estimated 80,000 cy of sediment would be dredged. Laboratory testing of the sediments confirmed the lack of contamination and they were approved for ocean disposal by the U.S. Environmental Protection Agency (USEPA) and USACE. However, the sediments also have sufficient content of sand for beneficial reuse in nearshore replenishment. Accordingly, the sediments would be transported by barge and deposited at an approved nearshore replenishment site (Imperial Beach).
- ***Notice to Mariners.*** To ensure safety of all vessels using the San Diego Bay, the Navy would issue a Notice to Mariners when in-water components of this project are occurring, including relocation of the marine mammal enclosures.
- ***Construction Monitoring.*** Sound propagation data will be collected through hydroacoustic monitoring during pile installation and removal. The presence of marine mammals will also be monitored during pile installation and removal. The results from acoustic and marine mammal monitoring during the period of the first Incidental Harassment Authorization (IHA) will be used to validate or revise estimated zones of influence and acoustic effects on marine mammals and support subsequent IHA application.

Although not an element of the (P-151) NBPL Fuel Pier Replacement Project, the Everingham Brothers San Diego Bay Bait Barge would be temporarily relocated by the owners. The two barges, which are currently anchored in Navy waters approximately 600 meters (m) south of the existing fuel pier, would be moved to either of two locations along the southwest side of Harbor Island, approximately 5 kilometers (km) from the project site (Figure 1-5). The two barges attract large numbers of sea lions, and their relocation would reduce the number of sea lions that would be exposed to noise levels constituting harassment under the MMPA. Barge relocation would also avoid construction underwater noise disturbance to the bait fish, which might otherwise affect their viability. The Bait Barge would be moved prior to the initiation of in-water construction. The barges could be moved back to their existing location when in-water construction is no longer occurring. Prior to moving the barges, the barge owners would deter sea lions from hauling out on the barges with sprinklers or other non-injurious methods, which is permissible under Section 101(a)(4) of the MMPA and would not constitute harassment.

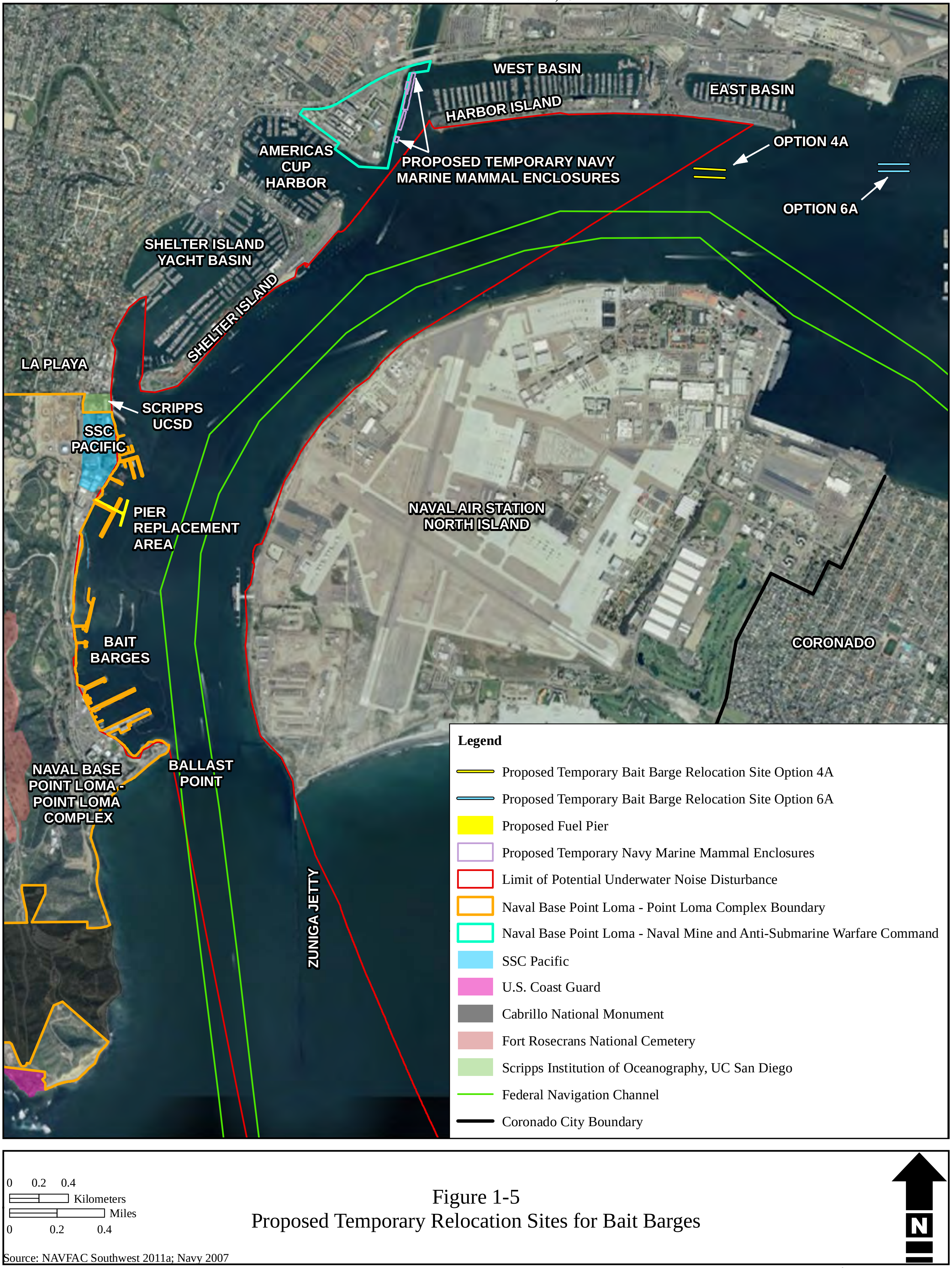



Figure 1-5
Proposed Temporary Relocation Sites for Bait Barges

Source: NAVFAC Southwest 2011a; Navy 2007

### 1.3.1 Demolition and Removal of the Existing Fuel Pier

Demolition and construction would occur in two phases to maintain the fueling capabilities of the existing fuel pier while the new pier is being constructed. Each of the utilities, systems and pier features would be demolished as described in this section, but on a segment-by-pier segment basis to allow for continuous fueling operations during demolition and construction. In particular, the south side of the existing pier would remain operational while the north side is undergoing demolition and the new pier is being constructed. When construction of the new pier is complete, the remainder of the old pier would be demolished. Table 1-1 below summarizes the work that would be done in each phase, and the approximate timing and durations of each phase. More detail is provided in Section 1.3.2. The total duration of demolition/construction is estimated to be approximately four years (2013 through 2017). Whereas this IHA application is for the first period of in-water demolition/construction, at least three subsequent IHA applications would be submitted for subsequent activities.

**Table 1-1. Construction Phase Summary**

| | |
|---|---|
| **PHASE ONE (Approximately 3 years)** | |
| 1 | Initial mobilization of equipment to the site, set up temporary office space (Aug-Sep 2013). |
| 2 | Temporary relocation of Navy marine mammals to NMAWC (Sep 2013-Mar 2014). |
| 3 | Relocation of Everingham Brothers Bait Company Bait Barge (Feb 2014). |
| 4 | Indicator Pile Program- Drive approximately 12 piles (several of them will be 'driven' twice: once to the tip elevation, and again after 48 hours to check the 'set-up' strength) (Mar 2014). |
| 5 | Construct temporary mooring dolphin south of existing fuel pier (Mar-Apr 2014). |
| 6 | Demolish above water components, north segment of the existing fuel pier (Apr-Jul 2014). |
| 7 | Construct abutments at landside end of approach segment for the new fuel pier (Mar-Oct 2014). |
| 8 | Construct portions of landside utilities and relocations (Sep 2014-Jun 2016). |
| 9 | Demolish in-water components, north segment of the existing fuel pier, Mar 2014 – March 2015 |
| 10 | Construct the new pier: ramped approach pier (lower and upper deck) two northern mooring dolphins, and double deck fueling pier (Mar 2014-Jun 2016). |
| 11 | Connect/construct fueling lines to new pier and begin fueling at the new fuel pier (Jun 2016). |
| **PHASE TWO (Approximately 1 year)** | |
| 1 | Construct southern berthing dolphin and mooring dolphin (Sep-Nov 2016). |
| 2 | Demolish remainder of existing fueling pier (approach and south segments) (Jun-Nov 2016). |
| 3 | Complete abutment construction (Sep-Oct 2016). |
| 4 | Remove temporary mooring dolphin (Nov 2016). |
| 5 | Complete grading, paving, and landside utility work (Nov 2016). |
| 6 | Demobilize equipment from site, remove temporary offices (Nov 2016-Jan 2017). |

More detail is provided below only on those aspects of the project involving in-water activity or otherwise might have the potential to result in takings of marine mammals. Other aspects of the project are considered in more detail in the Navy's Environmental Assessment. It should be noted that the fuel storage tanks, pipelines, and supporting infrastructure are currently being replaced under the P-401 construction project (Navy 2010a).

In addition to fueling vessels, NBPL DFSP supplies JP-5 (jet fuel) to Naval Air Station (NAS) North Island across San Diego Bay to the east via two underwater pipelines (Naval Facilities Engineering Command [NAVFAC] 2009). The NAS North Island pipelines are not included in either the fuel pier or fuel storage facility replacement projects (Navy 2007, 2010a). However the NAS North Island pipelines are in the fuel pier replacement project area, both onshore and offshore. The Navy would work with contractors to establish a safety buffer zone between the pipelines and the demolition and construction work zone footprint and would ensure that all contractors' equipment and vessels remain outside the buffer zone during demolition and construction.

The majority of the work would be conducted over water and would include removal of the pier, pilings, plastic camels and fenders. All utility infrastructure would be removed, including water and sewer pipelines, lighting systems, and wiring. The fueling systems, including piping and pipe supports would also be removed. Facility information for the existing fuel pier is included in Table 1-2.

**Table 1-2. Existing Fuel Pier (Pier 180) Information**

| *Existing Pier 180* | *Pier Specifications* |
|---|---|
| Installation | Naval Base Point Loma (NBPL), San Diego, California |
| Activity | Defense Fuel Supply Point (DFSP) |
| Facility Name | Fuel Pier (Pier 180) |
| Pier Area | 71,180 square ft (sf) |
| Description | T-shaped fuel pier, consisting of 3 sections with concrete deck |
| Approach Segment | Built in 1908, Size: 34 ft (ft) x 500 ft, timber support piles, steel caissons and superstructure, plastic fender piles |
| North Segment | Built in 1908, Size: 50 ft x 349 ft, timber support piles, steel caissons and superstructure, plastic fender piles |
| South Segment | Built in 1942, Size: 60 ft x 598 ft, concrete support piles and superstructure, plastic fender piles |
| Function | Loading and off-loading of fuels and contaminated petroleum products |
| Current Ship Loading | Average: 43 ships/month |
| Condition of Facility | Facility is aging, is in poor condition, and is seismically deficient |
| Major Structural Repairs | Repairs to four undermined caissons on the Approach Pier in 1957 and two additional undermined caissons in 1987. The 1987 repairs included the installation of a submerged steel sheet pile bulkhead to prevent further undermining of the caissons. |

*Source:* Navy 2010a.

Demolition Process

Aspects of the demolition process that would occur on or alongside the pier and would not impact marine mammals include hazardous materials abatement, the removal of mechanical and electrical utilities, the evacuation of the fueling system and pipelines, the removal of cleat and bollard bases and removal of the plastic fendering system. These activities do not require analysis here and are described and analyzed further in the Navy's Environmental Assessment.

*Concrete Deck and Pier Pilings.* Typical pier demolition takes place bayward to landward and from the top down. Table 1-3 below lists the types and numbers of piles to be removed. Section 2 provides more specific details on the activities proposed to occur during the period of this IHA. First, the fender piles and exterior appurtenances (such as utilities and the fuel piping systems) would be removed above and below the pier deck (see below for more detail). Then, the deck would be demolished using concrete saws (e.g., http://diamondconcretesawing.com/diamond-concrete-sawing/industries/road--bridge.aspx) and a barge-mounted excavator equipped with a hydraulic breaker (e.g., www.hitachi-c-m.com/global/products/excavator/barge/dredging_ships.html). Next, structural and fender piles would be demolished.

**Table 1-3. Existing Fuel Pier (Pier 180) Piles and Caissons**

| *Pile Type or Structure* | *Number* |
|---|---|
| 16-in concrete structural piles | 518 |
| 14- and 24-in concrete fender piles | 105 |
| 13-in plastic fender piles | 34 |
| 16-in steel pipe filled with concrete | 24 |
| 12-in timber piles | 739 |
| 66-in diameter concrete-filled steel caissons – approach | 26 |
| 84-in diameter concrete-filled steel caissons – north section | 25 |
| **Total** | **1,471** |

The removal of utilities attached to the pier would be accomplished by securing the material as needed for capture and disposal once it is detached from the pier; cutting it into manageable segments; severing connections to the pier; capturing and disposing the material. Typically piles would be cut off at the mudline; however, the full length of the piles would be pulled at the area where the new approach segment would be constructed. An attempt would first be made to dry-pull the piles with a barge-mounted crane. A vibratory hammer or a pneumatic chipper may be used to loosen the piles. Jetting (the application of a focused stream of water under high pressure) would be another option to loosen piles that could not be removed through the previous procedures. The caisson elements would be removed with a clamshell, which is a dredging bucket consisting of two similar halves that open/close at the bottom and are hinged at the top. The clamshell would be used as an "underwater crane" to grasp and lift large components such as caissons and piles. When a wooden pile cannot be completely pulled out, the pile may be cut at the mudline using the clamshell's hydraulic jaws and/or a diver-operated underwater chainsaw (e.g.,www.echopkins.com/useruploads/files/58231_stanley_specs_sheet_cs11.pdf; www.csunitec.com/saws/air-chain-saws.html), except for piles that are within the footprint of the approach pier, which may require jetting to remove. Section 2 provides more specific detail on the numbers of piles to be removed and the methods to be used during the period of this IHA. Once extracted, the piles would be loaded on to a support barge where they would be floated over to the quaywall. Once on shore, the debris would be crushed onsite or hauled to a concrete recycling facility. 100% of the concrete material would be recycled. Figure 1-6 shows the location of the contractors' laydown area for materials, equipment, and concrete recycling. The contractor may also stage some equipment and materials on barges. During demolition, floating slick bar booms would be used to provide a complete barrier to floating debris. Any floating debris would be gathered in work boats and would be disposed of or recycled as appropriate.

To minimize sediment disturbance and impacts to eelgrass, steel sheet pile bulkheads along the south side of the approach segment and the outboard side of the north segment would not be removed. The bulkheads protrude about 10 ft above the mudline, and preserve a remnant soil mound that lies beneath the approach pier and main pier structure (Terra Costa Consulting Group 2010). This remnant soil mound was created by dredging the bay floor adjacent to the pier (Terra Costa Consulting Group 2010). Original engineering plans for the sheet pile bulkhead indicate that it was covered in rock rip-rip (Terra Costa Consulting Group 2010).

Discarded Military Munitions (DMM)

The project area may contain discarded military munitions (DMM). The Navy would coordinate with the demolition and construction contractors to minimize health and safety risks posed by DMM.

Demolition Debris

Four major types of debris would result from the demolition of the fuel pier: concrete; wood; steel; and plastic. The Proposed Action would be in accordance with the DoD Low-Impact Development Initiative requiring all demolition projects that take place after 2011 to recycle and divert materials from local landfills to the maximum extent practicable. Materials would be reused or recycled as appropriate. 100% of the concrete material would be recycled. Materials that cannot be reused or recycled would be transported to a permitted landfill. No special permits would be required for disposal of non-hazardous solid waste. Debris would not be allowed to fall into San Diego Bay. Disposal and recycling/reuse of debris would not impact marine mammals and hence are not discussed further in this application. The Navy's Environmental Assessment provides additional detail and analysis of this topic.

### 1.3.2 Demolition/Construction Equipment and Phasing

The Navy will be implementing the conditions within the Memorandum of Understanding (MOU) with the US Fish and Wildlife Service by eliminating, to the maximum extent practicable, impacts from in-water construction that impact least tern foraging. This will be accomplished by scheduling activities that generate underwater noise and/or turbidity outside of the least tern foraging season (nominally 1 April to 15 September). Therefore, this IHA will address all in-water construction activities that cause in-water noise and turbidity and will be restricted to the time period of September through April, allowing flexibility to begin work in early September and/or continue work in April if the activities can be accommodated within the framework of the MOU. The new fuel pier would be constructed concurrently with demolition of the existing pier. The north segment of the existing pier would be demolished first while the existing approach and south segment would remain operational. Fueling capabilities would be provided by the south segment. During the estimated construction period of approximately four years, fuel pier operations would continue with minimal interruption. As described below, the two phases are designed with some overlap to maintain operational capability and make full use of the available construction timeframe.


Figure 1-6
Contractors' Laydown Area

Source: NAVFAC Southwest 2011a

To maintain continuous fueling capability, access to the existing south pier would be required during early construction phases. Access to the new north pier would be required during later phases for both construction and fueling activities. Figure 1-7 shows the construction and navigation zones, as well as the construction area for an unrelated project at the Scripps Institute of Oceanography pier. In the event that construction and dredging take place concurrently, there would be sufficient space to accommodate both operations and normal nonmilitary boat traffic. This IHA application considers the worst-case underwater sound levels that would result in the event of simultaneous pile driving by both projects.

Construction and dredging activities would take place adjacent to the San Diego Harbor navigation channel. The proposed fuel pier construction zone is approximately 1,200 ft from the channel. The dredge footprint (Figure 1-8), where the dredge vessels would operate, lies outside (westward) of the channel. Most of the vessels involved with the project would transit the channel intermittently, with the exception of the sediment transport barges that may make more frequent trips to the nearshore dredged material beneficial reuse site.

*Phase I – Fuel Pier Construction: Project Indicator Pile Program and Temporary Mooring Dolphin (March-April 2014); North Segment Demolition (350 lf) (March-July 2014).* The Indicator Pile Program will facilitate two major elements of the overall project. First, it will validate the length of pile required and the method of installation (vibratory and impact**).** Approximately 12 steel pipe indicator piles (36-in and 48-in diameter, exact mix to be determined later) would be driven in the new pier alignment. The purpose of the indicator piles is to verify the driving conditions and establish the final driving lengths prior to fabrication of the final production piles that would be used to construct the new pier. Second, it will validate the acoustics modeling used to determine take levels in this IHA application. A robust monitoring array will be established during the indicator pile installations (see monitoring plan). Measurements will be taken at all critical underwater sound contours including the 180, 160 and 120 dB RMS contours established in the modeling effort (details provided in Section 6 of this application).

A temporary mooring dolphin with a deck approximately 14 ft above mean lower low water (MLLW) would be constructed to allow vessels to berth and load/unload fuel on the existing south segment while the north segment of the existing pier is under demolition. Sixteen 36-inch piles would be driven during construction. The same pile driving equipment and barges used to construct the temporary mooring dolphin would later be used to construct the new fuel pier.

The north segment would be demolished by water access using barges to provide a working area for the crane and equipment. The demolition waste would be placed on two barges and hauled offsite for processing, recycling, and disposal. Water access is preferable for the heavy equipment and demolition waste to keep the existing pier operational during the demolition phase. Access to the existing pier is necessary for laborers, trucks, and removal of pier appurtenances. Some equipment used for demolition may include: hydraulic hammers mounted to back-hoes for breaking concrete, front-end loaders, fork-lifts, concrete saws, steel cutting torches, and excavators with hydraulic thumb shears. The floating barges would be supported by tug boats and small work boats. While demolition of the north segment of the existing fuel pier is underway, the steel piles for the new pier approach segment would be fabricated offsite and transported to NBPL. Other construction equipment needed for Phase II would be mobilized to NBPL within this time period.

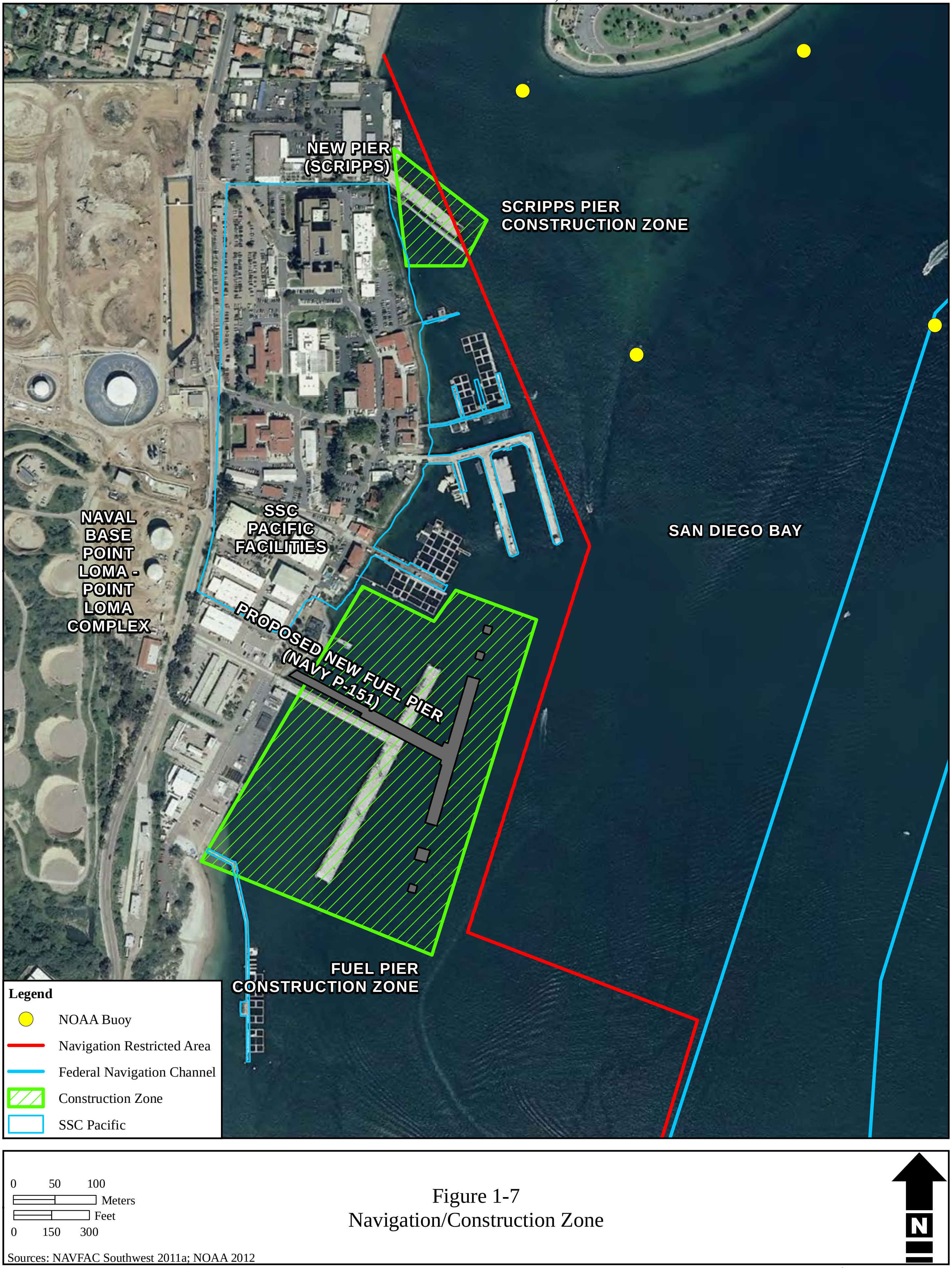



Figure 1-7
Navigation/Construction Zone

Sources: NAVFAC Southwest 2011a; NOAA 2012

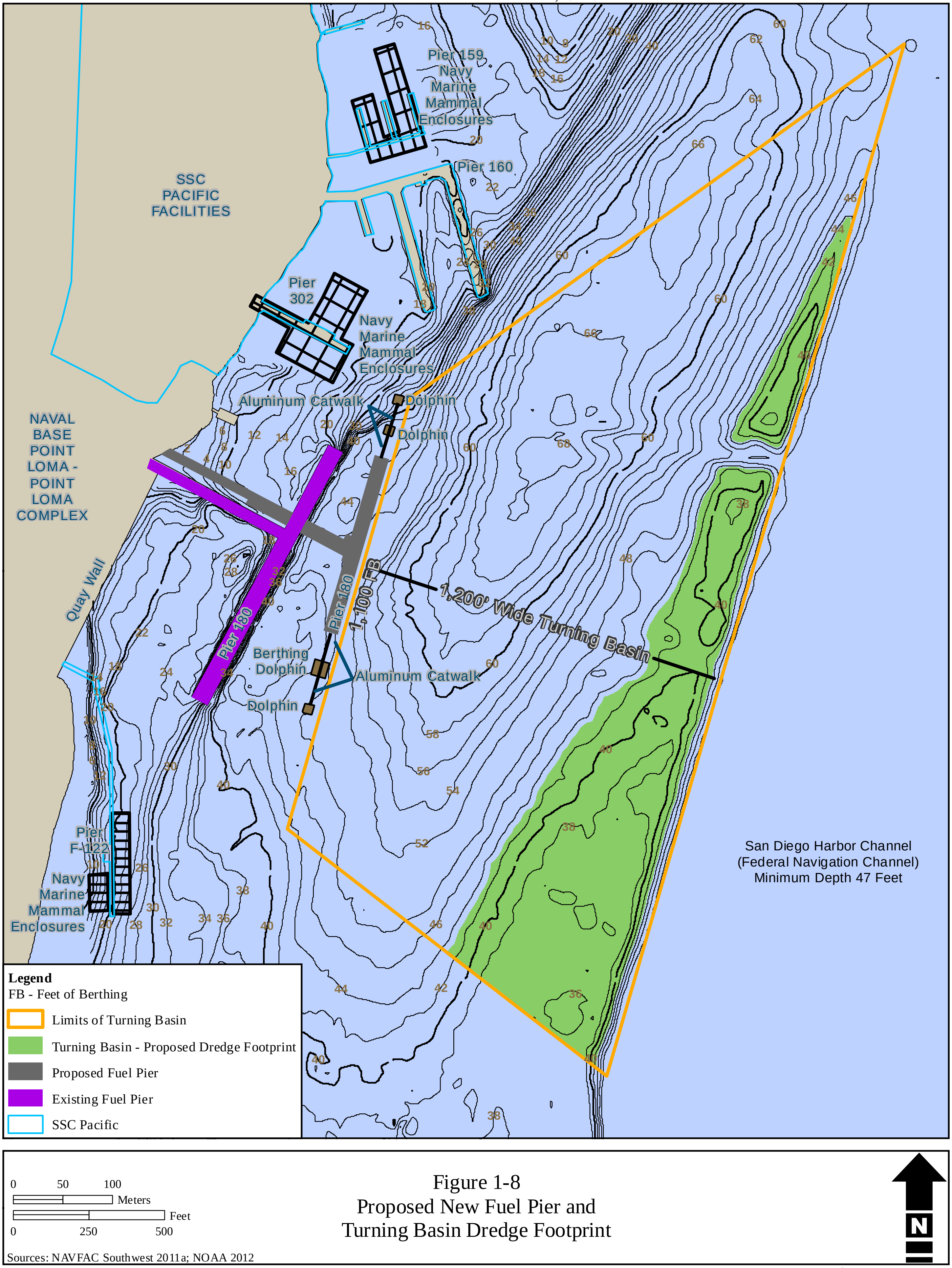



Figure 1-8
Proposed New Fuel Pier and
Turning Basin Dredge Footprint

Sources: NAVFAC Southwest 2011a; NOAA 2012

*Phase I - Approach Pier (Connection to Shore) Construction (700 lf) (March 2014-October 2015).* It is not necessary to wait for the complete demolition of the north segment to begin construction. The approach pier construction would begin after the piles have been fabricated offsite and delivered. The piles would likely be delivered by barge. The approach pier construction would require two barge-mounted cranes, one with a pile driving rig and one for constructing the pier. Two additional barges would be used to store the piles, concrete formwork, steel reinforcement, and cast-in-place concrete deck sections. The floating barges would be supported by tug boats and small work boats. Construction from shore and/or the remaining fuel pier approach segment is a possibility for a small percentage of the work. Additional equipment would include front-end loaders, fork-lifts, steel welding and cutting equipment, concrete placement and finishing equipment, concrete saws and drills, and carpentry tools for building formwork. Materials delivered by truck may include concrete, reinforcing steel, utility pipes, and other miscellaneous construction materials.

*Phase I - North Pier Construction (600 lf) and Mooring Dolphins (1,024 square ft [sf]) (March 2014-September 2016).* The north pier would be constructed concurrently with the approach pier. The pile driving for the north pier would begin after the pile driving for the approach pier is complete, most likely using the same pile driving rig. The north pier construction would require a second barge mounted crane for the pier construction. Two additional barges and equipment would also be required as described in Phase II. Two mooring dolphins and connecting catwalks would also be constructed at this time.

*Phase II – South Pier Construction (1,100 lf) (September 2016-November 2016).* The south berthing dolphin and mooring dolphin construction would begin after the approach pier, north pier, and mooring dolphins are operational. This segment would be constructed using a pile driving rig, and two barge mounted cranes. Additional barges and equipment would also be required as described in Phase I. When the new south berthing and mooring dolphins are completed, the new pier section would be connected via walkways.

*Phase II - South Pier and Approach Pier Demolition (June 2016-November 2016).* The old south pier and old approach pier demolition would begin after the new south pier is operational. The temporary mooring dolphin near the north pier would also be demolished at this time, and the debris would be recycled along with the south pier demolition debris. This phase would require two barge mounted cranes to expedite the demolition of the existing pier. The other equipment used would be the same as Phase I.

*Turning Basin Dredging (October-December 2013).* Although proposed to occur in the fall of 2013, dredging for the turning basin could occur any time before, during, or shortly after the construction process. Dredging would only occur outside of the least tern foraging season.

### 1.3.3 Construction of Replacement Fuel Pier

During development of the new pier design several measures were adopted to minimize impacts to eelgrass. These measures include: pier alignment positioned to minimize eelgrass disturbance; pier extended into deeper water to minimize dredging; existing sheet piling left in place to minimize sediment and eelgrass disturbance; and use of mooring dolphins to reduce the size of new pier footprint and minimize bay shading.

Alternative 1 would involve construction of a new double deck fuel pier. The approach segment would be 700 ft long by 50 ft wide. The new pier approach segment would connect to shore as a single deck with a ramp leading to the upper deck of the double deck berthing segment. The berthing segment would be 605 ft long by 50 ft wide, supplemented with three mooring dolphins and one berthing dolphin to extend berthing length to 1,100 ft. The approach segment would be constructed approximately 5 ft north of the existing pier to minimize disturbance to eelgrass and to facilitate connecting the pier with pipelines to onshore NBPL DFSP fuel storage facilities. The new pier approach segment would be 200 ft longer than the existing pier approach segment, so the berthing segment of the new pier would stand in a deeper, previously dredged location where most of the area to be used by vessels approaching the pier already meets the minimum depth requirement of 40 ft. This placement would accommodate a wider variety of ships than is currently possible at the existing fuel pier where depths are 30 to 40 ft (Figure 1-8). No dredging would be needed alongside the pier during construction, and the need for future maintenance dredging along the pier would be reduced or eliminated. The top of the lower deck would be set approximately 5 ft above extreme high tide (13 ft above MLLW). The new pier upper deck elevation would be 28 ft above MLLW and 20 ft above extreme high tide. The upper deck would have sufficient height needed for the pier fuel load arms to safely reach fuel transfer points on the majority of larger ships (Navy 2010a).

The 1,100 ft berthing length was chosen to provide flexibility in fueling multiple types of vessels at the proposed new fuel pier, including large, medium speed, roll-on/roll-off ships, placing the fuel loading arms near fueling points on each of the vessels. The inner berths provide two additional berthing areas, the south and north inner berths. The south inner berth accommodates vessels up to 500 ft long and the north inner berth provides a small craft berthing area for vessels up to 400 ft long. The existing fuel pier total area is 71,180 square ft/1.63 acres (sf/ac). The total area of the new pier (including the 700 ft long approach segment and dolphins) would be 65,865 sf/1.51 ac. This would be a decrease of 5,315 sf/0.12 ac of bay shading compared to the area of the existing fuel pier.

The replacement pier structure, including the mooring dolphins, would consist of steel pipe piles, supporting concrete pile caps and cast-in-place concrete deck slabs. The upper 10 ft of the steel wall pipe piles would be filled with concrete as part of the connection between the piles and the pier deck. Approximately 554 total piles would be installed. Concrete pilings are not suitable to feasibly support the double-deck pier due to the structural seismic forces, so steel structural pilings would be used. Design of the fuel pier takes into account seismic loading, vessel loading, gravity loads and functionality of the overall system. The State of California enforces special requirements for marine oil terminals, particularly with regard to seismic criteria, and the Navy has agreed to comply with the California marine oil terminal requirements for this facility. The design of the piles is governed by loading conditions that include seismic loads. The structural analysis performed has determined that concrete piles of sizes available in Southern California cannot develop sufficient strength and stiffness to withstand the design loads considering the water depth at the site, the geotechnical conditions, and with the deflection limitations needed for the fuel operations. The sizes of the steel piles are dependent on water depth, subsurface soil conditions, and the mass of the deck structure. In most areas, a 36-in diameter steel pile is adequate to meet the criteria. In other areas, a 48-in diameter pile is necessary.

The existing sheet pile system would continue to be protected with the existing (protected/reconnected) impressed system. New steel piles would be protected with a combination of coating and cathodic protection systems with anodes (aluminum) that would require replacement approximately every 20 years. The service life of the entire pier structure would be 75 years.

Table 1-4 lists the types and numbers of pilings to be installed. The project construction schedule calls for pile driving at various times during Phase I and II. It is the intention of the contractor to get the majority of the structural piles driven as early as possible after the least tern nesting season. Therefore, the intention would be to drive steel piles during the months of October through December, then complete the deck and utility work after pile installation. Pile driving would occur during normal working hours (7:00 A.M. to 4:00 P.M.). The impact pile driver would be used for all three types of piles (steel, concrete and fiberglass), A vibratory hammer would be used to get the steel pile to refusal, then an impact hammer would be used until the pile meets the structural requirement. It is anticipated that the final impact phase would require 25 to 125 blows to get 10 to 15 feet of structural integrity. The concrete piles would first be jetted, a process wherein pressurized air or water jets are applied at the tip of the pile to loosen the substrate and allow the pile to sink vertically. The pile is then driven the last few ft with the impact hammer. The fiberglass piles do not need to be embedded very deeply into the subsurface, so they would be driven for the entire length. Use of steel wall pipe, concrete, and fiberglass rather than creosote wood pilings would be consistent with Navy policy and is preferred by the Regional Water Quality Control Board (RWQCB) because, unlike creosote pilings, these materials are not a potential source for polycyclic aromatic hydrocarbons (PAHs) to the bay. The fender system for the pier would include foam-filled fenders at the berths and plastic log camels.

**Table 1-4. Replacement Fuel Pier Pilings to Be Installed**

| *Pile Type* | *Location* | *Number* | *Install Period* | *Pile diameter (inches)* | | | |
|---|---|---|---|---|---|---|---|
| | | | | 48 | 36 | 16 | 24 |
| 48-in diameter x 1-in steel wall pipe piles | Indicator Piles | 7 | Mar 2014 | 7 | | | |
| 36-in diameter x 1-in steel wall pipe piles | Indicator Piles | 5 | Mar 2014 | | 5 | | |
| 36-in diameter x 1-in steel wall pipe piles | Temporary Dolphin | 16 | Mar 2014 | | 16 | | |
| 48-in diameter x 1-in steel wall pipe piles | Abutment Piles | 24 | Mar-Apr 2014 | 24 | | | |
| 36-in diameter x 1-in steel wall pipe piles | Approach Pier | 110 | Mar-Nov 2014 | | 110 | | |
| 16-in diameter concrete-filled fiberglass piles | Approach Pier | 40 | Sept 2015 | | | 40 | |
| 36-in diameter x 1-in steel wall pipe piles | Double Deck Pier | 97 | Nov-Dec 2014 | | 97 | | |
| 48-in diameter x 1-in steel wall pipe piles | Mooring Dolphin | 16 | Jan 2015 | 16 | | | |
| 24-in diameter x 1-in prestressed concrete piles | Fender Piles | 165 | Sept-0ct 2015 | | | | 165 |
| 16-in diameter concrete-filled fiberglass piles | Secondary Fender | 44 | Oct 2015 | | | 44 | |
| 48-in diameter x 1-in steel wall pipe piles | Mooring Dolphin | 17 | Sept 2016 | 17 | | | |

| Pile Type | Location | Number | Install Period | Pile diameter (inches) | | | |
|---|---|---|---|---|---|---|---|
| | | | | 48 | 36 | 16 | 24 |
| 48-in diameter x 1-in steel wall pipe piles | Abutment Piles | 13 | Sept 2016 | 13 | | | |
| **Total Piles Each Type** | | | | **77** | **228** | **84** | **165** |
| **Total Piles to be Installed** | | | | | | | **554** |

Concrete catwalks (approximately 14 ft above MLLW) would connect the berthing and mooring dolphins to the main pier (refer to Figure 1-8). The approach segment would be of similar construction to the berthing pier. The main pier decks would be designed for a 50 ton mobile crane, 20 ton truck load and 10 ton forklifts (5 ton forklift on the lower deck); heavy equipment would not be operated on the berthing or mooring dolphins.

There would be fueling stations on the upper and lower decks of the new fuel pier berthing segment. Each fueling station would have the capability to supply diesel fuel marine (DFM) and JP-5 turbine (jet) fuel to vessels. The upper deck would be used for offloading fuel from tankers to the tank farm and for supplying fuel to higher profile vessels. The lower deck would be used for fueling smaller profile vessels. Table 1-5 below lists the fueling stations on the two decks of the berthing segment of the proposed new fuel pier.

**Table 1-5. New Pier Fueling Stations**

| Deck | Side | Product | Number of Stations |
|---|---|---|---|
| Upper | Outboard | Fuel | 4 |
| Upper | Outboard | Lube Oil | 2 |
| Upper | Inboard | Fuel | 4 |
| Upper | Inboard | Lube Oil | 1 |
| Lower | Outboard | Fuel | 4 |
| Lower | Outboard | Lube Oil | 1 |
| Lower | Inboard | Fuel | 3 |
| Lower | Inboard | Lube Oil | 0 |

The upper deck would also have six piping connections to receive ballast water from fleet tankers and other larger ships. An 8-in diameter oily water pipe would be used to transfer the ballast water to the NBPL Fuel Oil Reclamation (FOR) facility. The ships could either pump directly to the oily water receipt tank at the treatment facility or transfer to the smaller collection tank located on the pier. A pump at the collection tank would then transfer the oily water to the receipt tank at the treatment system.

Storm water from both pier decks would be captured and routed to the FOR as well. All rainfall accumulating on the lower deck as well as rainfall from the 85th percentile storm event accumulating on the upper deck of the new pier would be collected on the pier and sent to the FOR receipt tank for treatment. The upper deck would be equipped with underflow scuppers that would permit a portion of the runoff from large storm events to discharge to the bay. The underflow design would prevent surface sheen and floating fuel from being discharged to the bay and also allow the "first flush" to be sent to the FOR Receipt Tank.

The pier operations would be supported by two pipelines for each fuel product and two for lube oil. There would be a 16-in and an 8-in pipeline for loading/unloading JP-5. For loading and unloading diesel fuel marine (DFM), there would be a 16 in and a 10 in pipeline. There would be two 6-in pipelines for loading lube oil. The 16 in pipes would support the fueling stations on the outboard side while the 8-in JP-5 and 10-in DFM pipes would support the fueling stations on the inboard side.

The 50 ft top-of-deck width is the minimum requirement for a fuel pier per DoD Unified Facilities Criteria (UFC). The new fuel pier would provide adequate deck space on the berthing segment by using a double deck structure to separate the fuel lines from operations on the berthing segment and provide containment for fuel pipelines and utilities. On the berthing segment the pipelines and utilities would be hung beneath the upper deck. Utilities would be in a dedicated vault separate from the pipelines. On the approach segment, fuel lines would be stacked in pipe racks running along one side of the lower deck. At the "T" juncture of the approach and berthing segments, the fuel lines' orientation would transition from horizontal along the lower deck to vertical to reach the upper deck, then horizontal again beneath the upper deck.

Concrete containment curbs would be incorporated into the pier deck design surrounding all fueling arms, fueling risers, and fuel pipes. There would be sumps in curbed containment areas in both pier decks to capture spilled fuel as well as rain water. Sumps located in the upper deck would be fitted with drains that would be piped to a collection tank on the lower deck. Sumps in the lower deck would connect to the FOR. There would be a 1 ft high concrete curb around the perimeter of the lower deck and 3 ½ ft high concrete curb around the upper deck.

The total fuel volume of the new pier pipelines would be 49,000 gallons, an increase of 22,960 gallons (approximately 88%) from the existing pipeline capacity of 26,040 gallons. The dual piping configuration would allow fueling operations to take place on both sides of the pier simultaneously, and include a cross-over capability so that fuel could be transferred from one side of the pier to the other should one side shut down temporarily.

An existing underground trench containing piping from the onshore fuel storage facilities would be extended to the pipelines on the new pier. The connection for the new pipelines would be located between 35 and 65 ft from the existing pier abutment. With the exception of some electrical duct bank work would be located in proximity to the existing pier abutment and the new pier abutment. In addition to the fuel pipelines, an 8-in diameter fire suppression water line would be installed on the new pier and connected to the onshore potable water supply system (Navy 2010c).

The total disturbed area on shore would be less than 1 acre, comprising previously disturbed areas that are paved and unpaved. The paved area northwest of the existing fuel pier would be excavated to extend the underground pipeline trench to the new pier and to install underground utilities and subsequently re-paved. A portion of the landscaped area between the existing fuel pier and lube oil storage tanks would be paved as part of the new pier landside abutment. Three palm trees would be removed from the landscaped area. A new security fence with a motorized gate would be constructed at the entrance to the new pier.

After the new pier is completed, the quaywall at the entrance to the old fuel pier would be rebuilt. This work would include the placement of approximately 100 cy of concrete to repair the quay wall. There would also be some grading and asphalt repairs in this area. Repairs to the quaywall would also include removal of two closed storage tanks. The connection between the new and old pier abutments would be constructed by placing closely-spaced 48 in diameter steel-pipe piles along the base of the new and existing bulkhead. The gaps between the piles would be closed by welding steel "wings" between the piles. A concrete cap would be placed at the top of the piles to support the new pier approach and provide a continuous surface. All the work would be performed in the dry, landward of the bulkhead.

### 1.3.4 Regulated Navigation Zones

The outboard edge of the new pier, referred to as the headline, would extend 200 ft further east than the existing pier. The Navy has coordinated with the USCG to amend the Security Zone east of the pier. The new pier would also extend beyond Navy waters into waters that are under the jurisdiction of the CSLC. Following completion of the National Environmental Policy Act (NEPA) process, Navy counsel would provide written notification to CSLC of the extension of Navy facilities into state waters (NAVFAC Southwest 2010). Regulated Navigation Zones are shown in Figure 1-9.

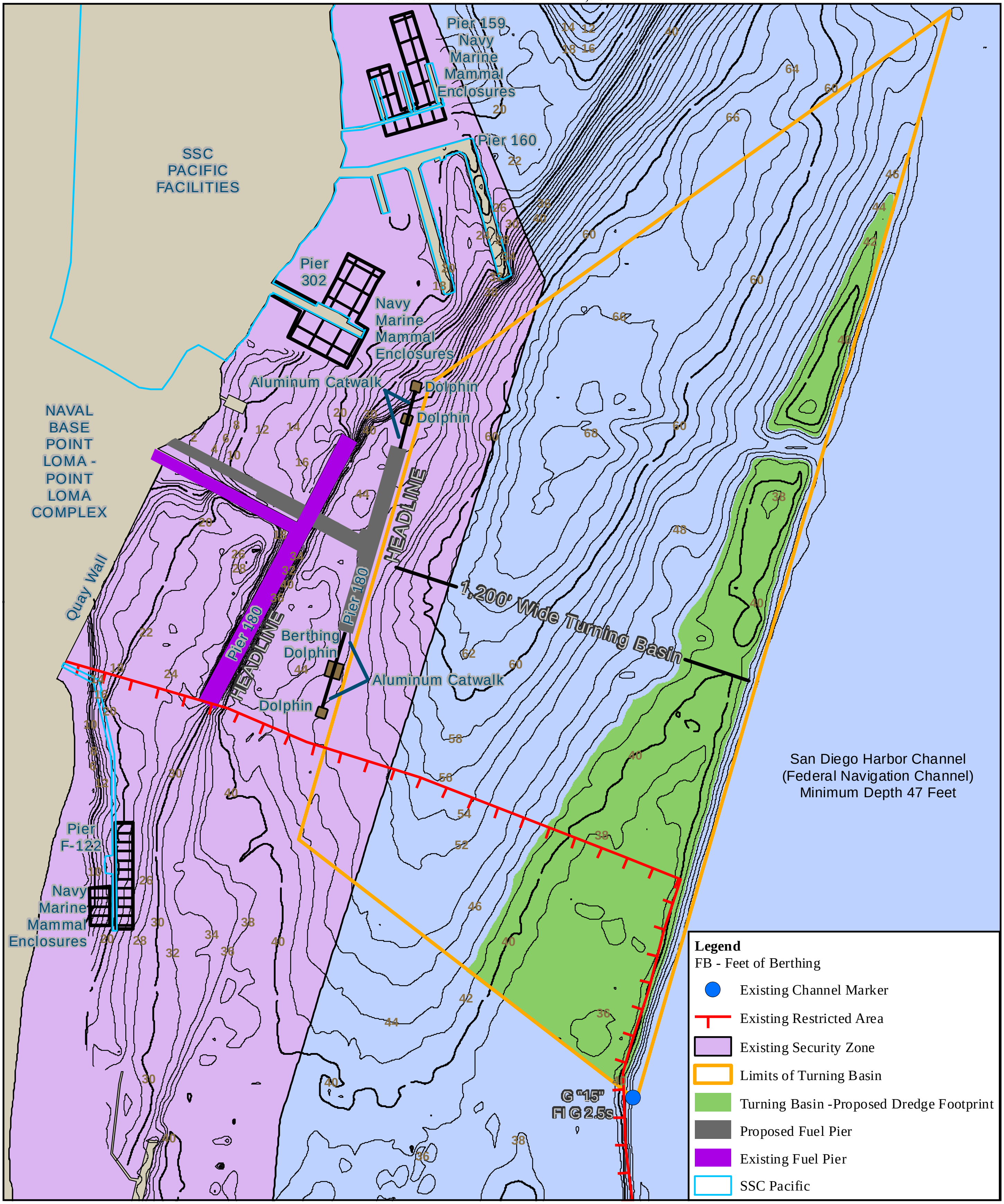
### 1.3.5 Dredging and Sediment Disposal

Vessel traffic moves in and out of San Diego Bay via the San Diego Harbor Channel (navigation channel) that is maintained at a depth of 47 ft MLLW by the USACE (Figures 1-8 and 1-9) (NOAA 2012a). Large vessels approaching the fuel pier in the channel from the south (inbound) require an area of open water with sufficient depth, known as a turning basin, to safely align at the pier. The proposed new pier layout would include a minimum 1,200 ft wide turning basin between the outboard (eastern) side of the pier and the navigation channel, to provide safety for the berthing operations of the large vessels being serviced at the facility. The north and south limits of the turning basin would be bounded by the existing channel markers located to the northeast and southeast of the fuel pier (Figure 1-9). The design depth for the turning basin would be 40 ft below MLLW (38 ft vessel draft plus 2 ft under keel). An additional 2 ft of dredge depth would be included as overdredge allowance, or tolerance that could vary depending on the precision of the dredging contractors' equipment and methods. Thus, the maximum project dredge depth would be 42 ft MLLW, but the entire overdredge volume might not be recovered if the contractor is able to excavate to 40 ft with less than 2 ft of tolerance. The majority of the existing bathymetry is deep enough to accommodate safe vessel operation. However, there is a wedge-shaped high spot adjacent to the western edge of the navigation channel where bottom depths rise from -40 to -36 ft MLLW (refer to Figure 1-8). This wedge-shaped area would need to be excavated to bring it to a minimum of 40 ft MLLW. The proposed dredge footprint would be located approximately 700 ft east of the new fuel pier, as illustrated in Figure 1-8. The dredge footprint would be limited to the area shown in green on Figure 1-8. The estimated volume of dredging required is shown in Table 1-6.

**Table 1-6. Proposed Dredging Volume**

| *Site* | *Design Depth (-40 ft MLLW)* | *Overdredge (2 ft)* | *Total* |
|---|---|---|---|
| Turning Basin | 40,000 cy | 40,000 cy | 80,000 cy |

*Note:* CY = Cubic yards



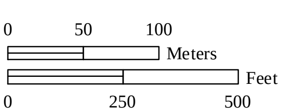




Figure 1-9
Regulated Navigation Zones

Sources: NAVFAC Southwest 2011a; NOAA 2012

As stated above in Section 1.3.1, underwater pipelines that supply JP-5 to NAS North Island are in the project area. The Navy would work with contractors to establish a safety buffer zone between the pipelines and the dredge footprint and would ensure that all contractors' vessels and equipment remain outside the buffer zone during dredging operations.

Sediment samples from the dredge footprint were collected in November 2010 and tested in accordance with regulations contained in Title 40 Code of Federal Regulations (CFR) Parts 220-228. The sediment characterization report is included as Appendix D of the EA. The sediment characterization report was provided to USEPA and USACE for review and comment on potential sediment disposal options. The agencies determined that the dredged material is suitable for unconfined aquatic disposal (USEPA 2011).

A medium size, 8-12 cy bucket, barge-mounted clamshell dredge would likely be used unless a hopper dredge is conveniently available in the area at the time of construction (Navy 2010d). The specific make and model of the bucket would be determined by the selected contractor and permit conditions. Dredge material would be loaded into a 5,000-10,000 cy capacity barge and transported to a beneficial reuse site to be determined, where it would be placed in the nearshore zone. Daily dredge production, including transport and placement at the beneficial reuse site can be assumed to be 2,000 cy. Maintaining this as an average production rate would enable up to 80,000 cy of material dredged from the turning basin to be dredged and placed at the beneficial reuse site in approximately three months (Navy 2010d). Dredging and beneficial reuse for nearshore replenishment of dredged materials would comply with USACE requirements for dredging and sediment disposal.

# 2 DATES, DURATION, AND LOCATION OF ACTIVITIES

*The dates and duration of such activity and the specific geographical region where it will occur.*

The conservation measures established in the Memorandum of Understanding Between U.S. Fish and Wildlife Service and the U.S. Navy Concerning Conservation of the Endangered California Least Tern in San Diego Bay, California would be followed, resulting in the avoidance of noise- and turbidity-producing in-water activities in designated least tern foraging habitat, which includes the project area, from April 1 through September 15, when least terns are present nesting and foraging in San Diego Bay. In keeping with these conservation measures, pile driving and pile removal other than dry pulling would take place only outside the least tern nesting season.

## 2.1 Dates of Construction

Assuming timely completion of the regulatory and NEPA processes, in-water activities would begin in September 2013, and proceed to completion in early 2017. This IHA will cover only those activities which will occur from September 2013 through April 2014.

The Navy requested the final IHAs for each phase of the project be issued 90 days prior to start of construction to facilitate proper contracting and communications with construction contractors. Follow-on IHAs will be required for a second period from September 2014 through April 2015, and for a third period from September 2015 through April 2016. Pile driving, dredging, and in-water demolition that requires jetting and vibratory pile extraction would only occur between September and April, inclusive, whereas all other construction and demolition activities could occur throughout the year.

## 2.2 Duration of Activities

Table 2-1 summarizes the in-water construction and demolition activities scheduled to take place during the timeframe covered by this IHA application. Additional discussion follows.

**Table 2-1. Activity Summary, First IHA Application**

| *Activity/Method* | *Location and Timing* | *# Days* | *Pile Type* | *# Piles Installed* | *# Piles Removed* |
|---|---|---|---|---|---|
| Guide pile driving | NMAWC, Sep-Oct 2013 | 16 | 18" square concrete | 50 | |
| Indicator pile driving | NBPL new pier footprint, Mar 2014 | 17 | 36" and 48"-dia steel pipe | 12 | |
| Temporary mooring dolphin pile driving | NBPL approx. 150 ft southwest of existing fuel pier, Mar 2014 | 5 | 36" dia-steel pipe | 16 | |
| Abutment pile driving | NBPL new pier shoreline, Mar-Apr 2014 | 13 | 48"-dia steel pipe | 24 | |
| Structural pile driving | NBPL new pier footprint, Mar-Apr 2014 | 15 | 36" and 48"-dia steel pipe | 26 | |
| **Total piles installed** | | | | **128** | |
| Dredging with hopper or clamshell bucket dredge | NBPL Turning basin 1, 200 ft east of fuel pier, Oct-Dec 2013 | 90 | n/a | n/a | n/a |

| *Activity/Method* | *Location and Timing* | *# Days* | *Pile Type* | *# Piles Installed* | *# Piles Removed* |
|---|---|---|---|---|---|
| Piles dry pulled with barge-mounted crane | NBPL old pier north segment-new pier footprint, Mar-Jul 2014 | 4[1] | 16"- square concrete fender | | 8 |
| Piles dry pulled with barge-mounted crane | NBPL old pier north segment-new pier footprint, Mar-Jul 2104 | 4[1] | 24"-in square concrete fender | | 6 |
| Piles cut at mudline | NBPL old pier north segment, Mar-Sep 2014 | 4[1] | 16"- square concrete fender | | 4[2] |
| Piles cut at mudline | NBPL old pier north segment, Mar-Sep 2014 | 4[1] | 12" dia timber | | 91[2] |
| **Total piles removed/cut (see Notes)** | | | | | **109[2]** |
| Extraction with clamshell dredging bucket | NBPL old pier north segment, Mar-Sep 2014 | 5[1] | 5'-6" or 7'-0" concrete-filled steel caisson | | 7 [2] |

*Notes:* " = inches; ' = feet; dia = diameter; # = number

[1]Pile and caisson demolition/removal are estimated to require use of vibratory extraction and/or pneumatic chipper, generating underwater sound, on approximately one-fourth (21 days total) of the above-water demolition time (84 days). This is included as a contingency in the event other methods of extraction are unsuccessful. This IHA only covers work through April 2014. The subsequent IHA application would address the resumption of work in September 2014.

[2]Contractor could cut up to this number of piles at mudline and remove up to this number of caissons depending on workload and approval under the California least tern MOU during March-April 2014. Piles/caissons not demolished under this IHA would be demolished outside the least tern foraging season under the subsequent IHA application.

### 2.2.1 Pile Driving

The indicator pile program will help detail the final pile driving program and validate the acoustic modeling and avoidance and minimization measures.

It is assumed that the contractor will drive approximately 2 steel piles per day, and 5 concrete or fiberglass piles per day. Each pile is assumed to require up to 2 hours of driving. Steel piles would be driven initially with a vibratory pile driver, and then finished as necessary with an impact pile driver. Working assumptions are 1-1.5 hours of vibratory pile driving and up to 0.5 hour of impact pile driving for each steel pile. Concrete and fiberglass piles would be jetted then driven with an impact pile driver only; sound levels are much lower for these types of piles.

The currently proposed construction schedule includes the following non-overlapping, consecutive episodes of pile driving within the period of this IHA request:

- Installation of steel indicator piles (12) to occur over 17 days.
- Installation of 50 18-in square concrete piles to support the relocated facilities of the Marine Mammal Program to NMAWC. Pile driving is estimated to occur on 16 days.Installation of steel temporary dolphin piles (8) to occur over 5 days.
- Installation of 24 steel abutment piles to occur over 13 days.
- Installation of approximately 26 steel structural piles over 15 days.

Steel piles are assumed to be a mix of 36- and 48-in diameter. As noted above, pile driving would likely occur on only a few hours of each day. Only the number of piles that could be driven between September 2013, and April 2014. (i.e., between the time that the 2014 tern foraging season ends, and the expiration of this IHA) would be installed.

### 2.2.2 Turning Basin Dredging

Dredging the turning basin would take approximately 90 days to complete, and is anticipated to occur from October through December 2013. Sediment would be dredged from a high spot approximately 1,200 ft east of the existing fuel pier.

### 2.2.3 Pile Extraction

Demolition of the north segment of the pier is scheduled to begin in 2014 within the window of this IHA application. This work is estimated to comprise 84 days, beginning as early as March 2014. Most of the demolition scheduled during this IHA application timeframe would fall within the least tern foraging season, so the work would consist of mainly above-water demolition: removal of the deck hardware, the deck itself and the underdeck. Limited in-water work would occur in accordance with the least tern season avoidance plan. Concrete fender piles (eight 16-in square and six 24-in square) would be removed from the footprint of the proposed new pier to allow installation of piles for the proposed new pier. The fender piles would be dry-pulled only, no vibratory or jetted removal. Fender piles could be removed concurrently with the above-water work or after. Depending on work load during March and April 2014, the contractor could proceed with north pier segment in-water demolition and cut up to 4 concrete piles at the mudline. Up to 7 concrete-filled steel caissons could be removed in this time period as well. The caisson elements could be removed with a barge-mounted derrick crane. The crane can be used to grasp and lift large components such as caissons and piles with attachments such as wire slings or clamshell buckets (i.e., dredge buckets). When a wooden pile cannot be completely pulled out, the wood piles (up to 91 wood piles for this application) could be cut at the mudline using crane-attached hydraulic jaws and/or a diver-operated underwater chainsaw.

## 2.3 Project Area Description

San Diego Bay is a narrow, crescent-shaped natural embayment oriented northwest-southeast with an approximate length of 15 miles and a total area of roughly 11,000 acres (Port of San Diego [POSD] 2007). The width of the bay ranges from 0.2 to 3.6 miles, and depths range from 74 ft MLLW near the tip of Ballast Point (refer to Figure 1-2) to less than 4 ft at the southern end (Merkel and Associates, Inc. 2009). About half of the bay is less than 15 ft deep and most of it is less than 50 ft deep (Merkel and Associates, Inc. 2009).

### 2.3.1 Bathymetric Setting

The northern and central portions of the bay have been shaped by historic dredging to support large ship navigation, and filling (Merkel and Associates, Inc. 2009). Only the far southern portion retains its natural shallow bathymetry (Merkel and Associates, Inc. 2009). The bathymetry and bedform of the bay are defined by a main navigation channel that steps up to shallower dredged depths toward the sides and bottom of the bay (Merkel and Associates, Inc. 2009). USACE dredges the navigation channel to maintain it a depth of -47 ft MLLW (NOAA 2012a). Outside the navigation channel, the bay floor consists of platforms at depths that vary slightly (Merkel and Associates, Inc. 2009). Within the north bay, typical depths range from 36 to 38 ft MLLW to support large ship turning and anchorage (Merkel and Associates, Inc. 2009). Small vessel marinas are typically dredged to depths of -15 ft MLLW (Merkel and Associates, Inc. 2009).

Bathymetry at the project site has been altered by filling and dredging as well. The quay wall at the fuel pier has been artificially filled to its elevation of approximately 12 ft above MLLW (Terra Costa Consulting Group Inc. 2010). The bay bottom on the south side of the fuel pier approach segment has been dredged to a depth of about -20 ft MLLW, while the bathymetry of the north side retains a more gradual downward slope to the east. Beneath the pier itself, the bottom was protected from historical dredging by the pier pilings and thus stands several ft higher than immediately adjacent depths (Terra Costa Consulting Group Inc. 2010; NAVFAC 2009). Beyond the pier headline, the bottom drops sharply to -30 ft and then -40 ft, the result of dredging. Bayward (east) of the headline, most of the bathymetry out to the navigation channel is at least -41 ft MLLW. However, there is one wedge-shaped high spot along the western edge of the navigation channel where bottom depths rise from -40 to -36 ft MLLW (Figure 2-1).

To the south, at the mouth of the bay, Zuniga Jetty extends some 7,500 ft south from Zuniga Point. The jetty is a rock-rubble structure constructed over 100 years ago that was built to direct tidal currents in and out of the bay and thereby maintain an open channel for navigation, while enhancing sand deposition on beaches to the east (NAVFAC SW and POSD 2011). Settlement and flattening of the jetty slopes have occurred over time, and much of the jetty, especially seaward, is awash or submerged at shallow depth depending on tidal conditions (NOAA 2012b).

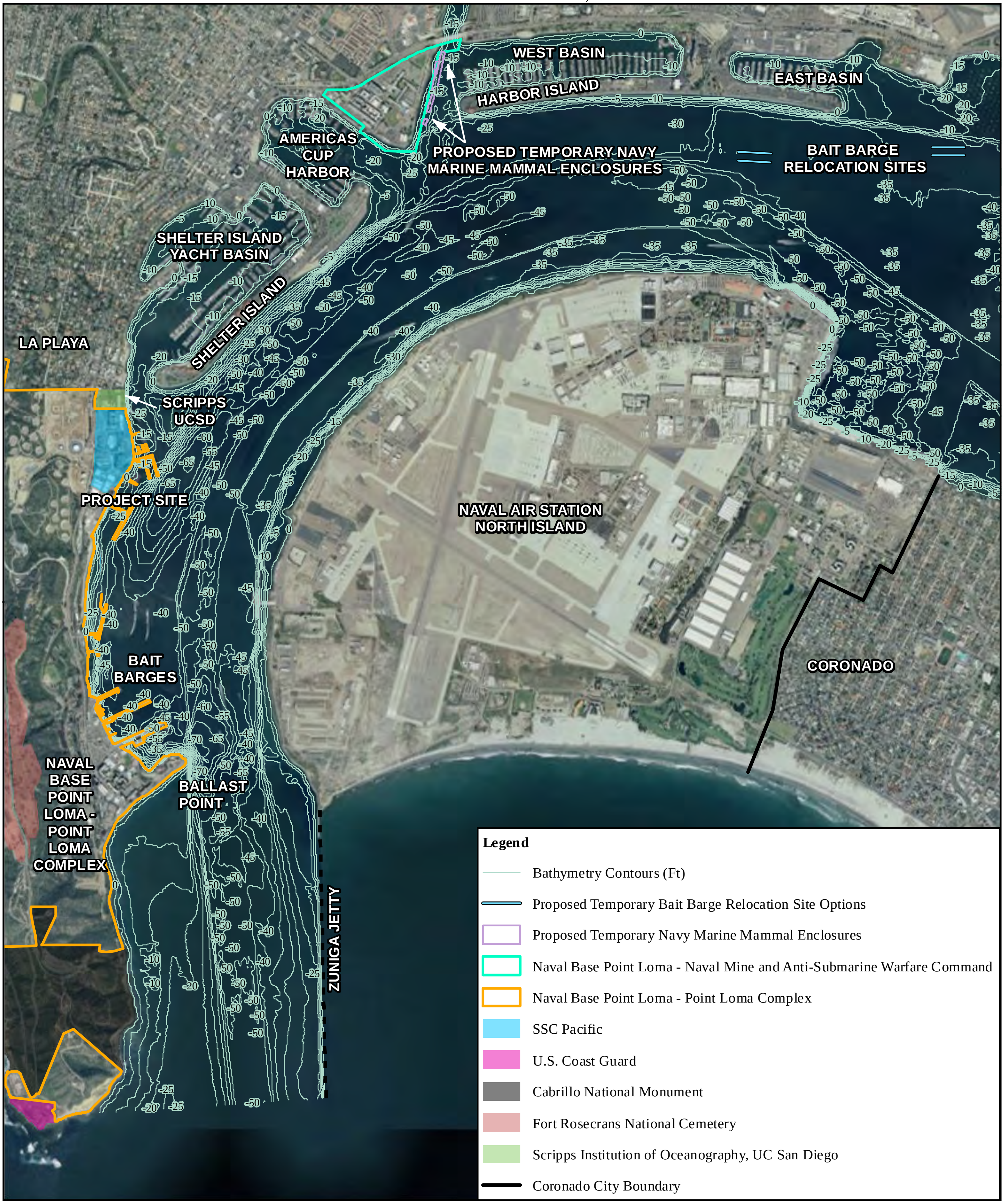
### 2.3.2 Tides, Circulation, Temperature, and Salinity

The tides, circulation, temperature, and salinity regime of San Diego Bay are described in the San Diego Bay Integrated Natural Resources Management Plan (INRMP) (NAVFAC SW and POSD 2011), which is the primary source for this section unless noted otherwise. The INRMP may be consulted for historical background and original data sources.

Bay circulation may be driven by wind, tides, temperature, and density gradients associated with seasonal, tidal, and diurnal cycles. In San Diego Bay, circulation is primarily related to tides, because winds are of mild magnitude and there is a low fetch area. Tidal patterns off this coast are mixed, with two unequal highs and lows each day. The diurnal difference in MHHW and low MLLW tides is 5.6 ft (1.7 m), with extremes of 9.8 ft (3 m). The tidal prism, or the volume of water contained between the tides, is about 73 x 106 m3. Highest tides are in January and June.

Tidal exchange in the bay exerts control over the flushing of contaminants, transport of aquatic larvae, salt and heat balance, and residence time of water. Current velocities near the entrance range from 0.5 to 3 knots (0.8 to 5 ft/sec) (POSD 2012) and are much lower in central and south bay. Velocities at depth lead velocities at the surface during flood tides by 30 to 90 min. Variations in velocity are due to variations in depth and width of the bay as the tidal prism moves southward, the presence of side traps such as marinas and basins, and the general reduction in velocity with distance from the entrance. Longitudinal tidal currents will still, however, exceed the strength of wind and wave action, except during periods of high winds.

Circulation within San Diego Bay is affected by the bay's crescent shape and narrow bay mouth, tides, and seasonal salinity and temperature variations (POSD 2007). San Diego Bay can be divided into four regions based upon circulation characteristics. The North Bay – Marine Region extends from the bay mouth to the area offshore from downtown San Diego. Tidal action has the greatest influence on circulation in this area where bay water is exchanged with sea water over a period of two to three days (POSD 2007). The North-Central Bay – Thermal Region runs from the north bay to Glorietta Bay (south of Coronado Island). In the Thermal Region, currents are mainly driven by surface heating (POSD 2007). The incoming tide brings cold ocean water from




0 0.25 0.5 Kilometers

0 0.25 0.5 Miles

N

Figure 2-1
Project Area Bathymetry

deeper areas, which is then replaced with warm bay surface water when the tide recedes. These tidal processes lead to strong vertical mixing (POSD 2007). The region between Glorietta Bay and Sweetwater Marsh is characterized as the South-Central Seasonally Hypersaline (i.e., higher salt content than seawater) Region. Here, variations in salinity due to warm-weather evaporation at the surface separate the water into upper and lower zones driven by density differences (POSD 2007). The South Bay estuarine region south of Sweetwater marsh receives occasional freshwater inflows from the Otay and Sweetwater Rivers (POSD 2007). Residence time of bay water in the estuarine region may be greater than one month (POSD 2007). Common salinity values for the bay range from 33.3 to 35.5 practical salinity units for the bay mouth and the south bay, respectively.

In general, tidal currents are strongest near the bay mouth, with maximum velocities of 3 knots (5 ft/sec) (POSD 2012). As discussed in Section 11.1.2, strong tidal currents prevent the effective use of bubble curtains to reduce underwater sound from pile driving at the project site. Tidal current direction generally follows the center of the bay channel. Residence time for water in the bay increases from approximately five to 20 days in mid-bay to over 40 days in south bay. During an average tidal cycle, about 13% of the water in the bay mixes with ocean water and then moves back into the bay (POSD 2007). The complete exchange of all the water in the bay can take 10 to 100 days, depending on the amplitude of the tidal cycle (POSD 2007). Tidal flushing and mixing are important in maintaining water quality within the bay. The tidally-induced currents regulate salinity, moderate water temperature, and disperse pollutants (POSD 2007).

A recent bay-wide water quality monitoring study confirms that the northern part of the bay is essentially marine and well mixed by the tides, while greater stratification and variability prevail farther back in the central and southern parts of the bay (Tierra Data, Inc. [TDI] 2012a). In San Diego Bay, this area of efficient flushing is within perhaps 3 to 4 mi (5 to 6 km) of the entrance, reaching almost to downtown. Residence time of bay water is just a few days. The net result of these circulation patterns in the bay is the presence of cold, clean ocean water at depth, explaining the Mussel Watch Project result that mussels at the mouth of the bay were found to be the cleanest in the county.

Temperature and density gradients, both with depth and along a longitudinal cross-section of the bay, drive tidal exchange of bay and ocean water beginning in the spring and continuing into fall. The seasonal thermal cycle has an amplitude of about 46 to 48 degrees Fahrenheit (° F) (8 to 9 degrees Celsius [° C]). Maximum water temperatures occur in July and August, and minimums in January and February. In the winter, thermal gradients are absent, with cooler air temperatures and higher winds causing the bay to be nearly isothermal. During 1993 surveys, the warmest temperature was 84.7° F (29.3° C) in south bay, and the coolest temperature, 59.2° F (15.1° C), was just north of the Coronado Bridge in January . The average surface temperature is estimated to be 63.3° F (17.4° C). Maximum vertical temperature gradients of about 0.3° F/ft (0.5° C/m) during the summer. Typical longitudinal temperature range is about 45 to 50° F (7 to 10° C) (about 0.3 to 0.5° C/km) over the length of the bay during the summer. Temperature inversions also occur diurnally due to night cooling.

Salinities of the project area resemble those of the nearby open ocean, i.e. 32.8 to 33 parts per thousand (TDI 2012a).

### 2.3.3 Substrates and Habitats

Marine mammal occurrence in San Diego Bay is predominantly in the North Bay – Marine Region as described above. Local and seasonal concentrations of marine mammals in San Diego reflect the opportunistic attraction of marine mammals in general to areas of high prey (fish) abundance, the proximity of pinniped haulouts, and resting sites to feeding areas, and, for cetaceans, the prevalence of marine conditions and access to and from the open ocean. Sediments in northern San Diego Bay are relatively sandy (USACE 2010; NAVFAC SW and POSD 2011) as tidal currents tend to keep the finer silt and clay fractions in suspension, except in harbors and elsewhere in the lee of structures where water movement is diminished. Much of the shoreline consists of riprap and manmade structures as can be seen in aerial views. As indicated by the bathymetry on previous figures (Figures 1-8, 1-9, 2-1) the predominant habitats of the project area are moderately deep (12 to 20 ft below MLLW) and deep (>20 ft below MLLW) subtidal and artificial hard substrates. Additionally, shallow sandy areas support beds of eelgrass which are ecologically vital nursery and foraging habitats for fish. The current (2011) and recent historic extent of eelgrass beds in the project area are shown in Figure 2-2.

Over-water structures such as the existing fuel pier provide substrates for the growth of algae and invertebrates off the bottom and support abundant fish populations. As noted in Section 1.3.3, the top surface area of the existing pier is 1.63 acres, which is approximately 3.1% of the dock and pier acreage of the North Bay as a whole (NAVFAC SW and POSD 2011).

### 2.3.4 Vessel Traffic and Ambient Underwater Soundscape

As illustrated by Table 2-2 below, San Diego Bay is heavily used by commercial, recreational, and military vessels, with an average of 82,413 vessel movements (in or out of the bay) per year. This equates to about 225 vessel transits per day, a majority of which are presumed to occur during daylight hours. The number of transits does not include recreational boaters that use San Diego Bay, estimated to number 200,000 (San Diego Harbor Safety Committee 2009).

Refer to Section 6 for background on acoustics and definitions of metrics. Acoustic monitoring of ship noise in Glacier Bay, Alaska (Kipple and Gabriele 2007), found that root mean square (rms) sound source levels from a variety of vessel types and sizes was typically within the range of 160-170 decibels (dB) referenced to 1 microPascal (re 1 μPa) at 1m. Ship noise was characterized by a broad frequency range (roughly 0.1 to 35 kilohertz [kHz]), with peak noise at higher frequency for smaller vessels. Similar broad-spectrum (10 Hz to >1 kHz) noise has been reported for a variety of categories of ships (NRC 2003). Ship noise in San Diego Bay thus has the potential to obscure underwater sound that would otherwise emanate from the project site to locations farther up the bay or offshore through the mouth.

Underwater noise measurements were made by the Navy at the fuel pier and other locations throughout the potential ZOI for pile driving during April-May of 2012 (Appendix B). The Navy intends to continue gathering ambient sound data for the project area up until in-water construction/demolition activities begin, at which time the mitigation and monitoring measures described in Sections 11 and 13 would be implemented.

Figure 2-3 shows the station locations where ambient sound was monitored from April 30 to June 1, 2012. Station locations were chosen to collect ambient data in the domain of Peter Dahl's transmission loss model. Station locations, time of day, depth of measurement and incidental observations are provided in Appendix B. Sound pressure levels (SPLs) were collected


Figure 2-2
Eelgrass Beds in the Project Area


Figure 2-3
Ambient Underwater Sound Locations

### Table 2-2. Port of San Diego Average Annual Vessel Traffic

| VESSEL TYPE | VESSEL MOVEMENTS (Inbound and Outbound) | | |
|---|---|---|---|
| | ***Subtotal by Vessel Type*** | | ***Total*** |
| | ***Cargo*** | ***Others*** | |
| **Total Annual Movements for All Vessel Types** | | | **82,413** |
| **Deep Draft Commercial Vessel (Cargo plus Cruise)** | | | 1,175 |
| **Cargo Ships** (largest vessel: 1,000' length,106' beam, 41'draft) | 740 | | 740 |
| Bulk | 20 | | |
| Container Ships | 100 | | |
| General Cargo | 180 | | |
| Roll On/Roll Off | 440 | | |
| **Cruise Ships** (largest vessel: 1,000' length, 106' beam, 34' draft) | | 435 | 435 |
| **Excursion Ships** (largest vessel: 222' length, 57' beam, 6' draft) | | 68,000 | 68,000 |
| **Commercial Sportfishing** (average vessel size: 123' length, 32' berth, 13' draft) | | 10,094 | 10,094 |
| **Military** (largest vessel: 1,115' length, 252'beam (flight deck), 39' draft) | | 3,144 | 3,144 |

*Note:* Tug traffic was not included in the above statistics since inner harbor tug movements alone exceed 7,000 for a typical year.
*Source: San Diego Harbor Safety Committee 2009.*

at mid water depth and 1 m below the surface on 7 separate days during daylight with a calibrated omni-directional hydrophone (Reson TC 4033) with a relatively flat response from a few Hz to 80 kHz. Sound pressures were recorded in 1/3 octave bins from 3 Hz to 20 kHz every 0.01 seconds (Larson Davis 831 sound level meter) for approximately 10 minutes at each location and depth. Hence, approximately 60,000 measurements over this frequency range were collected at each location and depth on 7 occasions. Statistics on the root-mean-square (rms) pressure levels over the 0.01 second intervals for each frequency band were recorded. In addition, statistics on the rms pressure level integrated from 3 Hz to 20 kHz were recorded, as well as the instantaneous peak pressure recorded over the 10 minute recording window at each station and depth.

Figure 2-4 is a cumulative distribution of all rms SPLs recorded during this period and integrated over the frequency range. The pressure levels are plotted in dB relative to the underwater standard of 1 micro Pascal (µPa). That is, dB=20*$\log_{10}$(measured pressure/1 µPa). The upper limit of the recordings exceeds 160 dB and the median SPL is 123.8 dB. The spatial distribution of SPL is fairly uniform at the 10 sample locations and depth (see appendix B). An interesting exception is the secondary peak on the left shoulder of the cumulative distribution. These data were taken from location 8 off the Zuniga Jetty at the mouth of San Diego Bay, often observed with no vessel traffic in the vicinity. This secondary peak appears to be due to large populations of snapping shrimp living in the rocky jetty.

Ambient sound levels (integrated 3 Hz -20 KHz) in northern San Diego Bay

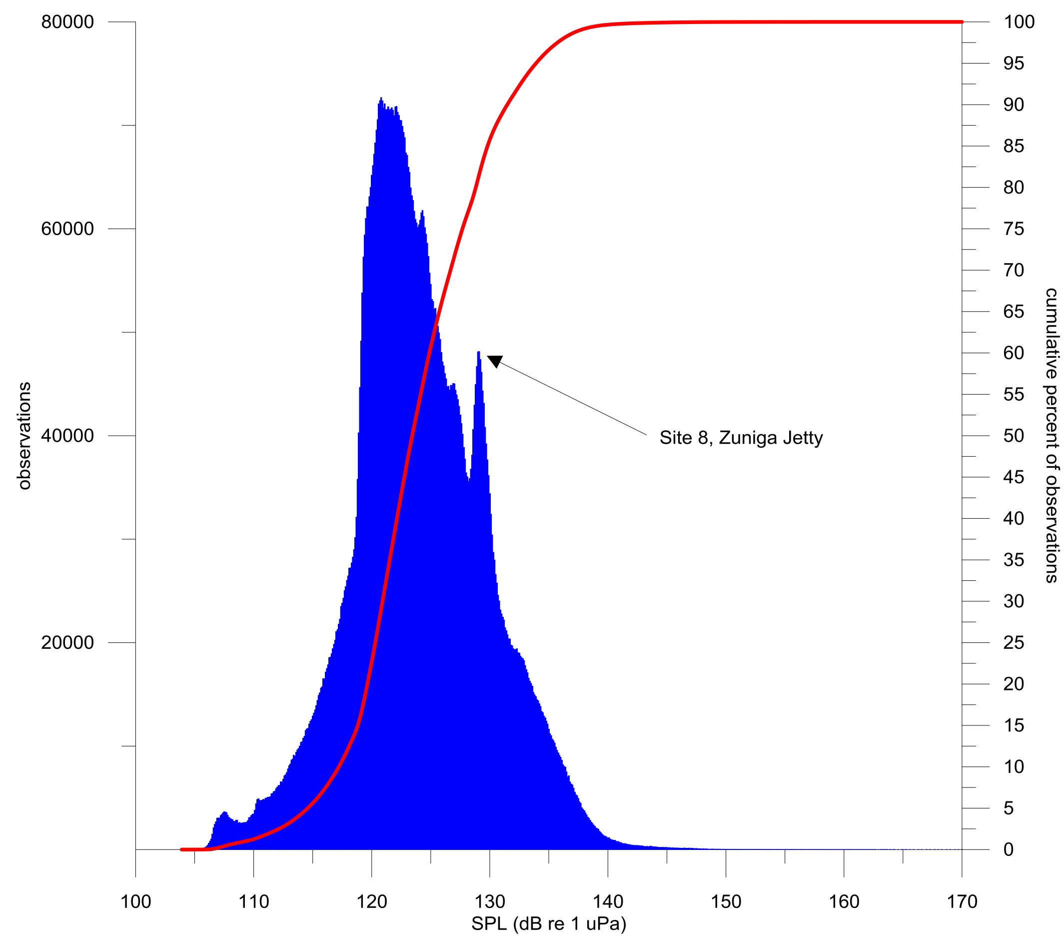



**Figure 2-4 Ambient San Diego Bay Sound Pressure Levels (rms) from all Sample Locations and Depths**

Figure 2-5 is a scatter plot of median (blue) and maximum (red) rms SPL at all locations for each 10 minute recording window versus sample location. SPL recordings were integrated over the frequency range. Data were collected Monday through Saturday. The relatively uniform distribution of underwater sound levels throughout this part of San Diego Bay reflects the active ship traffic passing through the study area in the navigation channel. The sample locations are distributed on either side of the channel in the fairly narrow entrance of San Diego Bay proper. Most ship traffic is transiting through the vicinity of the fuel pier to berths farther in the bay. Higher levels in the plot were observationally associated with nearby ship movementswhen the data were collected (refer to the field log in Appendix B), with the exception of Zuniga Jetty as noted above.

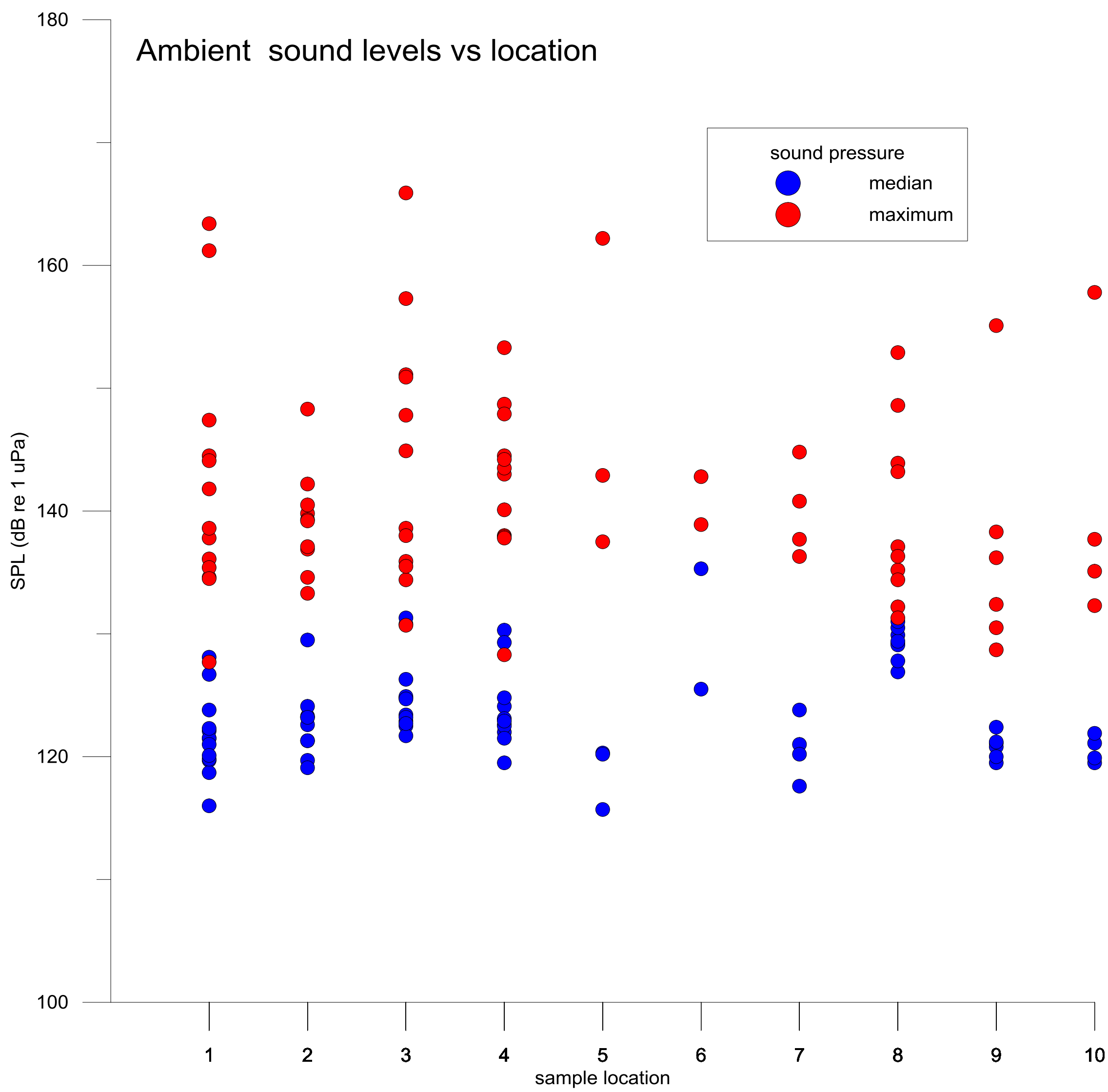



**Figure 2-5 Ambient Underwater SPLs from all Sample Locations and Depths**

Figure 2-6 is a scatter plot similar to 2-5 at all locations versus time of day. The relatively uniform distribution of underwater sound levels during the day reflects the active ship traffic passing through the study area.

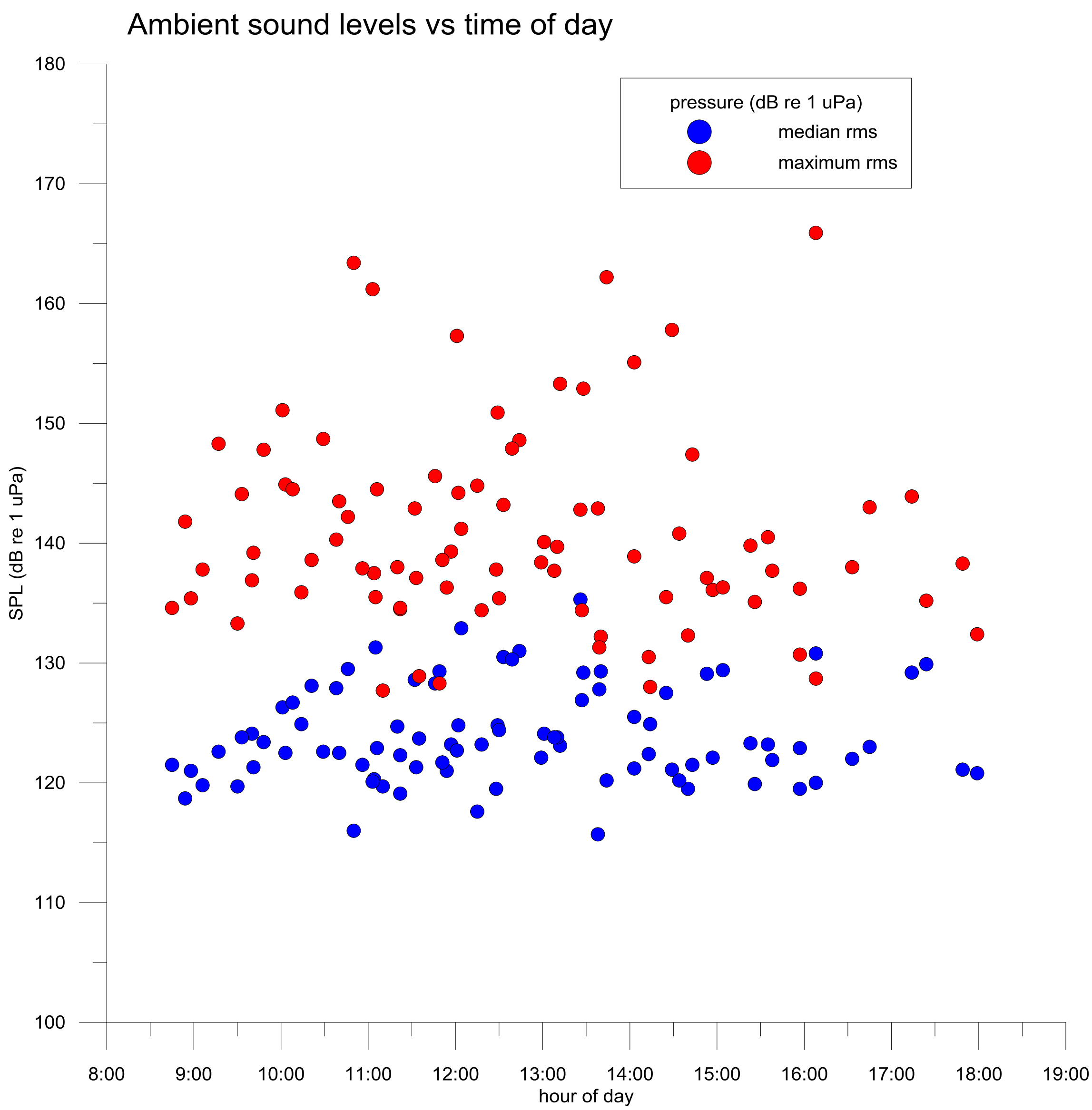



**Figure 2-6 Ambient Underwater SPLs from all Sample Locations as a Function of Time of Day**

# 3 MARINE MAMMAL SPECIES AND NUMBERS

*The species and numbers of marine mammals likely to be found within the activity area.*

Recognizing that the results from regional offshore surveys for marine mammals are not necessarily representative of northern San Diego Bay, the Navy has conducted marine mammal surveys in the project area beginning in 2007 and continuing through March 2012 (Merkel and Associates, Inc. 2008; U.S. Pacific Fleet 2009-2012; TDI 2012b). Boat survey routes (Figure 3-1) established in 2007 and enabling the detection of all marine mammals throughout the project area have been resurveyed on 16 occasions, 13 of which were during the seasonal window for in-water construction and demolition (September – April) and are hence applicable to the assessment of potential occurrence during project activities. These surveys and other local information as well as the Navy Marine Species Density Database (NMSDD) (Hanser et al. 2012) are considered in determining the baseline on the species and numbers of marine mammals that occur in the activity area.

Figure 3-2 shows the locations of all marine mammals documented in the Navy's surveys of the project area. Of the approximately 41 marine mammal species that occur in Southern California waters (Carretta et al. 2012), only three year-round species and one migratory species are expected to occur in the general area of northern San Diego Bay. These include two pinnipeds - the United States (U.S.) stock of California sea lion (*Zalophus californianus*) and California stock of harbor seal (*Phoca vitulina richardii*); and two cetaceans – the California coastal stock of bottlenose dolphin (*Tursiops truncatus*), and the Eastern North Pacific stock of the gray whale (*Eschrichtius robustus*) (NAVFAC SW and POSD 2011; Navy 2010e).

Other species that occur in the Southern California Bight may have the potential for isolated occurrence within San Diego Bay or just offshore (Navy 2010e, 2012). The Pacific white-sided and common dolphin (*Lagenorhynchus obliquidens* and *Delphinus* sp., respectively) were sighted along a previously used transect on the opposite side of the Point Loma Peninsula (Merkel & Associates 2008), near the kelp forests. Risso's dolphin (*Grampus griseus*) is fairly common in southern California coastal waters (Carretta et al. 2012; Hanser et al. 2012), but has not been seen in San Diego Bay. These species have not been observed near the project area and are expected to have zero density within potential acoustic zones of influence, and hence are not considered further.

None of the four species that are likely to occur are listed under the Endangered Species Act (ESA), whereas all are protected under the MMPA. The relative abundance of these species in the project area is summarized in Table 3-1 and the following paragraphs.

The U.S. stock of California sea lion and the California stock of harbor seal can be commonly found at haul-out sites on the mainland and on navigation buoys, barges, and docks within California harbors. California sea lions and harbor seals do not typically haul out at the same location at the same time. Within and adjacent to San Diego Bay, California sea lions are the dominant and by far the most numerous pinniped observed, which may explain the absence of harbor seals from most of the area. California sea lions are especially abundant on the two bait barges, which are relatively close to the fuel pier and are within the zone of influence (ZOI, defined in later chapters) for potential harassment.

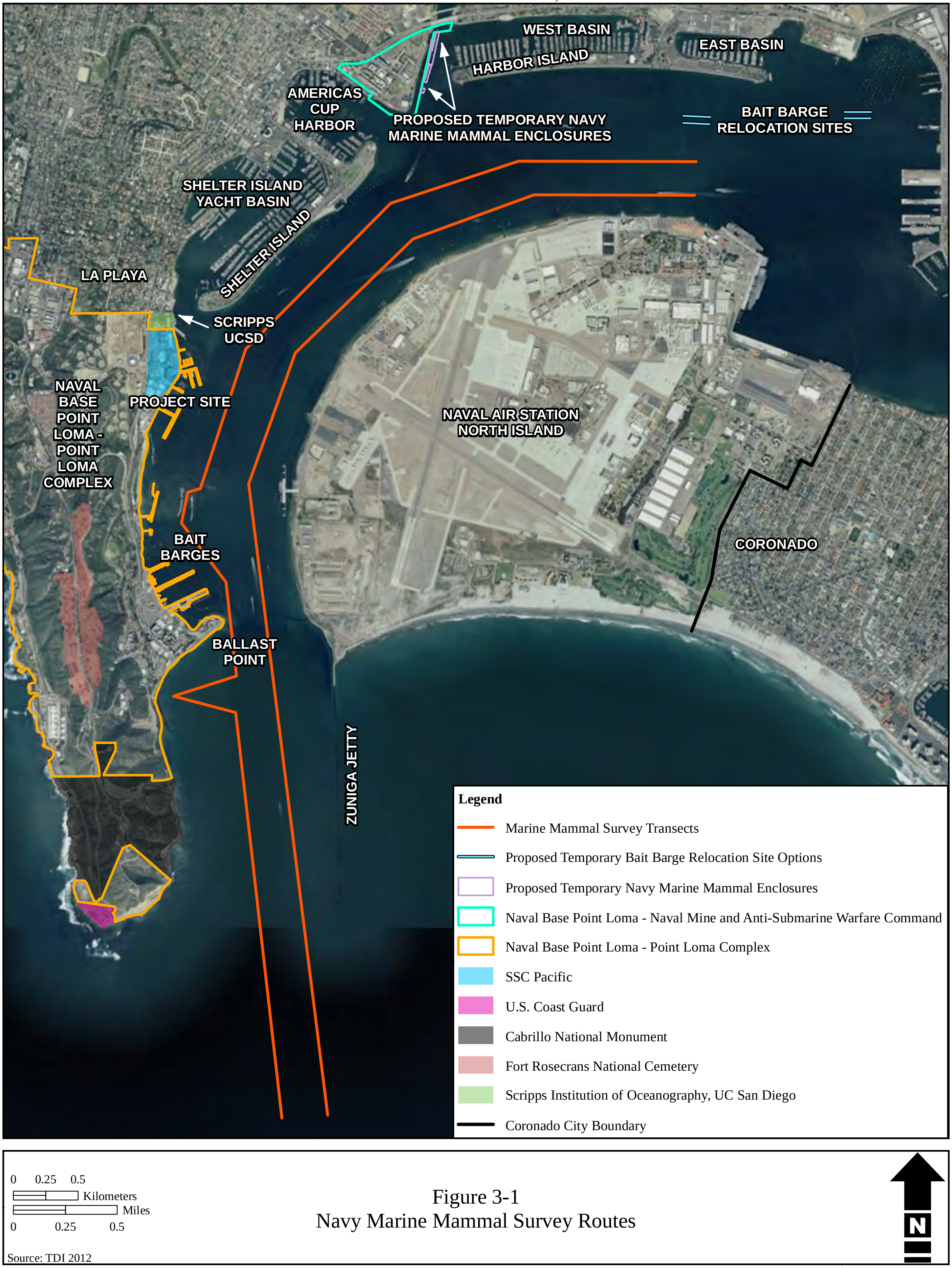



Figure 3-1
Navy Marine Mammal Survey Routes

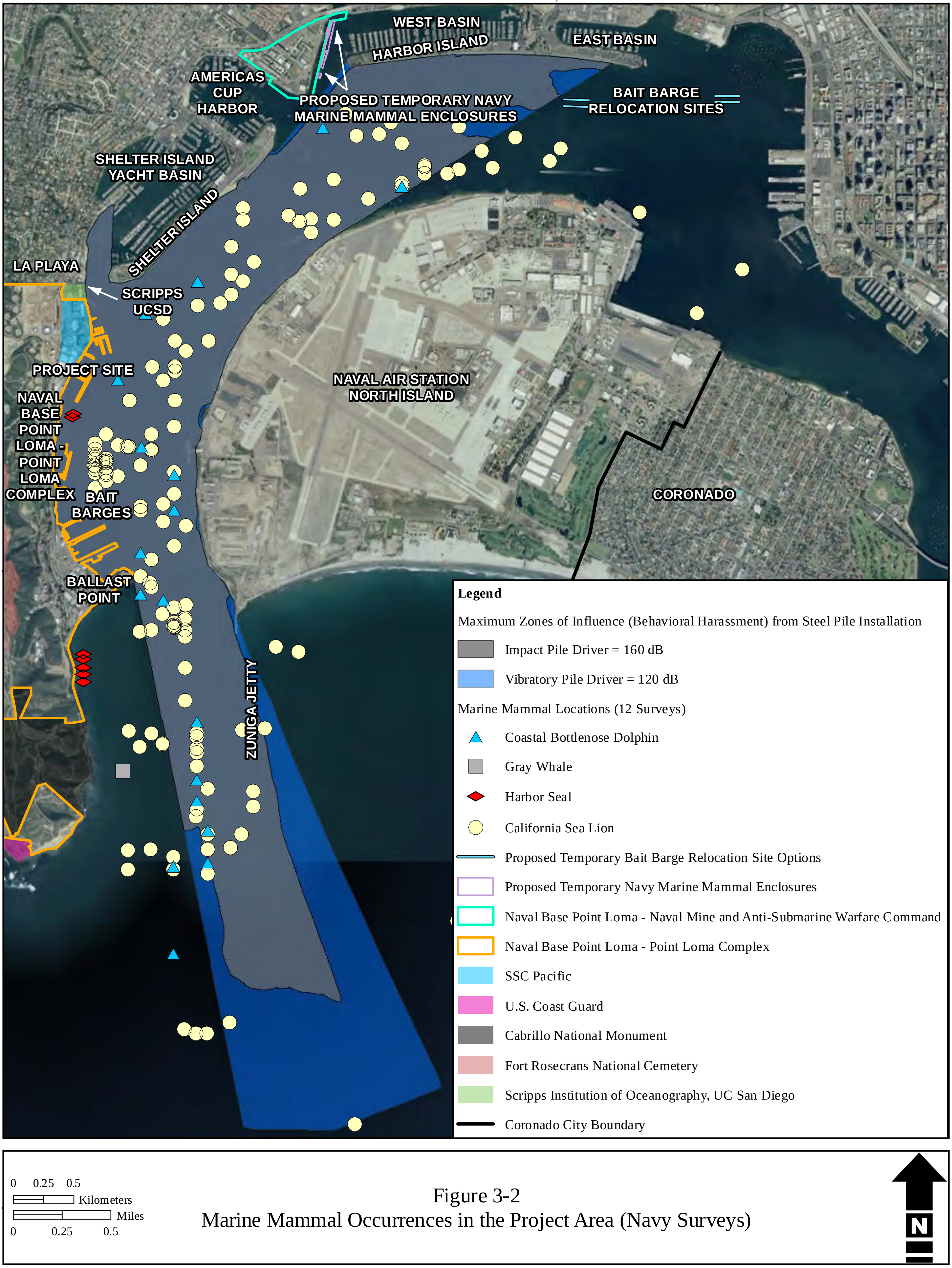



Figure 3-2
Marine Mammal Occurrences in the Project Area (Navy Surveys)

In the Navy's surveys, harbor seals have only been observed hauled out along the shore south of Ballast Point, outside of the ZOI for project pile driving activities, or elsewhere outside of the potential ZOI. However, up to 4 harbor seals have also been observed in Navy monitoring of another project at Pier 122, roughly 250 m south of the fuel pier (Jenkins 2012; location shown on Figure 3-2). Therefore harbor seals are considered potentially present and affected within the ZOI for harassment.

### Table 3-1. Marine Mammals Occurring in the Vicinity of Naval Base Point Loma

| *Species* | *Stock Abundance*[1] | *Relative Occurrence in North San Diego Bay* | *Season(s) of Occurrence* | *Abundance in the Project Area (density)*[2] |
|---|---|---|---|---|
| **California sea lion**<br>*Zalophus californianus*<br>U.S. Stock | 296,750 | Abundant | Year-round | Average 59.92 individuals in ZOI ($5.22/km^2$) |
| **Harbor seal**<br>*Phoca vitulina*<br>California stock | 30,196 (Coefficient of Variation [CV] = 0.157) | Uncommon, localized | Year-round | 0-4 individuals in ZOI (≤ $0.35/km^2$) |
| **Bottlenose dolphin**<br>*Tursiops truncatus*<br>California coastal stock | 323 (CV = 0.13) | Occasional | Year-round | 0-40 individuals in ZOI (assume $0.36/km^2$) |
| **Gray whale**<br>*Eschrichtius robustus*<br>Eastern North Pacific Stock | 19,126 (CV = 0.071) | Rare visitor | Late winter | ≤1 individual (≤ $0.09/km^2$) |

Sources: [1]NMFS marine mammal stock assessment reports (Carretta et al. 2012; Allen and Angliss 2010) . [2] Abundances from Navy Marine Mammal Surveys and monitoring (Merkel and Associates, Inc. 2008; U.S. Pacific Fleet 2009-2012; TDI 2012b; Jenkins 2012) sightings within the maximum ZOI for vibratory pile driving ($11.49 km^2$). For bottlenose dolphin, the assumed density is from Hanser et al. (2012).

The Eastern North Pacific stock of gray whale occurs off southern California during their annual migration between summer feeding areas in the Bering and southern Chukchi seas and winter calving areas in Baja California and mainland Mexico. While gray whales may occasionally be found within a kilometer of shore during both their southward and northward migration periods, they are generally found farther offshore (Navy 2010e). There has been only a single sighting of gray whales (one juvenile) during the Navy's surveys. Although this individual was outside of the ZOI for potential harassment by pile driving (TDI 2012b, location shown on Figure 3-2), it likely crossed through the ZOI, and on several occasions in recent years, an individual gray whale hase entered San Diego Bay and lingered for up to varying lengths of time (NAVFAC SW and POSD 2011; Jenkins 2012; San Diego Union Tribune 2012). Therefore, the gray whale is considered potentially present and affected within ZOIs for behavioral harassment.

The California Coastal stock of the bottlenose dolphin is a toothed whale (odontocete) that regularly inhabits the nearshore waters of southern California. This species regularly moves along the California coast and occasionally enters northern San Diego Bay. This particular stock has limited site fidelity and can be distributed anywhere between Monterey to northern Baja Mexico depending on localized prey abundance (Navy 2011). Bottlenose dolphins have been sighted with increasing regularity in San Diego Bay (TDI 2012b; Jenkins 2012).

## 3.1 Species Descriptions and Abundances

### 3.1.1 California Sea Lion

*Species Description*

The California sea lion is now considered to be a full species, separated from Galapagos sea lion (*Z. wollebaeki*) and the extinct Japanese sea lion (*Z. japonicus*) (Carretta et al. 2012). The breeding areas of the California sea lion are on the Channel Islands, western Baja California, and the Gulf of California. Mitochondrial DNA analysis of California sea lions has identified five genetically distinct geographic populations: (1) Pacific Temperate, (2) Pacific Subtropical, (3) Southern Gulf of California, (4) Central Gulf of California and (5) Northern Gulf of California. The Pacific Temperate population makes up the U.S. stock and includes rookeries within U.S. waters and the Coronado Islands just south of the U.S.-Mexico border.

The California sea lion is sexually dimorphic. Males may reach 1,000 pounds and 8 ft in length; females grow to 300 pounds and 6 ft in length. Their color ranges from chocolate brown in males to a lighter, golden brown in females. At around 5 years of age, males develop a bony bump on top of the skull called a sagittal crest. The crest is visible in the "dog-like" profile of male sea lion heads, and hair around the crest gets lighter with age (National Marine Fisheries Service [NMFS] 2012).

*Population Abundance*

The entire population cannot be counted because all age and sex classes are never ashore at the same time. In lieu of counting all sea lions, pups are counted when all are ashore, in July during the breeding season, and the number of births is estimated from pup counts (Carretta et al. 2012). The size of the population is then estimated from the number of births and the proportion of pups in the population. Based on these censuses, the U.S. stock has generally increased from the early 1900s, to a current estimate of 296,750, with a minimum estimate of 153,337 (Carretta et al. 2012). There are indications that the California sea lion may have reached or is approaching carrying capacity, although more data are needed to confirm that leveling in growth persists (Carretta et al. 2012). San Diego Bay hosts a resident non-breeding population of California sea lions, numbers of which fluctuate as individuals move between the bay and rookeries on offshore islands. Navy surveys (Figures 3-1, 3-2) have documented between 23 and 122 individuals in the project area, with an average of 59.92 individuals counted within the maximum ZOI for the project during the seasonal period of proposed in-water construction and demolition.

### 3.1.2 Harbor Seal

*Species Description*

Harbor seals, which are members of the family Phocidae ("true seals"), inhabit coastal and estuarine waters and shoreline areas from Baja California to western Alaska. For management purposes, differences in mean pupping date (i.e., birthing), movement patterns, pollutant loads and fishery interactions have led to the recognition of three separate harbor seal stocks along the west coast of the continental U.S. The three distinct stocks are: 1) inland waters of Washington State (including Hood Canal, Puget Sound, and the Strait of Juan de Fuca out to Cape Flattery),

2) outer coast of Oregon and Washington, and 3) California (Carretta et al. 2012). The California stock is the only stock that is expected to occur within the Project Area.

*Population Abundance*

Based on post-breeding counts of individuals at known haul-outs, corrected for the proportion of the population that is out at sea, the population estimate for the California stock of harbor seal is 30,196 (CV = 0.157). The minimum population size is estimated as 26,667, with numbers apparently stabilizing during the past decade (Carretta et al. 2012). Harbor seals are relatively uncommon within San Diego Bay. Sightings in the Navy transect surveys of northern San Diego Bay cited above were limited to individuals outside of the ZOI, on the south side of Ballast Point. Therefore, the use of transect data would result in a density estimate of zero, which is unrealistic given the known occurrence of harbor seals in the general vicinity and the likelihood that a small number of individuals could occur (TDI 2012b; Jenkins 2012). Navy marine mammal monitoring for another project conducted intermittently at Pier 122 from 2010-2012 has documented from zero to 4 harbor seals near Pier 122 (within the ZOI) at various times, with the greatest number of sightings during April and May (Jenkins 2012). For the in-water work period of this IHA, the presence of 3 individuals for up to 30 work days during the winter-spring months is assumed. .

### 3.1.3 Gray Whale

*Species Description*

Gray whales are mysticetes or baleen whales and are the only species in the family Eschrichtiidae. They can grow to about 50 ft (15 m) long and weigh approximately 80,000 lb (35,000 kg); females are slightly larger than males. The Eastern North Pacific stock of gray whale occurs off southern California during their annual migration between summer feeding areas in the Bering and southern Chukchi seas and winter calving areas in Baja California and mainland Mexico. The southward migration occurs during November-December, whereas the return northward migration occurs during February-May. During migration they travel alone or in small groups. Gray whales are bottom feeders that suck sediment and benthic invertebrates from the sea floor, filtering their prey through coarse baleen plates (NMFS 2012).

*Population Abundance*

The Eastern North Pacific stock has continued to increase at rate of approximately 2.5 to 3.3% per year on average, with the most recent estimate of abundance being 19,126 individuals (Allen and Angliss 2010). Gray whales can occur near the mouth of San Diego Bay, and occasionally enter the bay (NAVFAC SW and POSD 2011). However, their occurrence in San Diego Bay is sporadic and unpredictable. In recent years, solitary individuals have entered the bay and remained for varying lenghts of time during March 2009, April 2010, and July 2011 (San Diego Union Tribune 2012). Estimates of regional cold season abundance and density in the offshore waters (Hanser et al. 2012) are not representative of the project area. For this IHA application, an occurrence of one individual per day in the ZOI for a portion of the gray whale migration season is considered the most plausible circumstance in which a take under the MMPA could occur.

### 3.1.4 Coastal Bottlenose Dolphin

Species Description

The California coastal stock of bottlenose dolphin is distinct from the offshore population and is resident in the immediate (within 1 km of shore) coastal waters, occurring primarily between Point Conception, California, and San Quintin, Mexico. Bottlenose dolphins have a robust body and a short, thick beak. They range in length from 6 to 12.5 ft (1.8 to 3.8 m) and weight from 300 to 1400 pounds (lbs) (135-635 kilograms [kg]); males are slightly larger than females. They are commonly found in groups of 2 to 15 individuals and in larger herds offshore. Coastal animals feed on benthic fish and invertebrates (NMFS 2012).

Population Abundance

Based on photographic mark-recapture surveys conducted along the San Diego coast in 2004 and 2005, population size for the California Coastal Stock is estimated to be 323 individuals, with a 95% confidence interval of 259-430 (Carretta et al. 2012). If the 35% of animals encountered that lack identifiable dorsal fin marks were included within this stock, the true population size would be closer to 450-500 animals (Carretta et al. 2012). In the aforementioned surveys of San Diego Bay, numbers of coastal bottlenose dolphins were highly variable (from 0 to 40). Given extreme variability in the number of coastal bottlenose dolphins sighted in surveys of the project ZOI, the regional density estimate developed in the NMSDD (Hanser et al. 2012) was considered a more reliable indicator of the number of animals likely to be present during construction/demolition activities and has been used in this IHA application.

## 3.2 Spatial Distribution

Density assumes that marine mammals are uniformly distributed within a given area, although this is rarely the case. Marine mammals are usually clumped in areas of greater importance, for example, areas of high productivity, lower predation, safe calving, foraging, etc. The site-specific surveys of northern San Diego Bay provide high resolution of the distribution of marine mammals within the affected area. The distribution of sightings (Figure 3-2) indicates that the assumption of uniform or random distribution throughout the affected area is reasonable, with two qualifiers: 1) sea lions are strongly concentrated on the Bait Barge; and 2) the area adjacent to and inshore of the fuel pier is not used to an appreciable extent.

## 3.3 Submergence

Cetaceans spend their entire lives in the water and spend most of their time (>90% for most species) entirely submerged below the surface. When at the surface, cetacean bodies are almost entirely below the water's surface, with only the blowhole exposed to allow breathing. This makes cetaceans difficult to locate visually and also exposes them to underwater noise, both natural and anthropogenic, essentially 100% of the time because their ears are nearly always below the water's surface.

Seals and sea lions (pinnipeds) spend significant amounts of time out of the water during breeding, molting, and "hauling out" (resting out of the water on land or structures) periods. Sea lions in San Diego Bay are most commonly observed out of water, especially on bait barges, navigation aids, and other structures. Within the bay, harbor seals would be most likely to occur in the water. When not actively diving, pinnipeds at the surface often orient their bodies vertically in the water column and often hold their heads above the water surface. Consequently, pinnipeds would not be exposed to underwater sounds to the same extent as cetaceans occurring in the same location, but would be subject to airborne noise to a greater degree.

For the purpose of assessing impacts from underwater sound at NBPL, the Navy assumed that that both cetaceans and pinnipeds that occur in the vicinity would be submerged and at the same water depth as the source, and would thereby experience the maximum received SPLs predicted to occur at a given distance from the acoustic source on the basis of acoustic modeling. However, pinnipeds are also conservatively assumed to be out of the water for sufficient periods to be exposed to whatever airborne noise is generated by construction activities as well.

# 4 STATUS AND DISTRIBUTION OF MARINE MAMMAL SPECIES OR STOCKS THAT COULD POTENTIALLY BE AFFECTED

*A description of the status, distribution, and seasonal distribution (when applicable) of the affected species or stocks of marine mammals likely to be affected by such activities.*

There are four marine mammal species, California sea lion, harbor seal, gray whale, and coastal bottlenose dolphin, that are known to occur in sufficient proximity to the project site that are likely to be affected by project activities. None of these species are listed as threatened or endangered under the Endangered Species Act (ESA). The population status, distribution, behavior and ecology, and acoustics (uses of sound and hearing ability) of each species is described below. Background on acoustics and definitions of metrics are provided in Section 6 of this document.

## 4.1 California Sea Lion (*Zalophus californianus*), U.S. Stock

### 4.1.1 Population Status

The U.S. stock is not considered strategic or depleted under the MMPA.

### 4.1.2 Distribution

More than 95% of the U.S. Stock breeds and gives birth to pups on San Miguel, San Nicolas, and Santa Barbara islands. Some movement has been documented between the U.S. Stock and Western Baja California, Mexico Stock, but rookeries in the United States are widely separated from the major rookeries of western Baja California. Smaller numbers of pups are born on San Clemente Island, the Farallon Islands, and Año Nuevo Island (Lowry et al. 1991). The California sea lion is by far the most commonly-sighted pinniped species at sea or on land in the vicinity of NBPL and northern San Diego Bay. In California waters, sea lions represented 97 percent (381 of 393) of identified pinniped sightings at sea during the 1998–1999 NMFS surveys (Carretta et al. 2000). They were sighted during all seasons and in all areas with survey coverage from nearshore to offshore areas (Carretta et al. 2000). Sea lions while potentially present at-sea, are most commonly seen hauled-out on piers and buoys within and leading into San Diego Bay, (Merkel and Associates, Inc. 2008). In a study of California sea lion reaction to human activity, Holcomb et al. (2009) showed that in general sea lions are rather resilient to human disturbance.

The distribution and habitat use of California sea lions varies with the sex of the animals and their reproductive phase. Adult males haul-out on land to defend territories and breed from mid-to-late May until late July. Individual males remain on territories for 27 to 45 days without going to sea to feed. During August and September, after the mating season, the adult males migrate northward to feeding areas as far away as Washington (Puget Sound) and British Columbia (Lowry et al. 1991). They remain there until spring (March through May), when they migrate back to the breeding colonies. Thus, adult males are present in offshore areas only briefly as they move to and from rookeries. Distribution of immature California sea lions is less well known, but some make northward migrations that are shorter in length than the migrations of adult males (Huber 1991). However, most immature sea lions are presumed to remain near the rookeries for most of the year. Adult females remain near the rookeries throughout the year. Most births occur from mid-June to mid-July (peak in late June).

Survey data from 1975 to 1978 were analyzed to describe the seasonal shifts in the offshore distribution of California sea lions near the Channel Islands (Bonnell and Ford 1987). The seasonal changes in the center of distribution were attributed to changes in the distribution of the prey species. If California sea lion distribution is determined primarily by prey abundance as influenced by variations in local, seasonal, and interannual oceanographic variation, these same areas might not be the center of sea lion distribution every year. Melin et al. (2008) showed that foraging female sea lions showed significant variability in individual foraging behavior, and foraged further offshore and at deeper depths during El Niño years as compared to non-El Niño years.

There are limited published at-sea density estimates for pinnipeds within southern California. At-sea densities likely decrease during warm-water months because females spend more time ashore to give birth and attend their pups. Radio-tagged female California sea lions at San Miguel Island spent approximately 70% of their time at sea during the nonbreeding season (cold-water months) and pups spent an average of 67% of their time ashore during their mother's absence (Melin and DeLong 2000). Different age classes of California sea lions are found in the San Diego region throughout the year (Lowry et al. 1991). Although adult male California sea lions feed in areas north of San Diego, animals of all other ages and sexes spend most, but not all, of their time feeding at sea during winter. During warm-water months, a high proportion of the adult males and females are hauled out at terrestrial sites during much of the period.

The geographic distribution of California sea lions includes a breeding range from Baja California to southern California. During the summer, California sea lions breed on islands from the Gulf of California to the Channel Islands and seldom travel more than about 31 miles (50 km) from the islands (Bonnell et al. 1983). The primary rookeries are located on the California Channel Islands of San Miguel, San Nicolas, Santa Barbara, and San Clemente (Le Boeuf and Bonnell 1980; Bonnell and Dailey 1993). Their distribution shifts to the northwest in fall and to the southeast during winter and spring, probably in response to changes in prey availability (Bonnell and Ford 1987).

The Navy has conducted numerous marine mammal surveys overlapping the north San Diego Bay project area and the potential ZOI for impact and vibratory pile driving operations. California sea lions regularly occur on rocks, buoys and other structures, and especially on bait barges, although numbers vary greatly. Surveys were conducted along two survey routes through the northern part of the bay during 2007-2008 (Merkel and Associates 2008). These transect surveys were recently repeated with minor modifications to thoroughly cover the northern part of the bay (U.S. Pacific Fleet 2009-2012; TDI 2012b). Sightings include all animals observed, their locations (using geographical positioning systems), and are annotated as to whether animals were swimming or hauled out; the latter account for the great majority of animals counted. Following are the results from the seasonal period of proposed in-water construction/demolition:

- 14 February 2007: 2 sightings 3 individuals (all in maximum potential ZOI)
- 28 December 2007: 8 sightings, 19 individuals (14 in maximum potential ZOI)
- 15 March 2008: 7 sightings, 7 individuals (6 in maximum potential ZOI)
- 13 October 2009: 15 sightings, 92 individuals (89 in maximum potential ZOI)
- 16 February 2010: 19 sightings, 60 individuals (50 in maximum potential ZOI)
- 10 April 2010: 8 sightings, 24 individuals (23 in maximum potential ZOI)

- 13 November 2010: 4 sightings, 114 individuals (all in maximum potential ZOI)
- 21 February 2012: 7 sightings, 60 individuals (58 in maximum potential ZOI)
- 28 February 2012: 8 sightings, 110 individuals (109 in maximum potential ZOI)
- 14 March 2012: 10 sightings, 92 individuals (90 in maximum potential ZOI)
- 21 March 2012: 27 sightings, 108 individuals (101 in maximum potential ZOI)
- 27 March 2012: 12 sightings, 194 individuals (11 in maximum potential ZOI)
- 28 March 2012: 6 sightings, 111 individuals (all in maximum potential ZOI)

Based on the above survey results, the average abundance of sea lions within the maximum project ZOI in northern San Diego Bay is 59.92 individuals, which translates to a site-specific density estimate of 5.22 individuals/km$^2$.

### 4.1.3 Behavior and Ecology

Sexual maturity occurs at around 4 to 5 years of age for California sea lions, and the pupping and mating season begins in May and continues through July (Heath 2002). California sea lions are gregarious during the breeding season and social on land during other times. California sea lions' food consists of squid, octopus, and a variety of fishes. While no studies have occurred of their diet in the bay, studies of food sources have been done in other California coastal areas (Antonelis et al. 1990; Lowry et al. 1990; Melin et al. 1993; Hanni and Long 1995; Henry et al. 1995). Fish species found in the bay that sea lions most likely feed on include spiny dogfish, jack mackerel, Pacific herring, Pacific sardine, and northern anchovy. They also eat octopus and leopard shark (NAVFAC SW and POSD 2011).

California sea lions show a high tolerance for human activity (Holcomb et al. 2009), modify their foraging in response to spatial and temporal variations in the availability of different prey species (Lowry et al. 1991), and make opportunistic use of almost any available structures as haulouts (NAVFAC SW and POSD 2011).

Sea lions seek a variety of structures, such as rocks, piers, and buoys, for hauling out. These behaviors can be destructive to structures due to the weight of the animal and fouling. If sea lions find an easy food source at tourist spots or fishing piers, their presence can become a nuisance at certain areas in the bay as they have at marinas in Monterey and San Francisco Bay (Leet et al.1992). Marina operators and commercial and sport fishermen tend to consider them a major nuisance, leading to some human-caused mortality.

Within the project study area, the vast majority of sea lions have been observed hauled out on buoys and other structures, particularly on the Bait Barge; these locations are shown in Figure 4-1. While the bait barges afford a large area for resting, the animals may also feed on bait fish that escape, are spilled in transfers, or are tossed into the water by fishermen. It is not known whether there are regular daily patterns in haul-out behavior or movements in and out of the bay.

While sea lions are common and apparently thrive amid anthropogenic structures and related noise and activities in northern San Diego Bay, it should be noted that this is a small fraction of the population, and that less developed areas of the adjacent mainland (Point Loma to La Jolla and the Silver Strand), as well as the offshore islands area also heavily utilized.

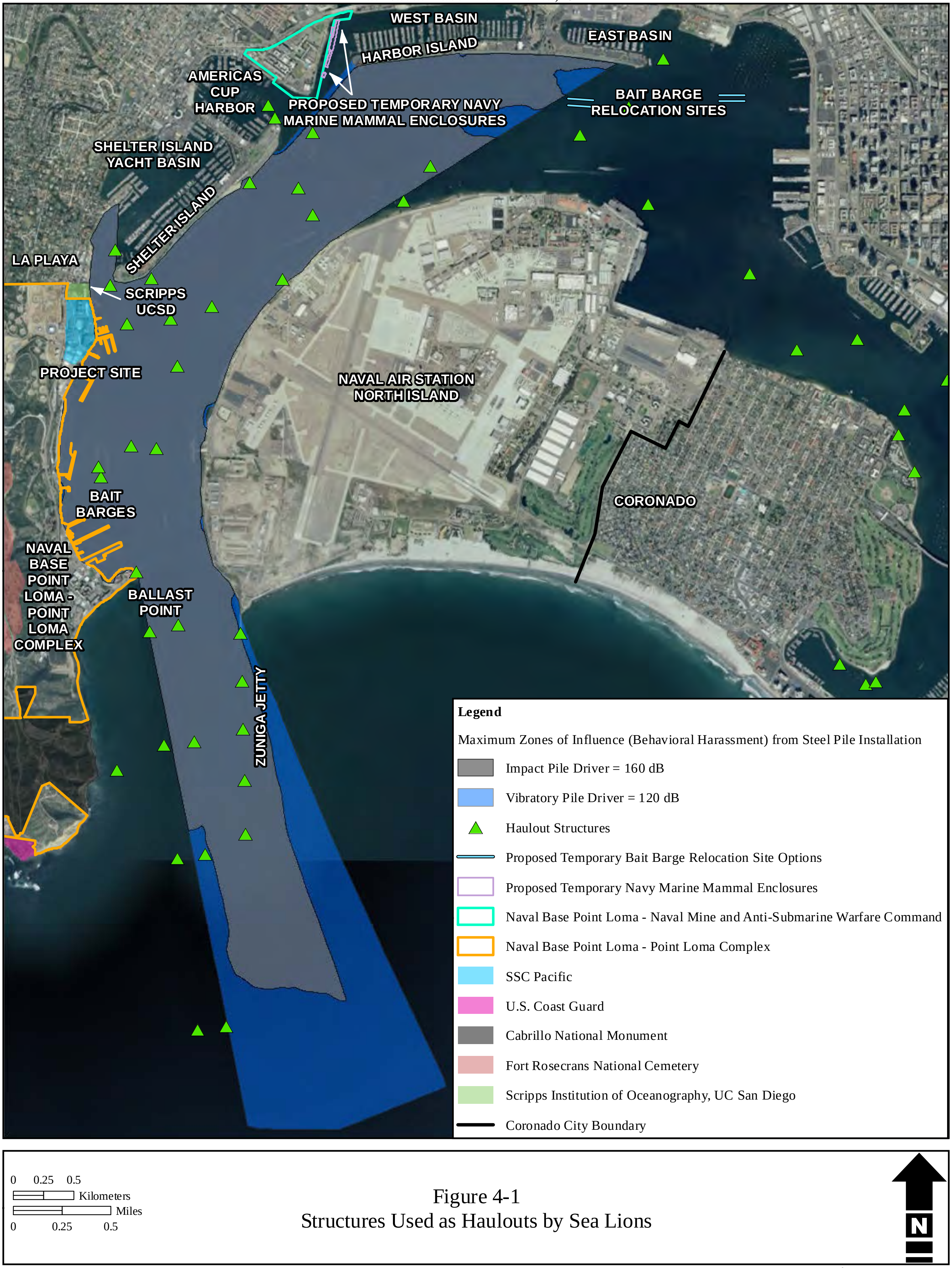



Figure 4-1
Structures Used as Haulouts by Sea Lions

### 4.1.4 Acoustics

On land, California sea lions make incessant, raucous barking sounds; these have most of their energy at less than 2 kHz (Schusterman et al. 1967). Males vary both the number and rhythm of their barks depending on the social context; the barks appear to control the movements and other behavior patterns of nearby conspecifics (Schusterman 1977). Females produce barks, squeals, belches, and growls in the frequency range of 0.25 to 5 kHz, while pups make bleating sounds at 0.25 to 6 kHz. California sea lions produce two types of underwater sounds: clicks (or short-duration sound pulses) and barks (Schusterman et al. 1966, 1967, Schusterman and Baillet 1969), both of which have most of their energy below 4 kHz (Schusterman et al. 1967).

The range of maximal hearing sensitivity underwater is between 1 and 28 kHz (Schusterman et al. 1972). Functional underwater high frequency hearing limits are between 35 and 40 kHz, with peak sensitivities from 15 to 30 kHz (Schusterman et al. 1972). The California sea lion shows relatively poor hearing at frequencies below 1 kHz (Kastak and Schusterman 1998). Peak hearing sensitivities in air are shifted to lower frequencies; the effective upper hearing limit is approximately 36 kHz (Schusterman 1974). The best range of sound detection is from 2 to 16 kHz (Schusterman 1974). Kastak and Schusterman (2002) determined that hearing sensitivity generally worsens with depth—hearing thresholds were lower in shallow water, except at the highest frequency tested (35 kHz), where this trend was reversed. Octave band noise levels of 65 to 70 dB RMS? above the animal's threshold produced an average temporary threshold shift (TTS) of 4.9 dB RMS?in the California sea lion (Kastak et al. 1999). Center frequencies were 1 kHz for corresponding threshold testing at 1 kHz and 2 kHz for threshold testing at 2 kHz; the duration of exposure was 20 min.

## 4.2 Harbor Seal (*Phoca vitulina*), California Stock

### 4.2.1 Population Status

The California Stock of harbor seal is not considered strategic or depleted under the MMPA.

### 4.2.2 Distribution

Harbor seals are considered abundant throughout most of their range from Baja California to the eastern Aleutian Islands. An unknown number of harbor seals also occur along the west coast of Baja California, at least as far south as Isla Asuncion, which is about 100 miles south of Punta Eugenia. Peak numbers of harbor seals haul-out on land during late May to early June, which coincides with the peak of their molt. They favor sandy, cobble, and gravel beaches (Stewart and Yochem 1994), with multiple haul-outs identified along the California mainland and Channel Islands (Carretta et al. 2012).

There are limited at-sea density estimates for pinnipeds within southern California. Harbor seals do not make extensive pelagic migrations, but do travel 300 to 500 km on occasion to find food or suitable breeding areas (Carretta et al. 2012). Based on likely foraging strategies, Grigg et al. (2009) reported seasonal shifts in harbor seal movements based on prey availability. When at sea, they remain in the vicinity of haul-out sites and forage close to shore in shallow waters. In relationship to the entire California stock, harbor seals do not have a significant mainland California distribution south of Point Mugu due to beach urbanization and potential disturbance impacts.

The Navy Marine Species Density Database (Hanser et al. 2012) developed an estimate for all of the waters of the Southern California Range Complex during winter and spring of 0.0202/km$^2$. Within San Diego Bay, harbor seals have recently been documented at two locations near the mouth of the bay; one on the south side of Ballast Point, out of potential ZOIs, and one at Pier 122, where from zero to 4 animals have been reported as present, with most sightings during the spring (Jenkins 2012).

According to Lerma (2012), all the animals observed south of ballast point within the sound shadow have been harbor seals, and harbor seals have not been documented in the water within the ZOI during the 2012 surveys; thus it is unlikely that those animals are actively foraging in or transiting the ZOI on a frequent basis. The haulout area south of ballast is only temporary with overwash of the rocks occurring daily. The primary harbor seal haulouts are in La Jolla. Considering the ZOI represents the shipping channel and heavy vessel traffic and noise, it would seem more likely that the harbor seals move toward Point Loma in preferred foraging habitat than into the ZOI.

Rather than rely on regional density estimates, this IHA application conservatively assumes that, as observed by Jenkins (2012), three harbor seals would be continuously present within the ZOI for up to 30 work days during the winter-spring period when in-water activities would occur.

### 4.2.3 Behavior and Ecology

Harbor seals prefer sheltered coastal waters and feed on schooling benthic and epibenthic fish species in shallow water (Bonnell and Dailey 1993). While not studied in the bay, specific prey species have been studied in other California waters (Stewart and Yokem 1985, 1994; Oxman 1993; Henry et al. 1995). Of particular note to San Diego Bay are these potential prey species: specklefin midshipman, plainfin midshipman, jack mackerel, shiner surfperch, yellowfin goby, and English sole. Harbor seals also eat octopus, of which two species are found in the bay (NAVFAC SW and POSD 2011). Although their ecological niche in the bay has not been studied, this pinniped is not likely to play a significant role because of their low numbers (NAVFAC SW and POSD 2012). Harbor seals mate at sea and females give birth during the spring and summer; although the "pupping season" varies by latitude.

### 4.2.4 Acoustics

In air, harbor seal males produce a variety of low-frequency (<4 kHz) vocalizations, including snorts, grunts, and growls. Male harbor seals produce communication sounds in the frequency range of 100 to 1,000 Hz (Richardson et al. 1995). Pups make individually unique calls for mother recognition that contain multiple harmonics with main energy below 0.35 kHz (Bigg 1981, Thomson and Richardson 1995). Harbor seals hear nearly as well in air as underwater and had lower thresholds than California sea lions (Kastak and Schusterman 1998). Kastak and Schusterman (1998) reported airborne low frequency (100 Hz) sound detection thresholds at 65.4 dB re 20 μPa for harbor seals. In air, they hear frequencies from 0.25 kHz - 30 kHz and are most sensitive from 6 to 16 kHz (Richardson et al. 1995, Terhune and Turnbull 1995, Wolski et al. 2003).

Adult males also produce underwater sounds during the breeding season that typically range from 0.025 to 4 kHz (duration range: 0.1 s to multiple seconds; Hanggi and Schusterman 1994). Hanggi and Schusteman (1994) found that there is individual variation in the dominant frequency range of sounds between different males, and Van Parijs et al. (2003) reported oceanic, regional, population, and site-specific variation that could be vocal dialects. In water, they hear frequencies from 1 to 75 kHz (Southall 2007) and can detect sound levels as weak as 60 to 85 dB re 1 μPa within that band. They are most sensitive at frequencies below 50 kHz; above 60 kHz sensitivity rapidly decreases.

## 4.3 Gray Whale (*Eschrichtius robustus*), Eastern North Pacific Stock

### 4.3.1 Population Status

In 1994, due to steady increases in population abundance, the Eastern North Pacific stock of gray whales was removed from listing under the ESA. This stock is not considered strategic or depleted under the MMPA.

### 4.3.2 Distribution

The Eastern North Pacific population is found from the upper Gulf of California (Tershy and Breese 1991), south to the tip of Baja California, and up the Pacific coast of North America to the Chukchi and Beaufort seas. There is a pronounced seasonal north-south migration. The eastern North Pacific population summers in the shallow waters of the northern Bering Sea, the Chukchi Sea, and the western Beaufort Sea (Rice and Wolman 1971). The northern Gulf of Alaska (near Kodiak Island) is also considered a feeding area; some gray whales occur there year-round (Moore et al. 2007). Some individuals spend the summer feeding along the Pacific coast from southeastern Alaska to central California (Sumich 1984, Calambokidis et al. 1987, 2002). Photo-identification studies indicate that gray whales move widely along the Pacific coast and are often not sighted in the same area each year (Calambokidis et al. 2002). In October and November, the whales begin to migrate southeast through Unimak Pass and follow the shoreline south to breeding grounds on the west coast of Baja California and the southeastern Gulf of California (Braham 1984, Rugh 1984). The average gray whale migrates 4,050 to 5,000 nm (7,500 to 10,000 km) at a rate of 80 nm (147 km) per day (Rugh et al. 2001, Jones and Swartz 2002). Although some calves are born along the coast of California (Shelden et al. 2004), most are born in the shallow, protected waters on the Pacific coast of Baja California from Morro de Santo Domingo (28°N) south to Isla Creciente (24°N) (Urbán- Ramírez et al. 2003). The main calving sites are Laguna Guerrero Negro, Laguna Ojo de Liebre, Laguna San Ignacio, and Estero Soledad (Rice et al. 1981).

Peak abundance of gray whales off the coast of San Diego is January during the southward migration, and in March during the migration north; although females with calves, which depart Mexico later than males or females without calves, can be sighted from March through May or June (Leatherwood 1974; Poole 1984; Rugh et al. 2001; Stevick et al. 2002; Angliss and Outlaw 2008). Gray whales are infrequent migratory transients offshore of San Diego Bay only during cold-water months (Carretta et al. 2000). Migrating gray whales that might infrequently transit the nearshore waters would not be expected to forage, and would likely be present for min to less than one or two hours at typical travel speeds of 3 knots (approximately 3.5 miles per hour) (Perryman et al. 1999, Mate and Urbán-Ramirez 2003).

A mean group size of 2.9 gray whales was reported for both coastal (16 groups) and non-coastal (15 groups) areas around SCI. The largest group reported was nine animals. The largest group reported by U.S. Navy (in 1998) was 27 animals (Carretta et al. 2000). Gray whales are not expected in the project area except during the northward migration, when they are closest to the coast (Rice et al. 1981). Gray whale transitory occurrence near the mouth of San Diego Bay is sporadic and unpredictable, and use of the regional seasonal density estimate of 0.115/km$^2$ for southern California coastal waters (Hanser et al. 2012) is considered unrealistically high for the project area. Jenkins (2012) noted a past occurrence of one gray whale that lingered in the northern part of the bay for two weeks. This circumstance is used to model the occurrence of gray whales in the ZOI, such that for the purposes of this IHA, it is conservatively assumed that one individual would be present in the ZOI during up to 15 days of the northward migration.

### 4.3.3 Behavior and Ecology

Gray whales use their baleen to sift out crustaceans, molluscs, and other invertebrates that they suck from bottom sediments. Bay species of potential benefit to gray whales for food would include medium to large size bivalve molluscs and decapod crustaceans, depending on the spacing between the baleen elements. However, they are unlikely to be feeding in the bay.

Gray whales dive to 160 to 200 ft for 5 to 8 min when foraging. In the breeding lagoons, dives are usually less than 6 min (Jones and Swartz, 2002), although dives as long as 26 min have been recorded (Harvey and Mate 1984). Gray whales may remain submerged near the surface for 7 to 10 min and travel 1600 ft or more before resurfacing to breathe when migrating. The maximum known dive depth is 560 ft (Jones and Swartz 2002). Migrating gray whales sometimes exhibit a unique snorkeling behavior—they surface cautiously, exposing only the area around the blow hole, exhale quietly without a visible blow, and sink silently beneath the surface (Jones and Swartz 2002). Mate and Urbán-Ramirez (2003) noted that 30 of 36 locations for a migratory gray whale with a satellite tag were in water <330 ft deep, with the deeper water locations all in the SCB within the Channel Islands. Whales in that study maintained consistent speed indicating directed movement. There has been only one study yielding a gray whale dive profile, and all information was collected from a single animal that was foraging off the west coast of Vancouver Island (Malcolm and Duffus 2000; Malcolm et al. 1996). They noted that the majority of time was spent near the surface on interventilation dives (<10 ft depth) and near the bottom (extremely nearshore in a protected bay with mean dive depth of 60 ft, range 46-72 ft depth). There was very little time spent in the water column between surface and bottom. Foraging depth on summer feeding grounds is between 160-200 ft (50-60 meters [m]) (Jones and Swartz 2002). Based on this very limited information, the following is a rough estimate of depth distribution for gray whales: 50 percent at <13 ft (surface and interventilation dives) and 50 at 13-59 ft. However, most gray whales would be expected at shallower depths during transit through southern California where foraging does not occur due to migration and limited suitable bottom prey habitat.

### 4.3.4 Acoustics

Au (2000) reviewed the characteristics of gray whale vocalizations. Gray whales produce broadband signals ranging from 100 Hz to 4 kHz (and up to 12 kHz) (Dahleim et al. 1984; Jones and Swartz 2002). The most common sounds on the breeding and feeding grounds are knocks (Jones and Swartz 2002), which are broadband pulses from about 100 Hz to 2 kHz and most energy at 327 to 825 Hz. The source level for knocks is approximately 142 dB re 1µPa at 1 m (Cummings et al. 1968). During migration, individuals most often produce low-frequency moans (Crane and Lashkari 1996). The structure of the gray whale ear is evolved for low-frequency hearing (Ketten 1992). The ability of gray whales to hear frequencies below 2 kHz has been demonstrated in playback studies (Cummings and Thompson 1971; Dalhheim and Ljungblad 1990; Moore and Clark 2002). Gray whale responses to noise include changes in swimming speed and direction to move away from the sound source; abrupt behavioral changes from feeding to avoidance, with a resumption of feeding after exposure; changes in calling rates and call structure; and changes in surface behavior, usually from traveling to milling (e.g., Moore and Clark 2002). Gailey et al. (2007) reported no apparent behavioral disturbance for Western Pacific Gray whales in response to low-frequency seismic survey.

## 4.4 Bottlenose Dolphin (*Tursiops truncatus*), California Coastal Stock

### 4.4.1 Population Status

The California Coastal Stock of bottlenose dolphin is not considered strategic or depleted under the MMPA.

### 4.4.2 Distribution

The bottlenose dolphin California Coastal stock occurs at least from Point Conception south into Mexican waters, at least as far south as San Quintin, Mexico. In southern California, animals are found within 500 m of the shoreline 99 percent of the time and within 250 m 90 percent of the time (Hanson and Defran 1993). Occasionally, during warm-water incursions such as during the 1982–1983 El Niño event, their range extends as far north as Monterey Bay (Wells et al. 1990). Bottlenose dolphins in the Southern California Bight (SCB) – the coastal waters between Point Conception and just south of the Mexican border - appear to be highly mobile within a narrow coastal zone (Defran et al. 1999), and exhibit little seasonal site fidelity to the SCB region (Defran and Weller 1999) and along the California coast; over 80 percent of the dolphins identified in Santa Barbara, Monterey, and Ensenada have also been identified off San Diego (Navy 2010e).

The Navy Marine Species Density Database (Hanser et al. 2012) estimated the density of coastal bottlenose dolphins throughout the waters of the Southern California Range Complex as 0.3612/km$^2$. As seen in the Navy's marine mammal surveys of San Diego Bay (Merkel and Associates 2008; U.S. Pacific Fleet 2009-2012; TDI 2012b), coastal bottlenose dolphins have occurred sporadically and in highly variable numbers and locations. Surveys were conducted along two survey routes through the northern part of the bay during 2007-2008 (Merkel and Associates 2008). These transect surveys were recently repeated with minor modifications to thoroughly cover the northern part of the bay (U.S. Pacific Fleet 2009-2012; TDI 2012b). Following are the results from the seasonal period of proposed in-water construction/demolition:

- 14 February 2007: no sightings
- 28 December 2007: no sightings
- 15 March 2008: 1 sighting, 12 individuals (all in maximum potential ZOI)
- 13 October 2009: no sightings
- 16 February 2010: no sightings
- 10 April 2010: no sightings
- 13 November 2010: 1 sighting, 1 individual (in maximum potential ZOI)
- 21 February 2012: no sightings
- 28 February 2012: 1 sighting, 3 individuals (all in maximum potential ZOI)
- 14 March 2012: 8 sightings, 41 individuals (36 in maximum potential ZOI)
- 21 March 2012: 3 sightings, 6 individuals (all in maximum potential ZOI)

- 27 March 2012: 2 sightings, 8 individuals (all in maximum potential ZOI)
- 28 March 2012: 2 sightings, 40 individuals (all in maximum potential ZOI)

Given extreme variability in the number of coastal bottlenose dolphins sighted in surveys of the project ZOI, the regional density estimate developed in the Navy Marine Species Density Database (Hanser et al. 2012) (0.36/km$^2$) is considered a more reliable indicator of the number of animals likely to be present during construction/demolition activities and has been used in this IHA application.

### 4.4.3 Behavior and Ecology

The coastal stock utilizes a limited number of fish prey species with up to 74 percent being various species of surfperch or croakers, a group of non-migratory year-round coastal inhabitants (Defran et al. 1999, Allen et al. 2006). For southern California, common croaker prey species include spotfin croaker, yellowfin croaker, and California corbina, while common surfperch species include barred surfperch and walleye surfperch (Allen et al. 2006). The corbina and barred surfperch are the most common surf zone fish where bottlenose dolphins have been observed foraging (Allen et al. 2006). Defran et al. (1999) postulated that the coastal stock of bottlenose dolphins showed significant movement within their home range (Central California to Mexico) in search of preferred but patchy concentrations of nearshore prey (i.e., croakers and surfperch). Bearzi et al (2009), in an analysis of coastal bottlenose dolphins in the vicinity of Santa Monica, also concluded that low individual re-sighting rates indicates a large coastal bottlenose dolphin distribution influenced by prey distribution. After finding concentrations of prey, animals may then forage within a more limited spatial extent to take advantage of this local accumulation until such time that prey abundance is reduced; the dolphins then shift location once again to be over larger distances (Defran et al.1999, Bearzi et al. 2009). Specific prey items of bottlenose dolphins along the California coast were studied by Defran et al. (1986). San Diego Bay bottlenose dolphins forage on species such as jack mackerel, Cortez grunt, striped mullet, black croaker, white sea bass, white croaker, spotted croaker, yellowfin croaker, California corbina, queenfish, Pacific mackerel, Pacific bonito, and sierra (NAVFAC SW and POSD 2011).

### 4.4.4 Acoustics

Sounds emitted by bottlenose dolphins have been classified into two broad categories: pulsed sounds (including clicks and burst-pulses) and narrow-band continuous sounds (whistles), which usually are frequency modulated. Whistles range in frequency from 0.8 to 24 kHz but can also go much higher. Clicks and whistles have a dominant frequency range of 110 to 130 kHz and a source level of 218 to 228 dB re 1 μPa at 1 m (peak to peak levels; Au 1993) and 3.5 to 14.5 kHz with a source level of 125 to 173 dB re 1 μPa at 1 m, respectively (Ketten 1998). The bottlenose dolphin has a functional high-frequency hearing limit of 160 kHz (Au 1993) and can hear sounds at frequencies as low as 40 to 125 Hz (Turl 1993). Inner ear anatomy of this species has been described (Ketten 1992). Electrophysiological experiments suggest that the bottlenose dolphin brain has a dual analysis system: one specialized for ultrasonic clicks and the other for lower-frequency sounds, such as whistles (Ridgway 2000). The audiogram of the bottlenose dolphin shows that the lowest thresholds occurred near 50 kHz at a level around 45 dB re 1 μPa (Nachtigall et al. 2000, Finneran and Houser 2006, 2007). Below the maximum sensitivity, thresholds increased continuously up to a level of 137 dB re 1 μPa at 75 Hz. Above 50 kHz, thresholds increased slowly up to a level of 55 dB re 1 μPa at 100 kHz, then increased rapidly above this to about 135 dB re 1 μPa at 150 kHz. Scientists have reported a range of best sensitivity between 25 and 70 kHz, with peaks in sensitivity occurring at 25 and 50 kHz at levels of 47 and 46 dB re 1 µPa (Nachtigall et al. 2000).

Temporary threshold shifts (TTS) in hearing have been experimentally induced and behavioral responses observed in captive bottlenose dolphins (Ridgway et al. 1997, Schlundt et al. 2000, 2006, Nachtigall et al. 2003, Finneran et al. 2002, 2005, 2007). Ridgway et al. (1997) observed changes in behavior at the following minimum levels for 1 second tones: 186 dB re 1 µPa at 3 kHz, 181 dB re 1 µPa at 20 kHz, and 178 dB re 1 µPa at 75 kHz. TTS levels were 194 to 201 dB re 1 µPa at 3 kHz, 193 to 196 dB re 1 µPa at 20 kHz, and 192 to 194 dB re 1 µPa at 75 kHz. Schlundt et al. (2000) exposed bottlenose dolphins to intense tones (0.4, 3, 10, 20, and 75 kHz); the animals demonstrated altered behavior at source levels of 178 to 193 dB re 1 µPa, with TTS after exposures between 192 and 201 dB re 1 µPa at 1 m (though one dolphin exhibited TTS after exposure at 182 dB re 1 µPa). Nachtigall et al. (2003) determined threshold for a 7.5 kHz pure tone stimulus. No shifts were observed at 165 or 171 dB re 1 µPa, but when the sound level reached 179 dB re 1 µPa, the animal showed the first sign of TTS. Recovery apparently occurred rapidly, with full recovery apparently within 45 min following sound exposure. TTS measured between 8 and 16 kHz (negligible or absent at higher frequencies) after 30 min of sound exposure (4 to 11 kHz) at 160 dB re 1 µPa (Nachtigall et al. 2004).

# 5 HARASSMENT AUTHORIZATION REQUESTED

*The type of incidental taking authorization that is being requested (i.e., takes by harassment only, takes by harassment, injury and/or death), and the method of incidental taking.*

Except with respect to certain activities not pertinent here, the MMPA defines ''harassment'' as: any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment] (50 CFR, Part 216, Subpart A, Section 216.3-Definitions). Level A, an authorization for which is not requested herein, is the more severe form of harassment because it may result in injury, whereas Level B only results in disturbance without the potential for injury.

Under Section 101 (a)(5)(D) of the MMPA, the Navy requests an IHA for the take of small numbers of marine mammals, by Level B behavioral harassment only, incidental to the replacement of the Fuel Pier at NBPL. The Navy requests an IHA for incidental take of marine mammals described within this application for one year commencing on September 30, 2013 (or the issuance date, whichever is later). Given that the project will not be completed until 2016, the need for multiple IHAs is anticipated.

## 5.1 Take Authorization Request

The exposure assessment methodology taken in this IHA application attempts to quantify potential exposures to marine mammals resulting from demolition of the existing pier and pile driving as necessary to construct the new pier. Section 6 presents a detailed description of the acoustic exposure assessment methodology. Results from this approach tend to provide an overestimation of exposures because all animals are assumed to be available to be exposed 100% of the time. Recognizing the complexity of the shoreline and bathymetry in the project area, the Navy collaborated with researchers at the University of Washington, to develop a realistic, site-specific model of transmission loss from underwater acoustic sources at the project site. The model is described in Appendix A. The transmission loss model was combined with the expected source levels (discussed in Section 6.4.2) to map dB RMS contours emanating from a source location at the approximate center of the new pier. Marine mammal occurrence data were then overlaid on the acoustic contour map for the largest ZOI to determine the average number of individuals present, based on the 13 surveys that were conducted during the maximum potential work window for pile driving from September – April. Dividing the average number of animals by the area of the largest ZOI yields an average density for the study area. Multiplying that average density by activity-specific ZOI gives the number of animals exposed per day of the activity to levels of sound that could result in harassment under the MMPA. Multiplying the daily exposure rate by the number of days of pile driving yields the total estimated harassments for that type of activity. It is noteworthy that the site-specific model for this project is somewhat more conservative (i.e. results in a lower loss rate) than the practical spreading loss equation which is typically used to model underwater sound transmission loss during pile driving.

The analysis for the Fuel Pier Replacement Project predicts up to 1,406 exposures (see Section 6 for estimates of exposures by species and installation type) from pile installation and removal activities during the first period of in-water construction and demolition activities that could be classified as Level B harassment as defined under MMPA. The Navy's mitigation procedures, presented in Section 11, include monitoring of mitigation zones prior to the initiation of pile driving and underwater acoustic recordings for which results are available in real-time or nearly so. These mitigation measures provide assurance that no marine mammals would be exposed to sound levels that could cause Level A harassment.

## 5.2 Method of Incidental Taking

Construction activities associated with the Fuel Pier Replacement Project as outlined in Sections 1 and 2 have the potential to disturb or displace small numbers of marine mammals. Specifically, only underwater sounds generated from pile installation and removal activities (impact/vibratory pile driving and pneumatic chipping) may result in "take" in the form of Level B harassment (behavioral disturbance). Level B harassment is not anticipated from airborne sounds generated during pile installation or removal, or during other non-pile driving construction activities. Level A harassment is not anticipated to result from any of the construction activities, and monitoring measures will be implemented to minimize the possibility of injury to marine mammals. Specifically, vibratory hammers will be the primary method of installation, which are not expected to cause injury to marine mammals due to the relatively low source levels (≤180 dB rms) and the continuous as opposed to impulsive nature of the sound. Also, pile driving will either not start or be halted if marine mammals approach the shutdown zone defined as the distance at which Level A harassment is possible. See Section 11 for more details on the impact reduction and mitigation measures proposed. Furthermore, the pile driving activities analyzed are similar to other construction activities within Washington State and California which have taken place with no reported injuries or mortality to marine mammals (e.g., CALTRANS 2010; NAVFAC 2012). Table 5-1 below lists the numbers of takes requested for the marine mammal species in the project area for the Y.

**Table 5-1. Number of Takes Requested per Species (Level B Harassments)**

| *Species* | *Number of Level B Takes Requested* |
|---|---|
| California sea lion | 994 |
| Harbor seal | 90 |
| Gray whale | 15 |
| Coastal bottlenose dolphin | 307 |
| ***Total*** | ***1,406*** |

# 6 NUMBERS AND SPECIES EXPOSED

*By age, sex, and reproductive condition (if possible), the number of marine mammals (by species) that may be taken by each type of taking identified in [Section 5], and the number of times such takings by each type of taking are likely to occur.*

## 6.1 Introduction

The NMFS application for an IHA requires applicants to determine the number of marine mammals that are expected to be incidentally harassed by an action and the nature of the harassment (Level A or Level B). Section 5 defines MMPA Level A and Level B and Section 6 below presents how these definitions were relied on to develop the quantitative acoustic analysis methodologies used to assess the potential for the Proposed Action to affect marine mammals.

The project construction and operation as outlined in Sections 1 and 2 have the potential to take marine mammals by harassment only, primarily through construction activities involving in-water pile driving and extraction. Other activities are not expected to result in take as defined under the MMPA. Underwater noise from dredging is similar to that of ships (Theobald et al. 2011), and given the volume of ship traffic in the area, is not expected to cause adverse behavioral effects to marine mammals in the vicinity. Airborne noise associated with topside demolition and construction activity is not expected reach thresholds at which pinnipeds could be affected beyond the immediate area of the pier, where no marine mammals would occur.

In-water pile driving and extraction would temporarily increase the local underwater and airborne noise environment in the project area. Research suggests that increased noise may impact marine mammals in several ways and depends on many factors. This will be discussed in more detail in Section 7. The following text provides a background on underwater sound, description of noise sources in the project area, applicable noise criteria, and the basis for the calculation of take by Level B harassment. Level A harassment of cetaceans and pinnipeds for this project is not expected to occur because the area of potential Level A harassment is small, marine mammals are not expected to approach within this distance, and if they did, monitoring as described later in this application would ensure curtailment of the activity. Therefore, Level A harassment is not discussed in this application.

## 6.2 Fundamentals of Sound

Sound is a physical phenomenon consisting of regular pressure oscillations that travel through a medium, such as air or water. Sound frequency is the rate of oscillation, measured in cycles per second or Hertz (Hz). The amplitude (loudness) of a sound is its pressure, whereas its intensity is proportional to power and is pressure squared. The standard international unit of measurement for pressure is the Pascal, which is a force of 1 Newton exerted over an area of 1 square meter; sound pressures are measured in microPascals (µPa).

Due to the wide range of pressure and intensity encountered during measurements of sound, a logarithmic scale is used, based on the decibel (dB), which, for sound intensity, is 10 times the $\log_{10}$ of the ratio of the measurement to reference value. For sound pressure level (SPL), the amplitude ratio in dB is 20 times the $\log_{10}$ ratio of measurement to reference. Hence each increase of 20 dB in SPL reflects a 10-fold increase in signal amplitude (whether expressed in terms of pressure or particle motion). That is, 20 dB means 10 times the amplitude, 40 dB means 100 times the amplitude, 60 dB means 1,000 times the amplitude, and so on. Because the dB is a relative measure, any value expressed in dB is meaningless without an accompanying reference. In describing underwater sound pressure, the reference amplitude is usually 1 µPa, and is expressed as "dB re 1 µPa." For in-air sound pressure, the reference amplitude is usually 20 µPa and is expressed as "dB re 20 µPa."

The method commonly used to quantify airborne sounds consists of evaluating all frequencies of a sound according to a weighted filter that mimics human sensitivity to amplitude as a function of frequency. This is called A-weighting and the decibel level measured is called the A-weighted sound level (dBA). Methods of frequency weighting that reflect the hearing of marine mammals have been proposed (Southall et al. 2007; Finneran and Jenkins 2012) and are being used in new analyses of Navy testing and training effects, but have not been adopted for pile driving and other non-explosive impulsive sounds (Marine Species Modeling Team 2012). Therefore, underwater sound levels are not weighted and measure the entire frequency range of interest. In the case of marine construction work, the frequency range of interest is 20 Hz to 20 kHz.

Table 6-1 summarizes commonly used terms to describe underwater sounds. Two common descriptors are the instantaneous peak SPL and the root mean square (rms) SPL. The peak pressure is the instantaneous maximum or minimum overpressure observed during each pulse or sound event and is presented in dB re 1 µPa. The rms level is the square root of the mean of the squared pressure (= intensity) level as measured over a specified time period. All underwater sound levels throughout the remainder of this application are presented in dB re 1 µPa unless otherwise noted.

**Table 6-1. Definitions of Acoustical Terms**

| *Term* | *Definition* |
|---|---|
| Decibel, dB | A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for water is 1 microPascal (µPa) and for air is 20 µPa (approximate threshold of human audibility). |
| Sound Pressure Level, SPL | Sound pressure is the force per unit area, usually expressed in microPascals where 1 Pascal equals 1 Newton exerted over an area of 1 square meter. The SPL is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressure exerted by the sound to a reference sound pressure. SPL is the quantity that is directly measured by a sound level meter. |
| Frequency, Hz | Frequency is expressed in terms of oscillations, or cycles, per second. Cycles per second are commonly referred to as hertz (Hz). Typical human hearing ranges from 20 Hz to 20 kHz. |
| Peak Sound Pressure, dB re 1 µPa | Peak SPL is based on the largest absolute value of the instantaneous sound pressure over the frequency range from 20 Hz to 20 kHz. This pressure is expressed in this application as dB re 1 µPa. |
| Root-Mean-Square (rms), dB re 1µPa | The rms level is the square root of the mean of the squared pressure level(s) as measured over a specified time period. For pulses, the rms has been defined as the average of the squared pressures over the time that comprise that portion of waveform containing 90 % of the sound energy for one impact pile driving impulse. |

| *Term* | *Definition* |
|---|---|
| Sound Exposure Level (SEL), dB re 1 µPa2 sec | Sound exposure level is a measure of energy. Specifically, it is the dB level of the time integral of the squared-instantaneous sound pressure, normalized to a 1-sec period. It can be an extremely useful metric for assessing cumulative exposure because it enables sounds of differing duration, to be compared in terms of total energy. |
| Waveforms, µPa over time | A graphical plot illustrating the time history of positive and negative sound pressure of individual pile strikes shown as a plot of µPa over time (i.e., seconds). |
| Frequency Spectrum, dB over frequency range | The amplitude of sound at various frequencies, usually shown as a graphical plot of the mean square pressure per unit frequency ($\mu Pa^2/Hz$) over a frequency range (e.g., 10 Hz to 10 kHz in this application). |
| A-Weighting Sound Level, dBA | The SPL in decibels as measured on a sound level meter using the A- or C-weighting filter network. The A-weighting filter de-emphasizes the low and high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective human reactions to noise. |
| Ambient Noise Level | The background sound level, which is a composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location. |

## 6.3 Effects of Pile Installation and Removal Activities

### 6.3.1 Description of Noise Sources

Underwater sound levels are comprised of multiple sources, including physical noise, biological noise, and anthropogenic noise. Physical noise includes waves at the surface, earthquakes, ice, and atmospheric noise. Biological noise includes sounds produced by marine mammals, fish, and invertebrates. Anthropogenic noise consists of vessels (small and large), dredging, aircraft overflights, and construction noise. Known noise levels and frequency ranges associated with anthropogenic sources similar to those that would be used for this project are summarized in Table 6-2. Details of each of the sources are described in the following text.

**Table 6-2. Representative Noise Levels of Anthropogenic Sources**

| *Noise Source* | *Frequency Range (Hz)*[1] | *Underwater Noise Level (dB re 1 µPa)* | *Reference* |
|---|---|---|---|
| Small vessels | 250 – 1,000 | 151 dB rms at 1 meter (m) | Richardson et al. 1995 |
| Tug docking gravel barge | 200 – 1,000 | 149 dB rms at 100 m | Blackwell and Greene 2002 |
| Vibratory driving of 72-in Steel Pipe pile | 10 – 1,500 | 180 dB rms at 10m | CALTRANS 2007 |
| Impact driving of 36-in Steel Pipe pile | 10 – 1,500 | 195 dB rms at 10m | WSDOT 2007 |
| Impact driving of 66-in Cast in Steel Shells (CISS) piles | 100 – 1,500 | 195 dB rms at 10 m | Reviewed in Hastings and Popper 2005 |

[1]These are the dominant frequency ranges but there is often considerable energy outside these ranges.

In-water construction activities associated with the Project would include impact pile driving and vibratory pile driving. The sounds produced by these activities fall into one of two sound types: pulsed and non-pulsed (defined below). Impact pile driving produces pulsed sounds, while vibratory pile driving produce non-pulsed (or continuous) sounds. The distinction between these two general sound types is important because they have differing potential to cause physical effects, particularly with regard to hearing (e.g., Ward 1997 as cited in Southall et al. 2007).

Pulsed sounds (e.g., explosions, gunshots, sonic booms, seismic airgun pulses, and impact pile driving) are brief, broadband, atonal transients (American National Standards Institute 1986; Harris 1998) and occur either as isolated events or repeated in some succession (Southall et al. 2007). Pulsed sounds are all characterized by a relatively rapid rise from ambient pressure to a maximal pressure value followed by a decay period that may include a period of diminishing, oscillating maximal and minimal pressures (Southall et al. 2007). Pulsed sounds generally have an increased capacity to induce physical injury as compared with sounds that lack these features (Southall et al. 2007).

Non-pulse (intermittent or continuous sounds) can be tonal, broadband, or both (Southall et al. 2007). Some of these non-pulse sounds can be transient signals of short duration but without the essential properties of pulses (e.g., rapid rise time) (Southall et al. 2007). Examples of non-pulse sounds include vessels, aircraft, machinery operations such as drilling or dredging, vibratory pile driving, and active sonar systems (Southall et al. 2007). The duration of such sounds, as received at a distance, can be greatly extended in highly reverberant environments (Southall et al. 2007).

### 6.3.2 Sound Exposure Criteria and Thresholds

Under the MMPA, NMFS has defined levels of harassment for marine mammals. Level A harassment is defined as "Any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild." Level B harassment is defined as "Any act of pursuit, torment, or annoyance which has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including but not limited to migration, breathing, nursing, breeding, feeding or sheltering."

Since 1997, NMFS has used generic sound exposure thresholds to determine when an activity in the ocean that produces sound might result in impacts to a marine mammal such that a take by harassment might occur (NMFS 2005). Recent studies of pile driving used to construct offshore wind turbines have validated the distances over which underwater sound from pile driving may exceed NMFS thresholds (Bailey et al. 2010), as well as behavioral responses of harbor porpoises (*Phocoena phocoena*) to intense sound from pile driving (Brandt et al. 2011; Thompson et al. 2010). Current NMFS practice regarding exposure of marine mammals to high level sounds is that cetaceans and pinnipeds exposed to impulsive sounds of 180 and 190 dB rms or above, respectively, are considered to have been taken by Level A (injurious) harassment.

Level A harassment is assumed to result in a "stress response." The stress response per se is not considered injury, but refers to an increase in energetic expenditure that results from exposure to the stressor and which is predominantly characterized by either the stimulation of the sympathetic nervous system or the hypothalamic-pituitary-adrenal axis (Reeder and Kramer 2005). The presence and magnitude of a stress response in an animal depends on the animal's life history stage, environmental conditions, reproductive state, and experience with the stressor (Navy 2010e).

Behavioral harassment (Level B) is considered to have occurred when marine mammals are exposed to sounds at or above 160 dB rms for impulse sounds (*e.g.*, impact pile driving) and 120 dB rms for continuous noise (*e.g.*, vibratory pile driving), but below injurious thresholds. Behavioral harassment may or may not result in a stress response. The criteria for vibratory pile driving would also be applicable to vibratory pile extraction or the use of a pneumatic chipper. The application of the 120 dB rms threshold can sometimes be problematic because this threshold level can be either at or below the ambient noise level of certain locations. As a result, these levels are considered precautionary (NMFS 2009, 74 FR 41684). NMFS is developing new science-based thresholds to improve and replace the current generic exposure level thresholds, but the criteria have not been finalized (Southall et al. 2007). The current Level A (injury) and Level B (disturbance) thresholds are provided in Table 6-3.

**Table 6-3. Injury and Disturbance Thresholds for Underwater and Airborne Sounds**

| *Marine Mammals* | *Airborne Marine Construction Criteria (Impact and Vibratory Pile Driving) (re 20 µPa)* | *Underwater Vibratory Pile Driving Criteria (e.g., non-pulsed/continuous sounds) (re 1 µPa)* | | *Underwater Impact Pile Driving Criteria (e.g., pulsed sounds) (re 1 µPa)* | |
|---|---|---|---|---|---|
| | *Disturbance Guideline Threshold (Haulout)[1]* | *Level A Injury Threshold* | *Level B Disturbance Threshold* | *Level A Injury Threshold* | *Level B Disturbance Threshold* |
| *Cetaceans (whales, dolphins, porpoises)* | *N/A* | *180 dB rms* | *120 dB rms* | *180 dB rms* | *160 dB rms* |
| *Pinnipeds (seals, sea lions, walrus; except harbor seal)* | *100 dB rms (unweighted)* | *190 dB rms* | *120 dB rms* | *190 dB rms* | *160 dB rms* |
| *Harbor seal* | *90 dB rms (unweighted)* | *190 dB rms* | *120 dB rms* | *190 dB rms* | *160 dB rms* |

[1] Sound level at which pinniped haulout disturbance has been documented. Not an official threshold, but used as a guideline.
N/A = not applicable

### 6.3.3 Limitations of Existing Noise Criteria

To date, there is no research or data supporting a response by pinnipeds or odontocetes to continuous sounds from vibratory pile driving as low as the 120 dB rms threshold. The 120 dB rms threshold level for continuous noise originated from research conducted by Malme et al. (1984, 1986) for California gray whale response to continuous industrial sounds such as drilling operations. The 120 dB rms continuous sound threshold should not be confused with the 120 dB rms pulsed sound criterion established for migrating bowhead whales in the Arctic as a result of research in the Beaufort Sea (Richardson et al. 1995; Miller et al. 1999). Southall et al. (2007) reviewed studies conducted to document behavioral responses of harbor seals and northern elephant seals to continuous sounds under various conditions, and concluded that those limited studies suggest that exposures between 90 dB and 140 dB re 1 µPa rms generally do not appear to induce strong behavioral responses.

### 6.3.4 Ambient Noise

Ambient noise by definition is background noise and it has no single source or point. Ambient noise varies with location, season, time of day, and frequency. Ambient noise is continuous, but with much variability on time scales ranging from less than one second to one year (Richardson et al. 1995). Ambient underwater noise in San Diego Bay is highly variable over time, largely because of anthropogenic sources that include vessel engines and cranes, generators, and other types of mechanized equipment on piers and wharves or the adjacent shoreline (Urick 1983).

In the project area, extensive measurements were made of underwater noise levels during April-May of 2012 (Figure 2-3; Appendix B). Median values were predominantly in the range of 120-130 dB re 1µPa, with substantially higher maximum rms and peak SPL readings (in excess of 150 dB re 1µPa) due to passing ships. From section 2.3.5, given there are about 225 commercial ship transits per day, most during daylight hours, plus an unknown but potentially equal number of recreational vessels moving in and out of San Diego Bay, underwater noise from passing ships is expected every few minutes in the North Bay. This pattern is expected to continue through the period of demolition and construction activities.

The ambient sound data for the project area suggest that with increasing distance from the project site, particularly for vibratory pile driving, as received sound levels drop below approximately 140 dB re 1µPa rms (refer to Section 2.3.4), project sound would become undetectable with regards to potential monitoring and verification of sound levels, and that it would not be perceived by marine mammals as louder or significantly different than regularly occurring background noise due to vessels. As such it would be unlikely to elicit biologically significant behavioral reactions.

## 6.4 Distance to Sound Thresholds

### 6.4.1 Underwater Sound Propagation Formula

Pile driving and vibratory pile extraction would generate underwater noise that potentially could result in disturbance to marine mammals swimming by the Project Area. Transmission loss (TL) underwater is the decrease in sound intensity due to sound spreading and chemistry- and viscosity-based absorption as an acoustic pressure wave propagates out from a source. TL parameters vary with frequency, temperature, sea conditions, current, source and receiver depth, water depth, water chemistry, and bottom composition and topography. The general formula for transmission loss is:

$$TL = B * \log_{10}(R) + C * R, \text{ where}$$

B = logarithmic (predominantly spreading) loss

C = linear (scattering and absorption) loss

R = ratio of receiver distance to source reference distance (usually 1m or 10m)

The C term is strongly dependent on frequency, temperature, and depth, but is conservatively assumed to equal zero for pile driving. The B term has a value of 10 for cylindrical spreading and 20 for spherical spreading. A practical spreading value of 15 is often used in shallow water conditions where spreading may start out spherically but then end up cylindrically as the sound in constrained by the surface and the bottom. For this application, however, a site-specific model was developed for TL from pile driving at a central point at the project site (Appendix A). The model is based on historical temperature-salinity data and location-dependent bathymetry. In the model, TL is the same for different sound source levels and is applied to each of the different activities to determine the point at which the applicable thresholds are reached as a function of distance from the source. The model's predictions result in a slightly lower average rate of TL than practical spreading, and hence are conservative. For pile driving at the Navy Marine

Mammal Program relocation site (NMAWC), no site-specific modeling was conducted, and practical spreading loss is assumed.

### 6.4.2 Underwater Noise from Pile Driving and Extraction

The intensity of pile driving or sounds is greatly influenced by factors such as the type of piles, hammers, and the physical environment in which the activity takes place. A large quantity of literature regarding SPLs recorded from pile driving projects is available for consideration. In order to determine reasonable SPLs and their associated effects on marine mammals that are likely to result from pile driving at NBPL, studies with similar properties to the proposed action were evaluated. Piles to be installed include 36- and 48-in steel pipes, 24- and 18-in concrete piles, and 16-in fiberglass-concrete piles. In addition, a vibratory pile driver could be used in the extraction of 16-in steel, 14- 16- and 24-in concrete, 13-in plastic, and 12-in timber piles.

Table 6-4 details representative pile driving activities that have occurred in recent years. Due to the similarity of these actions and the Navy's proposed action in terms of pile size and type, installation method, and water depth, as well as substrate and expected sound speed, they represent reasonable SPLs which could be anticipated.

**Table 6-4. Underwater Sound Pressure Levels from Similar *in-situ* Monitored Construction Activities**

| *Project and Location* | *Pile Size andType* | *Installation Method* | *Water Depth* | *Measured Sound Pressure Levels* |
|---|---|---|---|---|
| Mukilteo Test Piles, WA[1] | 36-in Steel Pipe | Impact | 7.3 m (24 ft) | 195 dB re 1 μPa (rms) at 10 m |
| Richmond-San Rafael Bridge, CA[2] | 66-in CISS Pile | Impact | 4.0 m (13.1 ft) | 195 dB re 1 μPa (rms) at 10 m |
| Richmond Inner Harbor, CA[2] | 72-in Steel Pipe Pile | Vibratory | ~5 m (16.4 ft) | 180 dB re 1 μPa (rms) at 10 m |
| San Francisco Bay, CA[2] | 24-in Concrete | Impact | 10-15 m (33-50 ft) | 176 dB re 1 μPa (rms) at 10 m |
| San Francisco Bay, CA[2] | 16-in Concrete | Impact | 10 m (33 ft) | 173 dB re 1 μPa (rms) at 10 m |
| Columbia River Crossing, WA[3] | 24- and 48-in Steel Pipe Piles | Vibratory extraction | 10 m (33 ft) | 172 dB re 1 μPa (rms) at 10 m |

Sources: [1]WSDOT 2007; [2]CALTRANS 2009; [3]WSDOT 2012.

Underwater sound levels from pile driving for this project are assumed to be as follows:

- For 36- and 48-in steel pipes, 195 dB re 1 μPa (rms) at 10 m when driven by impact hammer, 180 dB re 1 μPa (rms) at 10 m when driven by vibratory hammer;
- For 24-in concrete piles driven by impact hammer, 176 dB re 1 μPa (rms) at 10 m; and
- For 16- and 18-in concrete piles driven by impact hammer, 173 dB re 1 μPa (rms) at 10 m.

As noted by NMFS (2010), there is a paucity of data on airborne and underwater noise levels associated with vibratory hammer extraction. However, it can reasonably be assumed that vibratory extraction emits SPLs that are no higher than SPLs caused by vibratory hammering of the same materials, and results in lower SPLs than caused by impact hammering comparable piles (NMFS 2010). The only available data regarding underwater sound from vibratory pile extraction are from the Columbia River Crossing Test Pile Project in Washington state (WSDOT 2012). In that project, underwater sound from vibratory extraction of several 24- and 48-in diameter steel pipes was found to range from 167 to 176 dB, averaging 172 dB re 1 μPa (rms) at 10 m. Because pile driving and extraction are less noisy for concrete than steel piles

(CALTRANS 2009), this is almost certainly greater than what would occur at the project site during removal of the existing pier structure, except possibly for the 16-in concrete-filled steel pipes. For vibratory extraction of concrete piles up to 24-in diameter, as well as the 12-in timber piles, a reduction of 10-20 dB from the sound produced by an impact driver can reasonably be assumed (CALTRANS 2009). Accordingly, for this IHA application we have assumed that vibratory extraction of concrete, wood, or plastic piles would generate sound levels of up to 160 dB re 1 µPa (rms) at 10 m. This approach is consistent with NMFS' recent evaluation of a pier demolition project (NMFS 2010) and is likely to overestimate the potential for MMPA harassment during pier demolition.

There is scant information on underwater sound produced by pneumatic chippers or underwater cutting tools. The only data cited in recent IHA and LOA applications (http://www.nmfs.noaa.gov/pr/permits/incidental.htm) were combined from a variety of diver tools, including jackhammers, drills, grinders, bolt guns, and hydraulic wrenches, showing peak source levels of up to 200 dB re 1µPa at 1 m and averaged levels of up to 161 dB re 1µPa at 1 m (Nedwell and Howell 2004). The averaged source levels would equate to approximately 141 dB re 1µPa at 10 m (assuming spherical spreading loss), but given the variability and uncertain applicability of these measurements to the proposed action, we have conservatively assumed that the pneumatic chipper could have up to the same sound source levels as vibratory extraction, i.e. 160 dB re 1µPa at 10 m, which equates to approximately 180 dB re 1µPa at 1 m.

Table 6-5 provides the calculated areas of ZOIs associated with different types of pile driving and extraction. It should be noted that the ZOIs for level A harassment would be closely monitored and subject to shutdowns if a marine mammal approaches the area. These calculations are based on the site-specific modeling of transmission loss at the project site, and practical spreading loss at the Marine Mammal Program relocation site. Predicted sound "contours" emanating from different sources are shown in Figures 6-1 through 6-7. The figures reflect the conventional assumption that the natural or manmade shoreline acts as a barrier to underwater sound. Although it is known that there can be leakage or diffraction around such barriers, the prediction of resulting sound levels remains in the research modeling world, and it is generally accepted practice to model underwater sound propagation from pile driving as continuing in a straight line past a shoreline projection such as Ballast Point (Dahl 2012). Although the influence of Zuniga Jetty was not modeled, it is reasonable to assume that project sound would not propagate east of the jetty (Dahl 2012). Hence the projection of sound through the mouth of the bay into the open ocean would be truncated along the jetty and narrower in reality than shown. The limits of ensonification due to the project are assumed to be essentially the same for different pile sizes subject to vibratory installation or removal (Figures 6-2, 6-6, 6-7).

The combined sound levels associated with simultaneous pile driving for both the Fuel Pier Replacement and the Scripps UCSD Pier repair project have also been considered. The Scripps Pier project requires impact driving of concrete piles, with an assumed sound source level of 175 dB re 1µPa (rms) at 10 m. The combined sound levels occurring if the 36- to 48-in steel piles needed for the Fuel Pier were being hammered at the same time are shown overlaid on the sound levels from the steel piles alone in Figure 6-8. As the figure shows, there is no added effect. This is because the sound from steel pile driving drowns out the lesser sound generated by concrete pile driving.

## Table 6-5. Calculated Areas of ZOIs and Maximum Distances Corresponding to MMPA Thresholds

| Description | Figure | Source Level, dB @ 10m | Area of ZOI ($km^2$) and Maximum Distance (m) | | | | |
|---|---|---|---|---|---|---|---|
| | | | Pinniped Level A – 190 dB[1] | Dolphin Level A – 180 dB[1] | Impact Level B – 160 dB[1] | Vibratory Level A – 180 dB[1,2] | Vibratory Level B – 120 dB[1] |
| Impact driving steel piles | 6-1 | 195 | 0.0034, 36 | 0.1477, 452 | 8.5069, 5,484 | N/A | N/A |
| Vibratory driving steel piles | 6-2 | 180 | N/A | N/A | N/A | 0.0004, 14 | 11.4895, 6,470 |
| Impact driving 24-in concrete piles | 6-3 | 176 | N/A | N/A | 0.1914. 505 | N/A | N/A |
| Impact driving 16-in concrete-fiberglass piles | 6-4 | 173 | N/A | N/A | 0.0834, 259 | N/A | N/A |
| Impact driving 18-in concrete piles | 6-5 | 173 | N/A | N/A | 0.0620, 74 | N/A | N/A |
| Vibratory extraction – steel piles | 6-6 | 172 | N/A | N/A | N/A | 0 | 11.4895, 6,467 |
| Vibratory extraction – non-steel piles[3] | 6-7 | 160 | N/A | N/A | N/A | 0 | 11.4890, 6,467 |

[1]All sound levels expressed in dB re 1 µPa rms; N/A = not applicable.[2]The vibratory driving steel pile Level A ZOI for pinnipeds (190 dB) is less than 3 m from the source (<0.0001 $km^2$). [3]Including use of a pneumatic chipper.


Figure 6-1
Underwater Sound from Impact Pile Driving,
36-48 " Steel Piles (Source = 195 dB rms)


0 0.25 0.5 Kilometers
0 0.25 0.5 Miles

Figure 6-2
Underwater Sound from Vibratory Pile Driving, 36-48" Steel Piles
(Source = 180 dB rms)

N


0 0.25 0.5 Kilometers
0 0.25 0.5 Miles

Figure 6-3
Underwater Sound from Impact Pile Driving,
24" Concrete Piles (Source = 176 dB rms)

N


Figure 6-4
Underwater Sound from Impact Pile Driving,
16" Fiberglass-Concrete Piles (Source = 173 dB rms)


Figure 6-5
Underwater Sound from Impact Pile Driving at Marine Mammal Relocation Site, 18" Concrete Piles (Source = 173 dB rms)

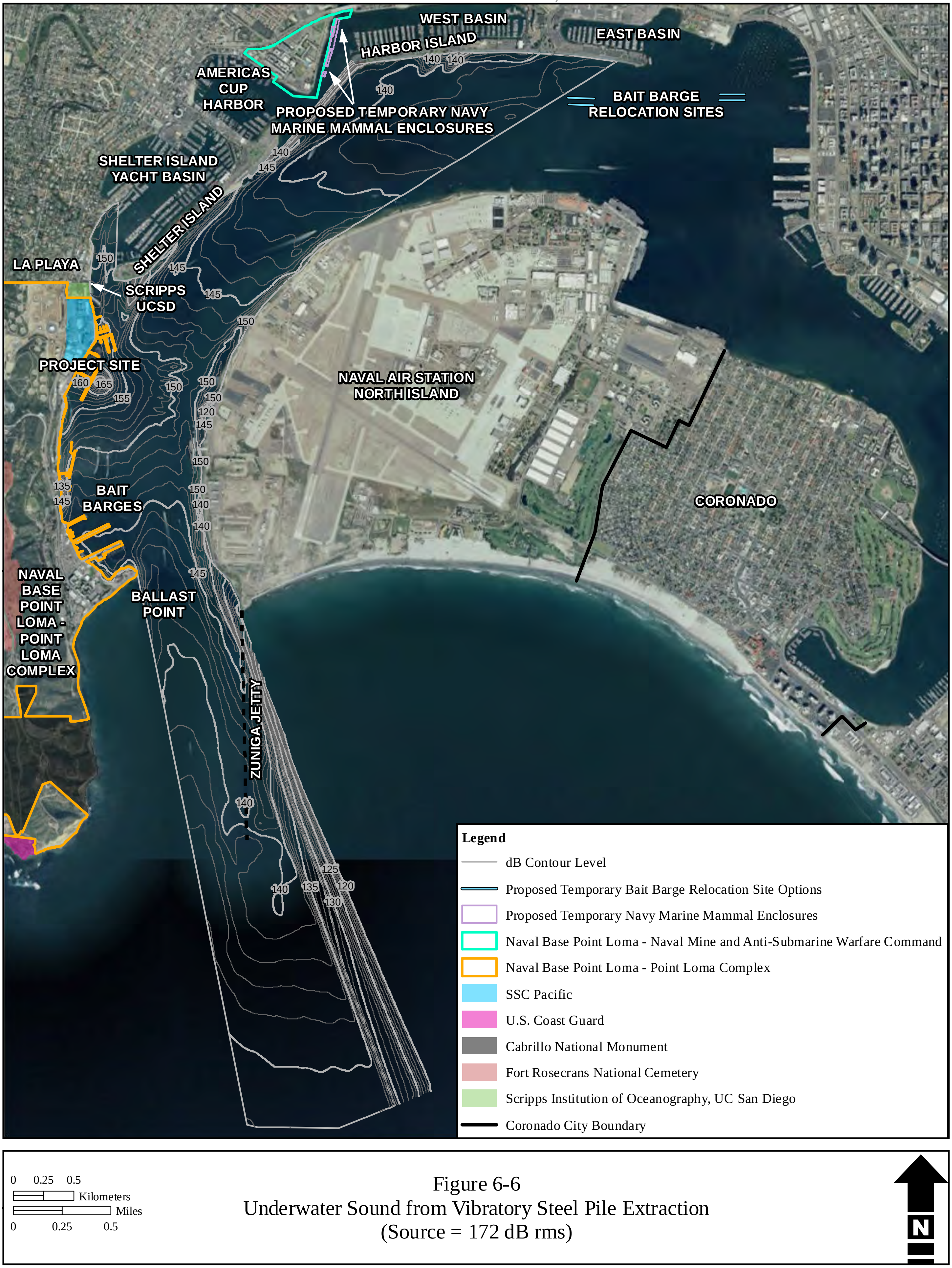



Figure 6-6
Underwater Sound from Vibratory Steel Pile Extraction
(Source = 172 dB rms)


0 0.25 0.5 Kilometers
0 0.25 0.5 Miles

Figure 6-7
Underwater Sound from Vibratory Non-Steel Pile Extraction
(Source = 160 dB rms)

N

### 6.4.3 Airborne Sound Propagation Formula

Pile driving can generate airborne noise that could potentially result in disturbance to marine mammals (pinnipeds) hauled out or at the water's surface. As a result, the Navy analyzed the potential for pinnipeds hauled out or swimming at the surface near the project site to be exposed to airborne SPLs that could result in Level B behavioral harassment. The appropriate airborne noise thresholds for behavioral disturbance for all pinnipeds, except harbor seals is 100 dB re 20 µPa rms (unweighted) and for harbor seals is 90 dB re 20 µPa rms (unweighted) (see Table 6-3). A spherical spreading loss model, assuming average atmospheric conditions, was used to estimate the distance to the 100 dB and 90 dB re 20 µPa rms (unweighted) airborne thresholds. The formula for calculating spherical spreading loss is:

$$TL = 20\log r$$

where:

TL = Transmission loss

$r$ = ratio of receiver distance to reference distance (equates to straight line distance from source when reference is at 1 m)

*Spherical spreading results in a 6 dB decrease in SPL per doubling of distance.

### 6.4.4 Airborne Sound from Pile Driving

The intensity of pile driving sounds is greatly influenced by factors such as the type of piles, hammers, and the physical environment in which the activity takes place. A large quantity of literature regarding SPLs recorded from pile driving projects is available for consideration. In order to determine reasonable airborne SPLs and their associated effects on marine mammals that are likely to result from pile driving at NBPL, studies with similar properties to the proposed action were evaluated. Studies which met the following parameters were considered: 1. Pile materials - steel pipe piles (36-48" diameter); 2. Hammer machinery - vibratory and impact; and 3. Physical environment - shallow depth (<100 foot). Table 6-6 details representative pile driving activities that have occurred in recent years. Due to the similarity of these actions and the Navy's proposed action, they represent reasonable SPLs which could be anticipated.

**Table 6-6. Airborne Sound Pressure Levels from Similar *in-situ* Monitored Construction Activities**

| *Project and Location* | *Pile Size andType* | *Installation Method* | *Water Depth* | *Measured Sound Pressure Levels* |
|---|---|---|---|---|
| Northstar Island, AK[1] | 42- in Steel Pipe Pile | Impact | ~12 m (40 ft) | 97 dB re 20 µPa (rms) at 525 ft |
| Keystone Ferry Terminal, WA[2] | 30- in Steel Pipe Pile | Vibratory | ~9 m (30 ft) | 98 dB re 20 µPa (rms) at 36 ft |

Sources: [1]Blackwell et al. 2004; [2]WSDOT 2010

Based on in-situ recordings from similar construction activities, the maximum airborne noise levels that would result from impact and vibratory pile driving are estimated to be 97 dB re 20 µPa (rms) at 525 ft and 98 dB re 20 µPa (rms) at 36 ft, respectively (Blackwell et al. 2004; WSDOT 2010). The distances to the airborne thresholds were calculated with the airborne transmission loss formula presented in section 6.4.3. All calculated distances to and the total area encompassed by the airborne marine mammal noise thresholds are provided in Tables 6-7 and 6-8, respectively.

**Table 6-7. Calculated Distances (m) to the Marine Mammal Noise Thresholds in Air from Pile Driving**

| *Species* | *Threshold* | *Airborne Behavioral Disturbance* | |
|---|---|---|---|
| | | *Distance (m) to Threshold Impact Pile Driving* | *Distance (m) to Threshold Vibratory Pile Driving* |
| Pinnipeds (seals, sea lions, walrus, except harbor seal) | 100dB re 20 µPa rms (unweighted) | 113 m (371 ft) | 9 m (30 ft) |
| Harbor seal | 90dB re 20 µPa rms (unweighted) | 358 m (1175 ft) | 28 m (92 ft) |

**Table 6-8. Calculated Area Encompassed (Per Pile) by the Marine Mammal Noise Thresholds In-air from Pile Driving**

| *Species* | *Threshold* | *Airborne Behavioral Disturbance* | |
|---|---|---|---|
| | | *Area Encompassed by the Threshold for Impact Pile Driving* | *Area Encompassed by the Threshold for Vibratory Pile Driving* |
| Pinnipeds (except harbor seal) | 100dB re 20 µPa rms (unweighted) | 0.040 $km^2$ | 0.000 $km^2$ |
| Harbor seal | 90dB re 20 µPa rms (unweighted) | 0.403 $km^2$ | 0.002 $km^2$ |

The distance to the sea lion airborne threshold would be 113 m (371 ft) for impact pile driving, and 9 m (30 ft) for vibratory pile driving. The distance to the harbor seal airborne threshold would be 358 m (1,175 ft) for impact pile driving, and 28 m (92 ft) for vibratory pile driving. The nearest location for harbor seals is approximately 250 m away and hence would be subject to airborne behavioral disturbance. These distances are all less than the corresponding distances calculated for underwater sound thresholds. Other types of pile driving and extraction would generate far lower airborne sound pressures, with much smaller distances and areas of potential disturbance and for that reason are not considered further in this application.

Since protective measures are in place out to the distances calculated for the underwater Level A threshold for sea lions, the distances for the airborne thresholds will be covered fully by monitoring.

### 6.4.5 Auditory Masking

Natural and artificial sounds can disrupt behavior by masking, or interfering with a marine mammal's ability to hear other sounds. Masking occurs when the receipt of a sound is interfered with by another coincident sound at similar frequencies and at similar or higher levels. If the second sound is manmade and disrupts hearing-related behavior such as communications or echolocation (Wartzok et al. 2003/04), it could be considered harassment under the MMPA. Noise can only mask a signal if it is within a certain "critical band" around the signal's frequency and its energy level is similar or higher (Holt 2008). Noise within the critical band of a marine mammal signal will show increased interference with detection of the signal as the level of the noise increases (Wartzok et al. 2003/04). In delphinid subjects, for example, relevant signals needed to be 17 to 20 dB rms louder than masking noise at frequencies below 1 kHz in order to be detected and 40 dB greater at approximately 100 kHz (Richardson et al. 1995). It is important to distinguish TTS and permanent threshold shift (PTS), which persist after the sound exposure, from masking, which occurs during the sound exposure. Because masking (without a resulting in a threshold shift) is not associated with abnormal physiological function, it is not considered a physiological effect in this IHA application, but rather a potential behavioral effect.

The most intense underwater sounds in the proposed action are those produced by impact pile driving. Given that the energy distribution of pile driving covers a broad frequency spectrum, sound from these sources would likely be within the audible range of California sea lions, harbor seals, gray whales, and bottlenose dolphins. Impact pile driving activity is relatively short-term, with rapid pulses occurring for approximately 15 min per pile. Vibratory pile driving is also relatively short-term, with rapid oscillations occurring for approximately 1.5 hours per pile. It is possible that impact and vibratory pile driving resulting from this proposed action may mask some acoustic signals that are relevant to the daily behavior of marine mammal species, but the short-term duration and limited areas affected make it very unlikely that survival would be affected. Masking effects are, therefore, treated as negligible. Any masking event that could possibly rise to Level B harassment under the MMPA would occur concurrently within the zones of behavioral harassment already estimated for vibratory and impact pile driving, and which have already been taken into account in the exposure analysis.

## 6.5 Basis for Estimating Take by Harassment

The U.S. Navy is seeking authorization for the potential taking of small numbers of California sea lions, harbor seals, gray whales, and coastal bottlenose dolphins in northern San Diego Bay as a result of pile removal and pile driving during demolition and construction activities associated with the Fuel Pier Replacement Project. The takes requested are expected to have no more than a minor effect on individual animals and no effect on the populations of these species. Any effects experienced by individual marine mammals are anticipated to be limited to short-term disturbance of normal behavior or temporary displacement of animals near source of the noise.

### 6.5.1 California Sea Lion

California sea lions are present in northern San Diego Bay year-round and are by far the dominant marine mammal in the bay. The local population comprises adult females and sub-adult males and females, with adult males being uncommon (Merkel and Associates, Inc. 2008; Navy 2010e; TDI 2012b). The Navy has conducted surveys by boat for marine mammals in northern San Diego Bay and adjacent waters on 16 separate occasions between 2007 and the end of March 2012. These surveys were conducted at slow speed (~3-5 knots) along the same general routes (Figure 3-1) during calm weather and excellent viewing conditions. Observers were able to closely investigate and confirm sightings. Individuals that conducted the surveys (D. Lerma, C. Johnson, K. Merkel) are of the opinion that the detectability of animals within the study area at the time of the survey approached 100%. However, to account for the possibility that some parts of the study area may not have been covered due to access limitations, and to allow for variation in the accuracy of counts of large numbers of animals, a 95% detection rate is assumed.

During the surveys, the maximum number of sea lions observed within the study area, defined as the 120 dB ZOI for potential behavioral disturbance by vibratory pile driving, was 114, with an average abundance of 59.92 individuals per survey day; this translates to an average density of 5.22/km$^2$. Adjusting based on 95% detection results in an average abundance of 63.07, and density of 5.50/km$^2$. This estimate is remarkably close to that of the Navy Marine Species Density Database (NMSDD) (Hanser et al. 2012) for North and Central San Diego Bay, which is 5.75/km$^2$ for the summer and fall periods. Although the NMSDD estimate for winter and spring is lower (2.51/km$^2$), this difference appears largely due to the inclusion of more recent (2012) surveys in this IHA application (U.S. Pacific Fleet 2012; TDI 2012b), which found higher numbers during winter and spring 2012 than were seen in previoius surveys.

In the surveys analyzed for this IHA application, an average of 47.00 animals were observed on or swimming next to the bait barges. Assuming the same proportion of the population continues to spend most of their time at the bait barges when they are moved out of the ZOI, there would be an average of 12.92 individuals within the ZOI (1.12/km$^2$). Assuming 95% detection results in an estimated average abundance of 13.60 and density of 1.18/km$^2$ in the ZOI without the bait barges' influence.

Potential takes would likely involve sea lions that are loafing on or in the vicinity of structures or moving through the area en route to foraging areas or structures where they haul out. California sea lions that are taken could exhibit behavioral changes such as increased swimming speeds, increased surfacing time, or decreased foraging. Most likely, California sea lions may move away from the sound source and be temporarily displaced from the areas of pile driving. With the absence of any major rookeries and the relocation of the bait barges, relatively few animals are likely to be hauled out or swimming near or adjacent to the project site. The structures remaining in the area (Figure 4-1) provide limited space for animals. As such, potential takes by disturbance will have a negligible short-term effect on individual California sea lions and would not result in population-level impacts.

### 6.5.2 Harbor Seal

As discussed previously, the occurrence of harbor seals in the ZOI appears to be limted to the presence of 3 individuals for one month (Jenkins 2012). Accordingly, harbor seal occurrence within potential ZOIs for project activities is expected to consist of up to 3 individuals for approximately one month in the vicinity of Pier 122, roughly 250 m south of the fuel pier (Figure 3-1). The take estimate for harbor seals is based on these individuals experiencing both airborne and underwater sound from the project when they are present.

Potential takes would likely involve harbor seals that are on the shoreline or structures at the identified location, or swimming in the vicinity. The most likely movements of harbor seals would be to and from foraging areas in the kelp beds south of Ballast Point. Harbor seals that are taken could exhibit behavioral changes such as entering the water in response to airborne noise, increased swimming speeds, increased surfacing time, or decreased foraging. Most likely, harbor seals may move away from the sound source and be temporarily displaced from the areas of pile driving. With the absence of any major rookeries and only a few isolated haul-out areas near or adjacent to the project site, potential takes by disturbance will have a negligible short-term effect on individual harbor seals and would not result in population-level impacts.

### 6.5.3 Gray Whale

Gray whale occurrence within northern San Diego Bay is sporadic and would likely consist of one-few individuals that venture close to, or enter the bay for a brief period, then continue northward. The take estimate for gray whales assumes the presence of 1 individual for 15 days near the mouth of the bay during the month of March. Note that this could represent the same individual for 15 days, 15 individuals that pass through the area, or intermediate numbers for varying periods.

### 6.5.4 Coastal Bottlenose Dolphin

Coastal bottlenose dolphins can occur at any time of year in northern San Diego Bay. Numbers sighted have been highly variable, ranging from zero (6 out of 13 surveys) to more than 30 individuals. The Navy has conducted surveys by boat for marine mammals in northern San Diego Bay and adjacent waters on 16 separate occasions between 2007 and the end of March 2012. These surveys were conducted at slow speed (~3.5 knots) along the same general routes (Figure 3-1) during calm weather and excellent viewing conditions. Observers were able to closely investigate and confirm sightings. Individuals that conducted the surveys (D. Lerma, C. Johnson, K. Merkel) were of the opinion that the detectability of animals within the study area at the time of the survey approached 100%. However, to account for the possibility that some parts of the study area may not have been covered due to access limitations, and to allow for variation in the accuracy of counts of large numbers of animals, a 95% detection rate is assumed. Unidentified dolphins recorded in the surveys are assumed to have been coastal bottlenose dolphins, which is the only dolphin that regularly occurs in San Diego Bay and adjacent waters (Navy 2011; NAVFAC SW and Port of San Diego 2011b).

During the surveys, the maximum number of bottlenose dolphins observed within the study area, defined as the 120 dB rms ZOI for potential behavioral disturbance by vibratory pile driving, ranged from zero to 40. Given this extreme variability, the regional density estimate of $0.36/km^2$ developed in the NMSDD (Hanser et al. 2012) is considered a more reliable indicator of the number of animals likely to be present within ZOIs during construction/demolition activities and is used in this IHA application.

Potential takes could occur if bottlenose dolphins move through the area on foraging trips when pile driving would occur. Bottlenose dolphins that are taken could exhibit behavioral changes such as increased swimming speeds, increased surfacing time, or decreased foraging. Most likely, bottlenose dolphins may move away from the sound source and be temporarily displaced from the areas of pile driving. There are no indications that bottlenose dolphins use or regularly occur in the area near the Fuel Pier. Hence any exposure to project-generated sound is likely to be transient and at relatively large distances. Therefore potential takes by disturbance will have a negligible short-term effect on individual bottlenose dolphins and would not result in population-level impacts.

## 6.6 Description of Take Calculation

The take calculations presented here rely on the best data currently available for marine mammal populations in San Diego Bay. The population data used for each species' take calculation is provided in subsections 6.5.1 through 6.5.4. The formula was developed for calculating take due to pile driving and extraction as applicable and applied to the species-specific noise impact threshold. The formula is founded on the following assumptions:

- The California sea lion's density is based on the average number seen (per day), adjusted upward assuming 95% detection, in Navy Marine Mammal surveys within the largest project ZOI - which is the 120 dB threshold for vibratory pile driving. The density of coastal bottlenose dolphin is based on the MNSDD (Hanser et al. 2012). Rather than a uniform density, the anticipated number and location of harbor seals and California gray whales within ZOIs is based on local knowledge.
- ZOIs for underwater sound generating activities at the fuel pier location are based on sound emanating from a central point in the water column slightly offshore of the existing pier, at the source levels specified in Table 6-5, and rates of transmission loss derived from the site-specific model in Appendix A. Graphical representations of each ZOI were provided in Figures 6-1 through 6-7.
- Pile driving or vibratory extraction is conservatively estimated to occur on every day within the scheduled window for that component of project construction, as defined in Section 2.2.1. Note that some project activities, notably the driving of concrete piles for the new fuel pier, would not occur during the period of this IHA.
- An individual can only be taken once due to underwater sound from pile driving, whether from impact or vibratory pile driving, or vibratory extraction, during each 24 hour period of that activity.
- Although sea lions and harbor seals in the project area spend a considerable amount of time above water, when they would not be subject to underwater sound, the conservative assumption is made that all sea lions within the ZOI are underwater during at least a portion of the noise generating activity, and hence exposed to sound at the predicted levels. However, all sea lions within each airborne sound ZOI are also assumed to be exposed to the airborne sound of each activity.

The calculation for marine mammal takes is estimated by:

$$\text{Take estimate} = (n * ZOI) * \text{days of activity}$$

where:

n = density estimate used for each species

ZOI[2] = noise threshold zone of influence (ZOI) impact area

n * ZOI produces an estimate of the abundance of animals that could be present in the area for exposure, this must be a whole number, therefore, this value was rounded (down if <0.5, up if >0.5).

The exposure assessment methodology is an estimate of the numbers of individuals exposed to the effects of pile driving and extraction activities exceeding NMFS established thresholds. Of significant note in these exposure estimates, additional mitigation methods (i.e. visual monitoring and the use of shutdown zones to ensure there are no Level A takes) were not quantified within the assessment and successful implementation of this mitigation is not reflected in exposure estimates. Results from acoustic impact exposure assessments should be regarded as conservative estimates that are strongly influenced by limited biological data. While

[2] Zone of Influence (ZOI) is the area encompassed by all locations where the SPLs equal or exceed the threshold being evaluated.

the numbers generated from the pile driving exposure calculations provide conservative overestimates of marine mammal exposures for consultation with NMFS, the intermittent duration and limited geographic extent of in-water construction and demolition activities would further limit actual exposures and their potential biological effects.

### 6.6.1 California Sea Lion

As described in Section 6.5.1, the density of California sea lions observed within the maximum project area ZOI, subtracting out individuals that have been on or next to the bait barges, and which are assumed to move out of the ZOI when the bait barges are moved during the tern season, is 1.18/km$^2$. Table 6-9 provides the number of potential exposures constituting takes under the MMPA that would be caused by each project component.

**Table 6-9. Number of Potential Exposures Constituting Takes of California Sea Lions within Acoustic Threshold ZOIs During 12-Month IHA Period**

| *Activity* | *# Days* | *Underwater* | | | | *Airborne* |
|---|---|---|---|---|---|---|
| | | *Impact Injury Threshold (190dB**)* | *Impact Disturbance Threshold (160dB**)* | *Vibratory Injury Threshold (190 dB**)* | *Vibratory Disturbance Threshold (120dB**)* | *Impact and Vibratory Disturbance Threshold (100dB)** |
| Impact driving steel piles | 50 | 0 | 500 | N/A | N/A | 0 |
| Vibratory driving steel piles | 50 | N/A | N/A | 0 | 700 | 0 |
| Impact driving 24-in concrete piles | 16 | 0 | 0 | N/A | N/A | 0 |
| Vibratory removal non-steel piles | 21 | N/A | N/A | 0 | 294 | 0 |

* The airborne exposure calculations assumed that 100% of the in-water densities were available at the surface to be exposed to airborne sound.
** rms

Since steel pile installation involves a combination of vibratory and impact hammering, both are assumed to occur on the same day, and the number of animals taken is given by the maximum of either type of exposure. Given that the vibratory (120 dB rms) ZOI is larger, all animals considered behaviorally harassed by impact pile driving are also considered to be harassed by vibratory pile driving, whereas animals outside of the ZOI for impact hammering but within the ZOI for vibratory hammering would only be harassed by the latter. The total estimate for pile driving is thus 700 sea lion harassments by continuous sound from vibratory hammering, of which 500 would also constitute harassment by impulsive sound from impact hammering. This represents a daily take of 14 individuals, which may or may not be the same individuals from day to day. No harassments anticipated from airborne sound of any type. Vibratory removal of concrete, plastic, and wood piles as part of demolition of the existing pier would result in 294 harassments, also representing a daily take of 14 individuals which may or may not be the same individuals from day to day (Table 6-9). To provide a more conservative estimate of total harassments, demolition use of vibratory extraction is assumed not to overlap the driving of steel piles for the new pier. Overall, a total of 994 California sea lion takes are predicted during the first IHA period.

### 6.6.2 Harbor Seal

The take estimate for harbor seals is based on the presence of 3 animals during 30 days within both airborne and underwater ZOIs for Level B harassment by pile driving and extraction. Therefore, the worst-case total number of takes equals 90, the same 3 animals being taken repeatedly.

### 6.6.3 Gray Whale

The take estimate for gray whales is based on the presence of an individual animal during 15 days within the underwater ZOIs for pile driving and extraction near the mouth of the bay. Therefore, the worst-case take estimate for gray whales is 15. This would represent up to 15 different individuals taken.

### 6.6.4 Coastal Bottlenose Dolphin

As described in Section 6.5.4, the estimated density of coastal bottlenose dolphins observed within the maximum project area ZOI is 0.36/km$^2$. Table 6-10 provides the number of potential exposures constituting takes under the MMPA that would be caused by each project component.

**Table 6-10. Number of Potential Exposures Constituting Takes of Coastal Bottlenose Dolphins within Acoustic Threshold ZOIs During 12-Month IHA Period**

| *Activity* | *# Days* | *Impact Injury Threshold (180dB)* | *Impact Disturbance Threshold (160dB)* | *Vibratory Injury Threshold (180 dB)* | *Vibratory Disturbance Threshold (120dB)* |
|---|---|---|---|---|---|
| Impact driving steel piles | 50 | 0 | 144 | N/A | N/A |
| Vibratory driving steel piles | 50 | N/A | N/A | 0 | 216 |
| Impact driving 24-in concrete piles | 16 | 0 | 0 | N/A | N/A |
| Vibratory removal non-steel piles | 21 | N/A | N/A | 0 | 91 |

Since steel pile installation involves a combination of vibratory and impact hammering, both are assumed to occur on the same day, and the number of animals taken is given by the maximum of either type of exposure. Given that the vibratory (120 dB rms) ZOI is larger, all animals considered behaviorally harassed by impact pile driving are also considered to be harassed by vibratory pile driving, whereas animals outside of the ZOI for impact hammering but within the ZOI for vibratory hammering would only be harassed by the latter. The total estimate for pile driving is thus 216 bottlenose dolphin harassments by continuous sound from vibratory hammering, of which 144 would also constitute harassment by impulsive sound from impact hammering. Vibratory removal of concrete, plastic, and wood piles as part of demolition of the existing pier would result in 91 harassments (Table 6-10). To provide a more conservative estimate of total harassments, demolition use of vibratory extraction is assumed not to overlap with the driving of steel piles for the new pier. Overall, a total of 307 coastal bottlenose dolphin takes are predicted during the IHA period. The total number of individuals taken is estimated as 4 per day, which may or may not be the same individuals on different days, during 71 days of vibratory/impact hammering and vibratory extraction.

## 6.7 Summary

Based on the modeling results presented above, the total number of takes that the Navy is requesting for the two marine mammal species that may occur within the Project Area during the duration of proposed activities are presented below in Table 6-11. All takes are currently anticipated to occur during fall to spring, September through April. There is the potential for 749 Level B disturbance takes of California sea lions, harbor seals, gray whales, and coastal bottlenose dolphins from impulsive and vibratory pile driving operations which would occur concurrently, and an additional 657 Level B disturbance takes (120 dB rms) of California sea lions and coastal bottlenose dolphins from vibratory pile driving and extraction due to underwater sound. Harbor seals may be exposed to airborne SPLs that would cause harassment, resulting in a total of 90 exposures; however, these would be to the same individuals that are subject to harassment by underwater sound.

**Table 6-11. Summary of Potential Exposures Constituting Takes for All Species**

| *Species* | *Underwater* | | | | *Airborne* |
|---|---|---|---|---|---|
| | *Impact Injury Threshold (190 dB rms)* | *Impact Injury Threshold (180 dB rms)* | *Both Impact Disturbance Threshold (160 dB) and Vibratory Disturbance Threshold (120 dB rms)* | *Vibratory Disturbance Threshold Only (120 dB rms)* | *Impact and Vibratory Disturbance Threshold (90 dB) dms** |
| California sea lion | 0 | N/A | 500 | 494 | 0 |
| Harbor seal | 0 | N/A | 90 | 0 | 90 |
| Gray whale | 0 | 0 | 15 | 0 | N/A |
| Coastal bottlenose dolphin | 0 | 0 | 144 | 163 | N/A |
| **Total** | **0** | **0** | **749** | **657** | **90** |

*Harbor seal only

# 7 IMPACTS TO MARINE MAMMAL SPECIES OR STOCKS

*The anticipated impact of the activity upon the species or stock of marine mammals*

## 7.1 Potential Effects of Pile Driving on Marine Mammals

### 7.1.1 Underwater Noise Effects

The effects of pile driving on marine mammals are dependent on several factors, including the size, type, and depth of the animal; the depth, intensity, and duration of the pile driving sound; the depth of the water column; the substrate of the habitat; the standoff distance between the pile and the animal; and the sound propagation properties of the environment. Impacts to marine mammals from pile driving activities are expected to result primarily from acoustic pathways. As such, the degree of effect is intrinsically related to the received level and duration of the sound exposure, which are in turn influenced by the distance between the animal and the source. The further away from the source, the less intense the exposure should be. The substrate and depth of the habitat affect the sound propagation properties of the environment. Shallow environments are typically more structurally complex which leads to rapid sound attenuation. In addition, substrates which are soft (i.e., mud) will absorb or attenuate the sound more readily than hard substrates (rock) which may reflect the acoustic wave. Soft porous substrates would also likely require less time to drive the pile, and possibly less forceful equipment, which would ultimately decrease the intensity of the acoustic source.

Impacts to marine species are expected to be the result of physiological responses to both the type and strength of the acoustic signature (Viada et al. 2008). Behavioral impacts are also expected, though the type and severity of these effects are more difficult to define due to limited studies addressing the behavioral effects of impulsive sounds on marine mammals. Potential effects from impulsive sound sources can range from brief acoustic effects such as behavioral disturbance, tactile perception, physical discomfort, slight injury of the internal organs and the auditory system, to death of the animal (Yelverton et al. 1973; O'Keeffe and Young 1984; Navy 2001).

<u>*Physiological Responses*</u>

Direct tissue responses to impact/impulsive sound stimulation may range from mechanical vibration or compression with no resulting injury, to tissue trauma (injury). Because the ears are the most sensitive organ to pressure, they are the organs most sensitive to injury (Ketten, 2000). Sound related trauma can be lethal or sub-lethal. Lethal impacts are those that result in immediate death or serious debilitation in or near an intense source (Ketten 1995). Sub-lethal impacts include hearing loss, which is caused by exposure to perceptible sounds. Severe damage, from a pressure wave, to the ear can include rupture of the tympanum, fracture of the ossicles, damage to the cochlea, hemorrhage, and cerebrospinal fluid leakage into the middle ear (NMFS 2008). Moderate injury implies partial hearing loss. Permanent hearing loss can occur when the hair cells are damaged by one very loud event, as well as prolonged exposure to noise. Instances of temporary threshold shifts (TTS) and/or auditory fatigue are well documented in marine mammal literature as being one of the primary avenues of acoustic impact. Temporary loss of hearing sensitivity (TTS) has been documented in controlled settings using captive marine mammals exposed to strong sound exposure levels at various frequencies (Ridgway et al. 1997; Kastak et al. 1999; Finneran et al. 2005), but it has not been documented in wild marine mammals exposed to pile driving. While injuries to other sensitive organs are possible, they are less likely since pile driving impacts are almost entirely acoustically mediated, versus explosive sounds which also include a shock wave which can result in damage.

No physiological responses are expected from pile driving operations occurring during the Fuel Pier Replacement Project for several reasons. Firstly, vibratory pile driving which is being utilized as the primary installation method, does not generate high enough peak SPLs that are commonly associated with physiological damage. Any use of impulsive pile driving will only occur from a short period of time (~30 to 120 min per steel pile). Additionally, the mitigation measures which the Navy will be employing (see Section 11) will greatly reduce the chance that a marine mammal may be exposed to SPLs that could cause physical harm. The Navy will have trained biologists monitoring a shutdown zone equivalent to the Level A Harassment zone (inclusive of the 180 dB re 1 μ Pa (cetaceans) and 190 dB re 1 μ Pa (pinnipeds) isopleths to ensure no marine mammals are injured.

*Behavioral Responses*

Behavioral responses to sound are highly variable and context specific. For each potential behavioral change, the magnitude of the change ultimately determines the severity of the response. A number of factors may influence an animal's response to noise, including its previous experience, its auditory sensitivity, it's biological and social status (including age and sex), and its behavioral state and activity at the time of exposure.

Habituation can occur when an animal's response to a stimulus wanes with repeated exposure, usually in the absence of unpleasant associated events (Wartzok et al. 2003/04). Animals are most likely to habituate to sounds that are predictable and unvarying. The opposite process is sensitization, when an unpleasant experience leads to subsequent responses, often in the form of avoidance, at a lower level of exposure. Behavioral state may affect the type of response as well. For example, animals that are resting may show greater behavioral change in response to disturbing noise levels than animals that are highly motivated to remain in an area for feeding (Richardson et al. 1995; National Research Council (NRC) 2003; Wartzok et al. 2003/04).

Controlled experiments with captive marine mammals showed pronounced behavioral reactions, including avoidance of loud sound sources (Ridgway et al. 1997; Finneran et al. 2003). Observed responses of wild marine mammals to loud pulsed sound sources (typically seismic guns or acoustic harassment devices, and also including pile driving) have been varied but often consist of avoidance behavior or other behavioral changes suggesting discomfort (Morton and Symonds 2002; CALTRANS 2001, 2006; also see reviews in Gordon et al. 2004; Wartzok et al. 2003/04; and Nowacek et al. 2007). Responses to continuous noise, such as vibratory pile installation, have not been documented as well as responses to pulsed sounds.

With both types of pile driving, it is likely that the onset of pile driving could result in temporary, short term changes in the animal's typical behavior and/or avoidance of the affected area. A marine mammal may show signs that it is startled by the noise and/or may swim away from the sound source and avoid the area. Other potential behavioral changes could include increased swimming speed, increased surfacing time, and decreased foraging in the affected area. Pinnipeds may increase their haul-out time, possibly to avoid in-water disturbance (CALTRANS 2001, 2006). Since pile driving will likely only occur for a few hours a day, over a short period of time, it is unlikely to result in permanent displacement. Any potential impacts from pile driving activities could be experienced by individual marine mammals, but would not cause population level impacts, or affect the long-term fitness of the species.

### 7.1.2 Airborne Noise Effects

Marine mammals that occur in the project area could be exposed to airborne sounds associated with pile driving that have the potential to cause harassment, depending on their distance from pile driving activities. Airborne pile driving noise would have less impact on cetaceans than pinnipeds because noise from atmospheric sources does not transmit well underwater (Richardson et al. 1995); thus airborne noise would only be an issue for hauled-out pinnipeds in the Project Area. Most likely, airborne sound would cause behavioral responses similar to those discussed above in relation to underwater noise. For instance, anthropogenic sound could cause hauled out pinnipeds to exhibit changes in their normal behavior, such as reduction in vocalizations, or cause them to temporarily abandon their habitat and move further from the source. Studies by Blackwell et al. (2004) and Moulton et al. (2005) indicate a tolerance or lack of response to unweighted airborne sounds as high as 112 dB peak and 96 dB rms. Based on these observations marine mammals could exhibit temporary behavioral reactions to airborne noise, however, exposure is not likely to result in population level impacts. The exposure modeling indicated that harbor seals would be exposed to airborne noise levels at SPLs that would constitute Level B behavioral harassment during either impact or vibratory pile driving (see Section 6 for modeling results). Injury or Level A harassment is not expected to occur from airborne noise. In conclusion, this is a negligible impact.

## 7.2 Conclusions Regarding Impacts to Species or Stocks

Individual marine mammals may be exposed to SPLs during pile driving and extraction operations at NBPL may result in Level B Behavioral harassment. Any marine mammals which are taken (harassed), may change their normal behavior patterns (i.e., swimming speed, foraging habits, etc.) or be temporarily displaced from the area of construction. Any takes would likely have only a minor effect on individuals and no effect on the population. The sound generated from vibratory pile driving is non-pulsed (e.g., continuous) which is not known to cause injury to marine mammals. Mitigation is likely to avoid most potential adverse underwater impacts to marine mammals from impact pile driving. Nevertheless, some level of impact is unavoidable. The expected level of unavoidable impact (defined as an acoustic or harassment "take") is described in Sections 6 and 7. This level of effect is not anticipated to have any detectable adverse impact on population recruitment, survival or recovery (i.e., no more than a negligible adverse effect).

# 8 IMPACT ON SUBSISTENCE USE

*The anticipated impact of the activity on the availability of the species or stock of marine mammals for subsistence uses.*

Potential impacts resulting from the Proposed Action will be limited to individuals of marine mammal species located in the marine waters near NBPL that have no subsistence requirements. Therefore, no impacts on the availability of species or stocks for subsistence use are considered.

# 9 IMPACTS TO THE MARINE MAMMAL HABITAT AND THE LIKELIHOOD OF RESTORATION

*The anticipated impact of the activity upon the habitat of the marine mammal populations, and the likelihood of restoration of the affected habitat.*

The proposed activities at NBPL will include the temporary relocation of bait barges used as haulouts by California sea lions, which is expected to result in a temporary redistribution of sea lions within northern San Diego Bay. The factors that currently attract sea lions to the barges are expected to operate equally in their new locations. There are no known foraging hotspots, or other ocean bottom structure of significant biological importance to marine mammals that may be present in the marine waters in the vicinity of the Project Area. Dredging and sediment disposal/reuse would temporarily disturb benthic and water column habitats and change bottom topography to a minor degree, but effects on prey availability and foraging conditions for marine mammals would be very brief and limited to the immediate area of dredging and disposal. Therefore, the main impact issue associated with the proposed activity will be temporarily elevated noise levels and the associated direct effects on marine mammals, as discussed in Sections 6 and 7. The most likely impact to marine mammal habitat occurs from pile driving effects on likely marine mammal prey (i.e., fish) nearby NBPL and minor impacts to the immediate substrate during installation and removal of piles.

## 9.1 Pile Driving Effects on Potential Prey (Fish)

Construction activities will produce both pulsed (i.e., impact pile driving) and continuous sounds (i.e., vibratory pile driving). Fish react to sounds which are especially strong and/or intermittent low-frequency sounds. Short duration, sharp sounds can cause overt or subtle changes in fish behavior and local distribution. Hastings and Popper (2005, Popper and Hastings 2009) identified several studies that suggest fish may relocate to avoid certain areas of noise energy. Additional studies have documented effects of pile driving (or other types of continuous sounds) on file, although several are based on studies in support of large, multiyear bridge construction projects (Scholik and Yan 2001, 2002, Govoni et al. 2003, Hawkins 2005, Hastings 1990, 2007, Popper et al. 2006, Popper and Hastings 2009). Sound pulses at received levels of 160 dB re 1 μPa may cause subtle changes in fish behavior. SPLs of 180 dB may cause noticeable changes in behavior (Chapman and Hawkins 1969; Pearson et al. 1992; Skalski et al. 1992). SPLs of sufficient strength have been known to cause injury to fish and fish mortality (CALTRANS 2001; Longmuir and Lively 2001). The most likely impact to fish from pile driving activities at the Project Area would be temporary behavioral avoidance of the immediate area. The duration of fish avoidance of this area after pile driving stops is unknown, but a rapid return to normal recruitment, distribution and behavior is anticipated. In general, impacts to marine mammal prey species are expected to be minor and temporary.

## 9.2 Pile Driving Effects on Potential Foraging Habitat

The area likely impacted by the Fuel Pier Replacement Project is relatively small compared to the available habitat in northern San Diego Bay. Given that the Navy's marine mammal surveys have documented no marine mammal occurrences in the immediate vicinity of the fuel pier (Figure 3-2), the affected area is used little, if at all, as foraging habitat. As a result, the removal and replacement of pilings, substrate disturbance, and high levels of activity at the project site would be inconsequential in terms of effects on marine mammal foraging.

The duration of fish avoidance of this area after pile driving stops is unknown, but a rapid return to normal recruitment, distribution and behavior is anticipated. Any behavioral avoidance by fish of the disturbed area would still leave significantly large areas of fish and marine mammal foraging habitat in northern San Diego Bay.

The project design has minimized effects on eelgrass beds and would mitigate any unavoidable losses by replacement. Hence the project would not negatively impact eelgrass beds and the important nursery and foraging habitat functions they provide for fish, which in turn serve as prey for marine mammals.

## 9.3 Summary of Impacts to Marine Mammal Habitat

Given the short daily duration of noise associated with individual pile driving\removal, seasonal limitations on the in-water activities that have the greatest potential to disturb marine mammals and their prey, and the relatively small areas being affected, pile driving and extraction activities associated with the proposed action are not likely to have a permanent, adverse effect on any EFH, or population of fish species. Therefore, pile driving\removal is not likely to have a permanent, adverse effect on marine mammal foraging habitat at the Project Area.

# 10 IMPACTS TO MARINE MAMMALS FROM LOSS OR MODIFICATION OF HABITAT

*The anticipated impact of the loss or modification of the habitat on the marine mammal populations involved.*

The proposed activities at NBPL are not expected to have any habitat-related effects that could cause significant or long-term consequences for individual marine mammals or their populations. The new fuel pier will have a smaller surface area than the existing pier, but as noted above, the pier is not used by marine mammals as foraging or resting habitat. Based on the discussions in Section 9, there will be no impacts to marine mammals resulting from loss or modification of marine mammal habitat.

# 11 MEANS OF EFFECTING THE LEAST PRACTICABLE ADVERSE IMPACTS – MITIGATION MEASURES

*The availability and feasibility (economic and technological) of equipment, methods, and manner of conducting such activity or other means of effecting the least practicable adverse impact upon the affected species or stocks, their habitat, and on their availability for subsistence uses, paying particular attention to rookeries, mating grounds, and areas of similar significance.*

The exposures outlined in Section 6 represent the maximum expected number of marine mammals that could be exposed to acoustic sources reaching Level B harassment levels. Navy proposes to employ a number of mitigation measures, discussed below, in an effort to minimize the number of marine mammals potentially affected.

## 11.1 Mitigation for Pile Driving Activities

### 11.1.1 Proposed Measures

The modeling results for zones of influences (ZOIs) discussed in Section 6 were used to develop mitigation measures for pile driving and demolition activities at NBPL. The ZOIs effectively represent the mitigation zone that would be established to prevent Level A harassment to marine mammals.

1. Shutdown and Buffer Zone During Pile Driving and Removal

   - During pile driving and removal, the shutdown zone shall include all areas where the underwater SPLs are anticipated to equal or exceed the Level A (injury) harassment criteria for marine mammals (180 dB rms isopleth for cetaceans; 190 dB rms isopleth for pinnipeds). During all pile driving and removal activities, regardless of predicted SPLs, a conservative 10 m (33 ft) shutdown zone shall be established and monitored to prevent injury to marine mammal species from their physical interaction with construction equipment during in-water activities.
   - During pile driving and removal, the buffer zone shall include areas where the underwater and airborne SPLs are anticipated to equal or exceed the Level B (disturbance) harassment criteria for marine mammals (underwater: 160 dB rms isopleths for impact pile driving, 120 dB rms isopleth for vibratory pile driving; airborne: 90 dB rms isopleth for harbor seals, 100 dB isopleth for sea lions). The distance encompassing these zones will be adjusted to accommodate any difference between predicted and measured sound levels.
   - The shutdown and buffer zones will be monitored throughout the time required to drive or extract a pile. If a marine mammal is observed entering the buffer zone, an exposure would be recorded and behaviors documented. However, that pile segment would be completed without cessation, unless the animal approaches or enters the shutdown zone, at which point pile driving or extraction will be halted.
   - All buffer and shutdown zones will initially be based on the distances from the source which were predicted for each threshold level. However, in-situ acoustic monitoring will be utilized during the first several days of each distinct sound-generating activity, and in any case until sufficient data have been collected to provide a robust estimate of the

actual distances to these threshold zones. The size of the shutdown and buffer zones will then be adjusted accordingly (increased or decrease) based on received SPLs.

2. Shutdown Zone During Other In-water Construction or Demolition Activities

   - During all in-water construction or demolition activities having the potential to affect marine mammals, in order to prevent injury from physical interaction with construction equipment, a shutdown zone of 10 m (33 ft) will be monitored to ensure marine mammals are not present within this zone. These activities could include, but are not limited to: (1) the movement of a barge to the pile location, or (2) the removal of a pile from the water column/substrate via a crane (i.e. "dead pull").

3. Visual Monitoring

   a. Impact Installation: Monitoring will be conducted within the Level A harassment shutdown zone and Level B harassment buffer zone during impact pile driving before, during, and after pile driving activities. Monitoring will take place from 15 min prior to initiation through 15 min post-completion of pile driving activities.

      Vibratory Installation and Removal: Monitoring will be conducted for a 10 m (33 ft) shutdown zone. Given ambient underwater sound of approximately 124 dB re 1 µPa (rms), punctuated by louder sound from passing ships, as well as the difficulty of effectively monitoring the full extent of the predicted 120 dB re 1 µPa (rms) Level B behavioral disturbance ZOI for vibratory pile driving/extraction, the Navy intends initially to monitor a buffer zone equivalent to the full extent of the predicted Level B disturbance ZOI, but to adjust the extent of the monitored buffer zone based on acoustic monitoring (see below). The outer limits of the buffer zone would be defined by the point at which the measured SPL (maximum rms) produced by the equipment either declines to 120 dB re 1 µPa or falls below the median ambient SPL (rms) and hence becomes indistinguishable from background. Monitoring will take place from 15 min prior to initiation through 15 min post-completion of vibratory installation/removal activities.

      Other In-Water Activities: Monitoring will take place from 15 min prior to initiation until the action is complete.

   b. Monitoring will be conducted by qualified observers. All observers would be trained in marine mammal identification and behaviors, have experience conducting marine mammal monitoring or surveys, and would have no other construction-related tasks while monitoring. A trained observer will be placed from the best vantage point(s) practicable (e.g., from a small boat, the pile driving barge, on shore, or any other suitable location) to monitor for marine mammals and implement shut-down/delay procedures when applicable by calling for the shut-down to the hammer operator.

   c. Prior to the start of pile driving activity, the shutdown and safety zones will be monitored for 15 min to ensure that it is clear of marine mammals. Pile driving will only commence once observers have declared the shutdown zone clear of marine mammals; Animals will be allowed to remain in the buffer zone and their behavior will be monitored and documented.

   d. If a marine mammal approaches/enters the shutdown zone during the course of pile driving operations, pile driving will be halted and delayed until either the animal has voluntarily left and been visually confirmed beyond the shutdown zone or 15 min have passed without re-detection of the animal.

e. In the unlikely event of conditions that prevent the visual detection of marine mammals, such as heavy fog, activities with the potential to result in Level A or Level B harassment will not be initiated. Impact pile driving would be curtailed, but vibratory pile driving or extraction would be allowed to continue if such conditions arise after the activity has begun.

4. Acoustic Measurements – Acoustic measurements will be used to empirically verify the proposed shutdown and buffer zones. For further detail regarding our acoustic monitoring plan see Section 13.

5. Timing Restrictions - The Navy has set timing restrictions to avoid noise and turbidity generating in-water construction and demolition activities in designated foraging habitat of the ESA-listed California least tern, which is nominally from 1 April through 15 September.

6. Soft Start - The use of a soft-start procedure is believed to provide additional protection to marine mammals by providing a warning and/or giving marine mammals a chance to leave the area prior to the hammer operating at full capacity. The Fuel Pier Replacement Project will utilize soft-start techniques (ramp-up/dry fire) recommended by NMFS for impact and vibratory pile driving. These measures are as follows:

   *"The soft-start requires contractors to initiate noise from vibratory hammers for 15 seconds at reduced energy followed by a 30-second waiting period. This procedure should be repeated two additional times. If an impact hammer is used, contractors are required to provide an initial set of three strikes from the impact hammer at 40 percent energy, followed by a 30-second waiting period, then two subsequent 3-strike sets."*

   The 30-second waiting period is proposed based on the Navy's recent experience and consultation with NMFS on a similar project at Naval Base Kitsap at Bangor.

7. Daylight Construction – Pile driving (vibratory as well as impact) will only be conducted during daylight hours.

### 11.1.2 Measures Considered but not Proposed

The use of bubble curtains to reduce underwater sound from impact pile driving was considered but is not proposed because the piles would be installed in relatively deep water and strong tidal currents (up to 3 knots) at the project site would disperse the bubbles and compromise the effectiveness of sound attenuation (CALTRANS 2009). Other considerations were that the potential for Level A exposures and the number and relative intensity of Level B exposures has already been reduced by 1) relocation of the bait barges; 2) primary reliance on vibratory installation of steel piles – in itself an accepted mitigation measure to reduce the intensity of underwater sound from pile driving (CALTRANS 2009) - except for final testing of load bearing capacity and structural integrity as needed with an impact hammer; 3) and relatively small ZOIs associated with impact pile driving of concrete piles.

The use of a coffer dam surrounding each pile to absorb sound was also considered. The installation and take-down of the coffer dam around each pile would substantially increase the time required to drive each pile. With the construction schedule already maximizing the amount of work that can be done during daylight hours and outside of the least tern nesting season, this would translate into several additional years of construction. Reasons 1 through 3 above also indicated this measure would not be cost effective.

Silt curtains were considered but rejected as a mitigation measure for turbidity because 1) the sediments of the project site are sandy and will settle out rapidly when disturbed; 2) fines that do remain suspended would be rapidly dispersed by tidal currents; and 3) tidal currents would tend to collapse the silt curtains and make them ineffective.

## 11.2 Mitigation Effectiveness

It should be recognized that although marine mammals will be protected from Level A harassment by marine mammal observers (MMOs) monitoring the near-field injury zones, mitigation may not be one hundred percent effective at all times in locating marine mammals in the buffer zone. The efficacy of visual detection depends on several factors including the observer's ability to detect the animal, the environmental conditions (visibility and sea state), and monitoring platforms.

All observers utilized for mitigation activities will be experienced biologists with training in marine mammal detection and behavior. Due to their specialized training the Navy expects that visual mitigation will be highly effective. Trained observers have specific knowledge of marine mammal physiology, behavior, and life-history which may improve their ability to detect individuals or help determine if observed animals are exhibiting behavioral reactions to construction activities.

Visual detection conditions in northern San Diego Bay are generally excellent. By its orientation, the bay is sheltered from large swells and infrequently experiences strong winds; winds are less than 17 knots 98% of the time between November and April (San Diego Bay Harbor Safety Committee 2009). Fog is anticipated on 10-20% of the days, typically in late night and early morning hours (San Diego Bay Harbor Safety Committee 2009) and could occasionally limit visibility for marine mammal monitoring. However, observers will be positioned in locations which provide the best vantage point(s) for monitoring, such as on nearby piers or on a small boat, and the shutdown and buffer zones cover relatively small and accessible areas of the bay. As such, proposed mitigation measures are likely to be very effective.

# 12 MINIMIZATION OF ADVERSE EFFECTS ON SUBSISTENCE USE

*Where the proposed activity would take place in or near a traditional Arctic subsistence hunting area and/or may affect the availability of a species or stock of marine mammal for Arctic subsistence uses, the applicant must submit either a plan of cooperation or information that identifies what measures have been taken and/or will be taken to minimize any adverse effects on the availability of marine mammals for subsistence uses. A plan must include the following:*

*(i) A statement that the applicant has notified and provided the affected subsistence community with a draft plan of cooperation;*

*(ii) A schedule for meeting with the affected subsistence communities to discuss proposed activities and to resolve potential conflicts regarding any aspects of either the operation or the plan of cooperation;*

*(iii) A description of what measures the applicant has taken an/or will take to ensure that proposed activities will not interfere with subsistence whaling or sealing; and*

*(iv) What plans the applicant has to continue to meet with the affected communities, both prior to and while conducting activity, to resolve conflicts and to notify the communities of any changes in the operation.*

There is no subsistence use of marine mammal species or stocks in the project area.

# 13 MONITORING AND REPORTING MEASURES

*The suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species, the level of taking or impacts on populations of marine mammals that are expected to be present while conducting activities and suggested means of minimizing burdens by coordinating such reporting requirements with other schemes already applicable to persons conducting such activity. Monitoring plans should include a description of the survey techniques that would be used to determine the movement and activity of marine mammals near the activity site(s) including migration and other habitat uses, such as feeding.*

## 13.1 Monitoring Plan

The following monitoring measures would be implemented along with the mitigation measures (Section 11) in order to reduce impacts to marine mammals to the lowest extent practicable. A marine mammal monitoring plan will be developed further and submitted to NMFS for approval well in advance of the start of construction. The monitoring plan includes the following components: acoustic measurements and visual observations.

The Navy intends to continue its marine mammal and acoustic surveys of the project area up to and including the completion of the indicator pile program in order to provide a more robust assessment of sound levels from steel pile driving and marine mammal responses, and to refine avoidance and minimization measures as warranted by the results. For all in-water activities, the monitoring described below would be implemented. The Navy would conduct post-project surveys as well on a quarterly basis to document any changes in the San Diego Bay populations of marine mammals.

### 13.1.1 Acoustic Measurements

The Navy will conduct acoustic monitoring for impact driving of steel piles in order to determine the actual distances to the 190 dB re 1µPa rms/180 dB re 1µPa rms and the 160 dB re 1µPa rms isopleths; for impact driving of other piles to determine the actual distance to the 160 dB re 1µPa rms isopleth; and for vibratory pile driving and extraction, including use of the pneumatic chipper, to determine the actual distance to either the 120 dB re 1µPa rms isopleth or the point at which the SPL (maximum rms) from the equipment diminishes to the median ambient SPL (rms) and hence becomes indistinguishable. The monitoring plan addresses both underwater and airborne sounds.

At a minimum, the methodology includes:

- Acoustic monitoring will be conducted for a minimum of 5 piles for each different type of pile and each different method of installation and removal.
- For underwater recordings, a stationary hydrophone system with the ability to measure SPLs will be placed in accordance with NMFS most recent guidance for the collection of source levels.
- For airborne recordings, reference recordings will be attempted at approximately 50 feet (15.2 meters) from the source via a stationary hydrophone. However, other distances may be utilized to obtain better data if the signal cannot be isolated clearly due to other sound sources (i.e., barges or generators).

- Hydrophones will be placed various distances and depths from piles using a static line or buoy. A weighted tape measure will be used to determine the depth of the water. The hydrophone will be attached to a nylon cord or steel chain if current is swift enough, to maintain a constant distance from the pile. The nylon cord or chain will be attached to a float or tied to a static line.
- Each hydrophone (underwater) and microphone (airborne) will be calibrated at the start of the action and will be checked at the beginning of each day of monitoring activity.
- For each monitored location, a two-hydrophone set-up will be used, with the first hydrophone at mid-depth and the second hydrophone at ~1 meter from the bottom in order to evaluate site specific attenuation and propagation characteristics that may be present throughout the water column.
- In addition to determining the area encompassed by the 190, 180, 160, and 120 db rms isopleths for marine mammals, hydrophones would also be placed at other distances as appropriate to accurately capture source levels and spreading loss.
- Ambient conditions, both airborne and underwater, would be measured at the project site in the absence of construction activities to determine background sound levels. Ambient levels are intended to be recorded over the frequency range from 10 Hz to 20 kHz. Ambient conditions will be recorded for 1 minute every hour of the work day, for one week of each month of the period of the IHA.
- Sound levels associated with soft-start techniques will also be measured.
- Underwater SPLs would be continuously monitored during the entire duration of each pile being driven. Sound pressure levels will be monitored in real time. Sound levels will be measured in Pascals which are easily converted to decibel (dB) units.
- Airborne levels would be recorded as unweighted, as well as in dBA and the distance to marine mammal injury and behavioral disturbance thresholds, also referred to as shutdown and buffer zones, (respectively), would be measured;
- Environmental data would be collected including but not limited to: wind speed and direction, air temperature, humidity, surface water temperature, water depth, wave height, weather conditions and other factors that could contribute to influencing the airborne and underwater sound levels (e.g., aircraft, boats, etc.);
- The chief inspector would supply the acoustics specialist with the substrate composition, hammer model and size, hammer energy settings and any changes to those settings during the piles being monitored, depth of the pile being driven, and blows per foot for the piles monitored.
- For acoustically monitored piles, post-analysis of the sound level signals will include frequency spectra between 10 Hz and 20 kHz; determination of absolute peak overpressure and under pressure levels recorded for each pile; average, minimum, and maximum rms values; for each absolute peak pile strike, the rise time, average duration of each pile strike, number of strikes per pile, Sound Exposure Level (SEL) of the absolute peak pile strike, mean SEL, and cumulative SEL (Accumulated SEL = single

strike SEL + 10*log (# hammer strikes) and a frequency spectrum for up to eight successive strikes with similar sound levels.

### 13.1.2 Visual Marine Mammal Observations

The Navy will collect sighting data and behavioral responses to construction for marine mammal species observed in the region of activity during the period of construction. All observers will be trained in marine mammal identification and behaviors. NMFS requires that the observers have no other construction related tasks while conducting monitoring.

### 13.1.3 Methods of Monitoring

The Navy will monitor the shutdown zone and safety zone before, during, and after pile driving and removal. Based on NMFS requirements, the Marine Mammal Monitoring Plan would include the following procedures:

- MMOs would be located at the best vantage point(s) in order to properly see the entire shut down zone and safety zone. This may require the use of a small boat to monitor certain areas while also monitoring from one or more land based vantage points;
- During all observation periods, observers would use binoculars and the naked eye to search continuously for marine mammals;
- Monitoring distances will be measured with range finders;
- In-water activities would be curtailed under conditions of fog or poor visibility that would obscure the presence of a marine mammal within the shutdown zone;
- The shutdown and safety zones around the pile will be monitored for the presence of marine mammals before, during, and after any pile driving or removal activity;
- Pre-Activity Monitoring:
  - The shutdown and buffer zones will be monitored for 15 min prior to in-water construction/demolition activities. If a marine mammal is present within the shutdown zone, the activity would be delayed until the animal(s) leave the shutdown zone. Activity would resume only after the MMO has determined, through sighting or by waiting approximately 15 min that the animal(s) has moved outside the shutdown zone.
- During Activity Monitoring:
  - The shutdown and buffer zones will also be monitored throughout the time required to drive and remove piles. If a marine mammal is observed entering the buffer zone, a "take" would be recorded and behaviors documented. However, that pile segment would be completed without cessation, unless the animal enters or approaches the shutdown zone, at which point all pile driving activities will be halted. Pile driving can only resume once the animal has left the shutdown zone of its own volition or has not been re-sighted for a period of 15 min.
- Post-Activity Monitoring: Monitoring of the shutdown and buffer zones would continue for 15 min following the completion of the activity.

### 13.1.4 Data Collection

NMFS requires that the MMOs use NMFS-approved sighting forms. NMFS requires that a minimum, the following information be collected on the sighting forms:

- Date and time that pile driving or removal begins or ends;
- Construction activities occurring during each observation period;
- Weather parameters identified in the acoustic monitoring (e.g., wind, humidity, temperature);
- Tide state and water currents;
- Visibility;
- Species, numbers, and if possible sex and age class of marine mammals;
- Marine mammal behavior patterns observed, including bearing and direction of travel, and if possible, the correlation to SPLs;
- Distance from pile driving activities to marine mammals and distance from the marine mammal to the observation point;
- Locations of all marine mammal observations;
- Other human activity in the area.

To the extent practicable, the Navy will record behavioral observations that may make it possible to determine if the same or different individuals are being "taken" as a result of project activities over the course of a day.

## 13.2 Reporting

A draft report would be submitted to NMFS within 45 calendar days of the completion of acoustic measurements and marine mammal monitoring. The results would be summarized in graphical form and include summary statistics and time histories of sound values for each pile. A final report would be prepared and submitted to the NMFS within 30 days following receipt of comments on the draft report from the NMFS. At a minimum, the report shall include:

- General data:
  - Date and time of activities.
  - Water conditions (e.g., sea-state, tidal state).
  - Weather conditions (e.g., percent cover, visibility).
- Specific pile data for acoustically monitored piles:
  - Description of the activities being conducted.
    - Size and type of piles.
    - The machinery used for installation or removal.
  - The power settings of the machinery used for installation or removal

- Specific acoustic monitoring information:
  - A description of the monitoring equipment.
  - The distance between hydrophone(s) and pile.
  - The depth of the hydrophone(s).
  - The physical characteristics of the bottom substrate where the piles were driven or extracted (if possible).
  - Acoustic data (per Section 13.1.1 above) for each monitored pile and activity.
- Pre-activity observational survey-specific data:
  - Dates and time survey is initiated and terminated.
  - Description of any observable marine mammal behavior in the immediate area during monitoring.
  - If possible, the correlation to underwater sound levels occurring at the time of the observable behavior.
  - Actions performed to minimize impacts to marine mammals.
- During-activity observational survey-specific data:
  - Description of any observable marine mammal behavior within monitoring zones or in the immediate area surrounding monitoring zones.
  - If possible, the correlation to underwater or airborne sound levels occurring at the time of this observable behavior.
  - Actions performed to minimize impacts to marine mammals.
  - Times when pile extraction is stopped due to presence of marine mammals within the shutdown zones and time when pile driving resumes.
- Post-activity observational survey-specific data:
  - Results, which include the detections of marine mammals, species and numbers observed, sighting rates and distances, behavioral reactions within and outside of safety zones.
  - A refined take estimate based on the number of marine mammals observed during the course of construction

# 14 RESEARCH

*Suggested means of learning of, encouraging, and coordinating research opportunities, plans, and activities relating to reducing such incidental taking and evaluating its effects.*

To minimize the likelihood that impacts will occur to the species, stocks and subsistence use of marine mammals, all construction activities will be conducted in accordance with all federal, state and local regulations and minimization measures proposed by the Navy will be implemented to protect marine mammals. The Navy will coordinate all activities with the relevant federal and state agencies. These include, but are not limited to: the NMFS, U.S. Fish and Wildlife Service, U.S. Coast Guard, Federal Energy Regulatory Commission (FERC), U.S. Army Corps of Engineers (USACE), and the Washington Department of Fish and Wildlife (WDFW). The Navy will share field data and behavioral observations on all marine mammals that occur in the project area. Results of each monitoring effort will be provided to NMFS in one summary report within 45 days of the conclusion of monitoring. This information could be made available to regional, state and federal resource agencies, scientists, professors, and other interested private parties upon written request to NMFS.

Additionally the Navy provides a significant amount of funding and support for marine research. The Navy provided $26 million in Fiscal Year 2008 and $22 million in Fiscal Year 2009 to universities, research institutions, federal laboratories, private companies, and independent researchers around the world to study marine mammals. Over the past five years the Navy has funded over $100 million in marine mammal research, with several projects ongoing in Washington.

The Navy sponsors 70% of all U.S. research concerning the effects of human-generated sound on marine mammals and 50% of such research conducted worldwide. Major topics of Navy-supported research include the following:

- Gaining a better understanding of marine species distribution and important habitat areas,
- Developing methods to detect and monitor marine species before and during training,
- Understanding the effects of sound on marine mammals, and
- Developing tools to model and estimate potential effects of sound.

The Navy has sponsored several workshops to evaluate the current state of knowledge and potential for future acoustic monitoring of marine mammals. The workshops brought together acoustic experts and marine biologists from the Navy and other research organizations to present data and information on current acoustic monitoring research efforts and to evaluate the potential for incorporating similar technology and methods in Navy activities. The Navy supports research efforts on acoustic monitoring and will continue to investigate the feasibility of passive acoustics as a potential monitoring tool. Overall, the Navy will continue to research and contribute to university/external research to improve the state of the science regarding marine species biology and acoustic effects. These efforts include monitoring programs; data sharing with NMFS from research and development efforts; and future research as described previously.

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# Appendix A
# Acoustic Transmission Loss Model for Pile Driving

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This memorandum summarizes our results of modeling acoustic transmission loss (TL) for San Diego Bay associated with underwater noise generated by impact pile driving. The TL modeling assumes a nominal pile driving location at position 477888.7 N, 3618101W where the nominal water depth is 14.7 m. A note on the model deliverable in the form of ArcGIS raster data is given at the end of this memorandum.

Our model assumes an average sound speed of 1504 m/s based on historical temperature-salinity data, and location-dependent bathymetry, both provided to us by NAVAC. Note that for purposes of modeling TL we have smoothed this bathymetry over a 100 m smoothing window and removed any features considered artifact. For geoacoustic properties of the sediments we use sound speed[1] and attenuation[2] for sand based a frequency of 500 Hz. Additional assumptions entering into the modeling are summarized as follows:

1. The spectrum of acoustic energy associated with impact pile driving is confined to frequencies less than about 2000 Hz[3]
2. The model is intended to simulate depth-averaged TL, which is specifically applicable to peak pressure emanating from an impact pile driving source, but also applies more generally to SEL and RMS measures.
3. The concept of a Mach cone that emanates from impact pile driving is incorporated in our TL model which causes the acoustic amplitude to decay as $R^{1/2}$ (cylindrical spreading) where R is range from the pile source, out to range of R*, or roughly 3 times the water depth. The Mach cone and precise definition of R* are discussed in ref.[3].
4. Beyond ranges of R* the amplitude decays as $R^{3/2}$. This decay mirrors the so-called practical spreading model (PSM), but our model differs fundamentally from the PSM. The primary differences are (i) model properties associated with R*, and (ii) depth-dependence in our model.
5. Depth-dependence is handled in two ways. For cases in which the depth increases from the source impact pile driving, the sound pressure amplitude decays as $(H/Ho)^{1/2}$ where H is the depth as a function of range from source and Ho is the depth at the source. This behavior applies unless and until the depth reaches a modal cut-off depth, associated with a frequency of 500 Hz. At this point the modal decay coefficient corresponding to the first mode at 500 Hz is applied, which increases TL at a rate significantly greater than $R^{3/2}$.

Numerical results of the model are incorporated into a TIFF file (Dahl_Model.tif ) that is attached to this email report. This file can be added as a layer in an ArcGIS map and transects can be drawn and interpolated (using the Interpolate Shape tool). In this way the model associated with any radial transect that originates from the source location can be extracted. Figure 1 displays a summary of the model for San Diego Bay along with two representative transects, with TL versus range for these two transects plotted in Fig. 2.

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[1] K. L. Williams, D. R. Jackson, E. I. Thorsos, D. Tang, and S. G. Schock,"Comparison of sound speed and attenuation measured in a sandy sediment to predictions based on the Biot theory of porous media," IEEE J. Ocean. Eng. 27, 413–428 (2002).

[2] J. Zhou, X. Zhang, and D. P. Knobles, "Low-frequency geoacoustic model for the effective properties of sandy bottoms," J. Acoust. Soc. Am. 125, 2847–2866 (2009).

[3] P.G. Reinhall, & P.H. Dahl, "Underwater Mach wave radiation from impact pile driving: Theory and observation", J. Acoust. Soc. Am. 130, 3, 1209-1216 (September 01, 2011).

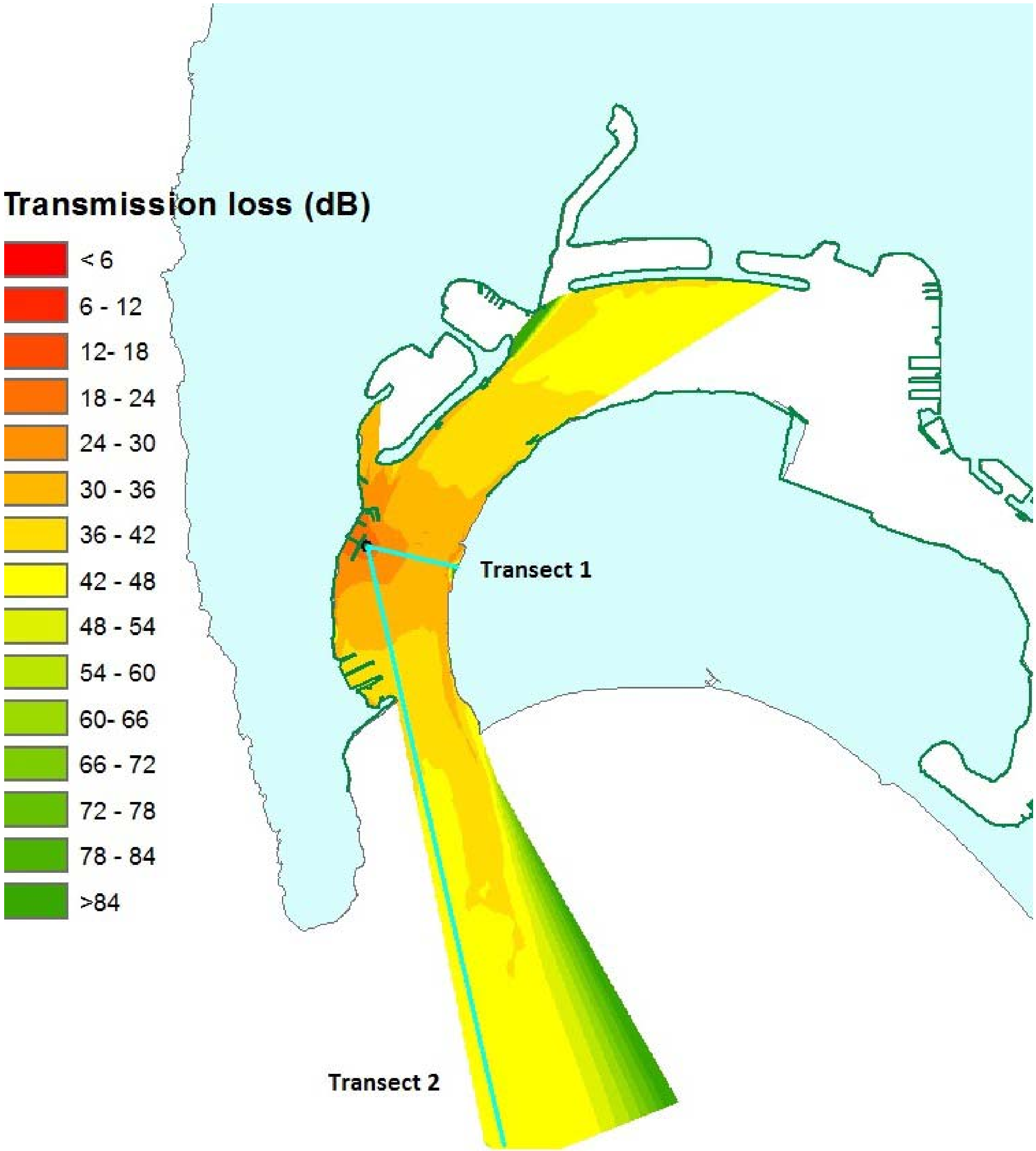



Figure 1. Transmission loss in San Diego associated with impact pile driving source located at 477888.7 N, 3618101W. Two transects that originate from the source are shown.

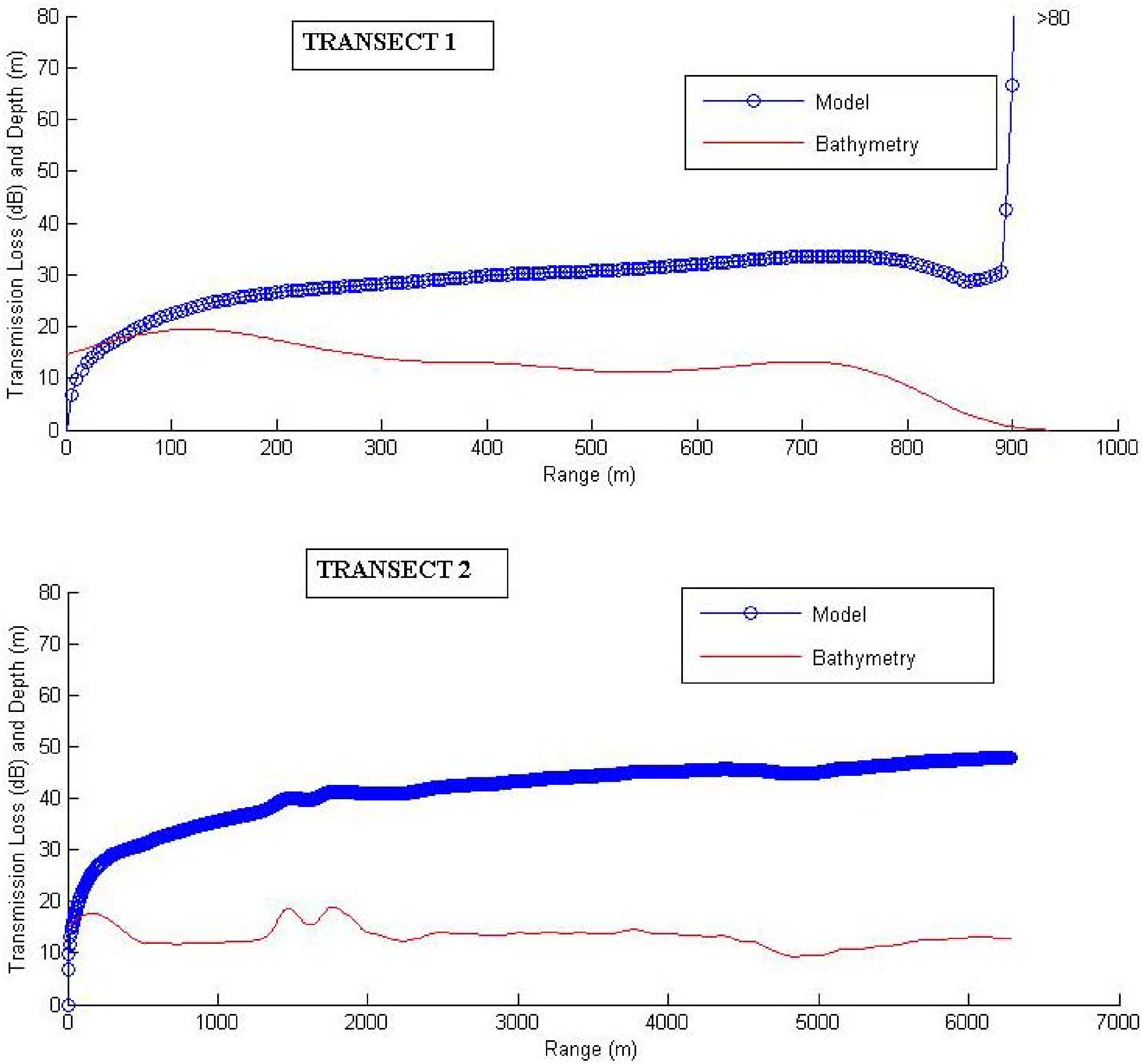
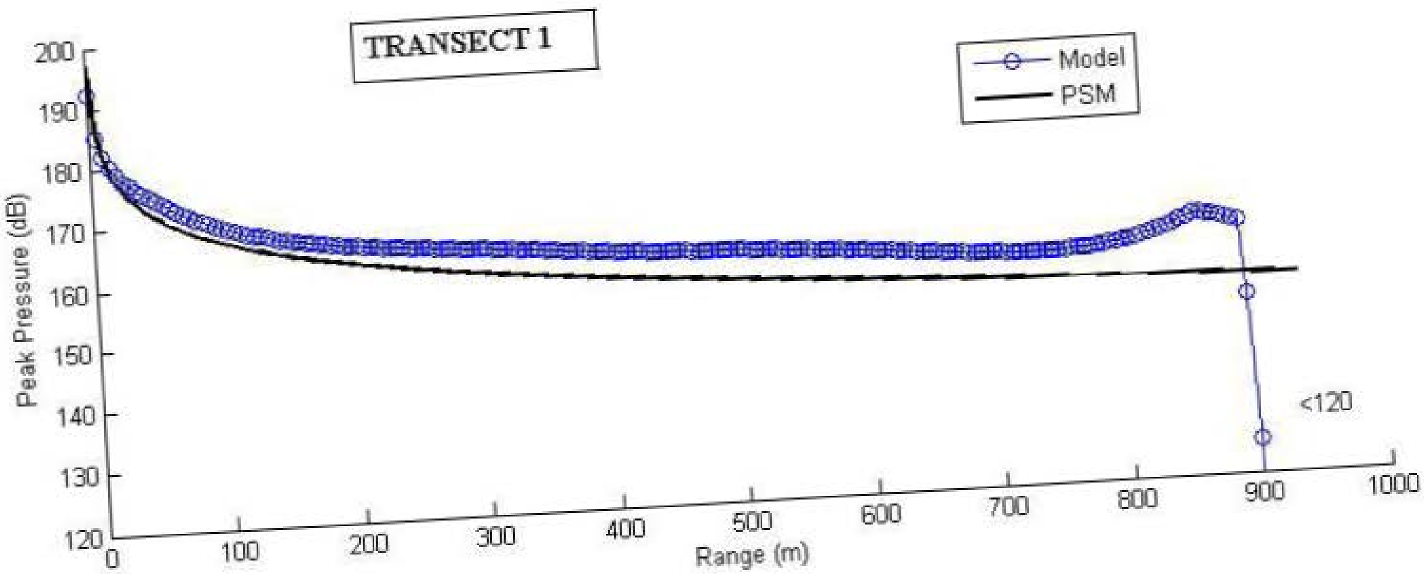



Figure 2. Transmission loss (in dB) and bathymetry (in m) for sample transects in San Diego plotted on the same scale. Note that for transect 1 only the first 80 dB of TL is plotted.

An example of how the model is applied, along with how results from it can differ from results obtained with the PSM is shown in Fig. 3. For this we assume a pile driving peak amplitude of 182 dB re 1 μPa exists at range 10 m for water depth 14.7 m, as given by the Cal Trans Report[4] for 0.6 m (24 inch) AZ steel sheet pile. Current use of the PSM takes this 182 dB value as a 10-m datum, from which estimates at extended range R m from the pile are computed to be equal to 182 – 15log10(R/10). For

[4] California Department of Transportation, "Technical Guidance for the Assessment and Mitigation of the Hydroacoustic Effects of Pile-driving on Fish" (2009).

example, at range 100 m, the estimate for peak level is reduced by 15 dB and is estimated to be 167 dB re 1 μPa. The model provided here gives TL starting from range 1 m (0 dB), and will show a TL at 10 m equal to 10 dB owing to cylindrical spreading and the influence of R*. Thus, to use the Cal Trans value as a 10-m datum, *one must subtract 10 dB from our model TL curve such that at range 10 m TL = 0 dB.* Results of this simple operation are shown in Fig. 3 along with comparable results using the PSM.



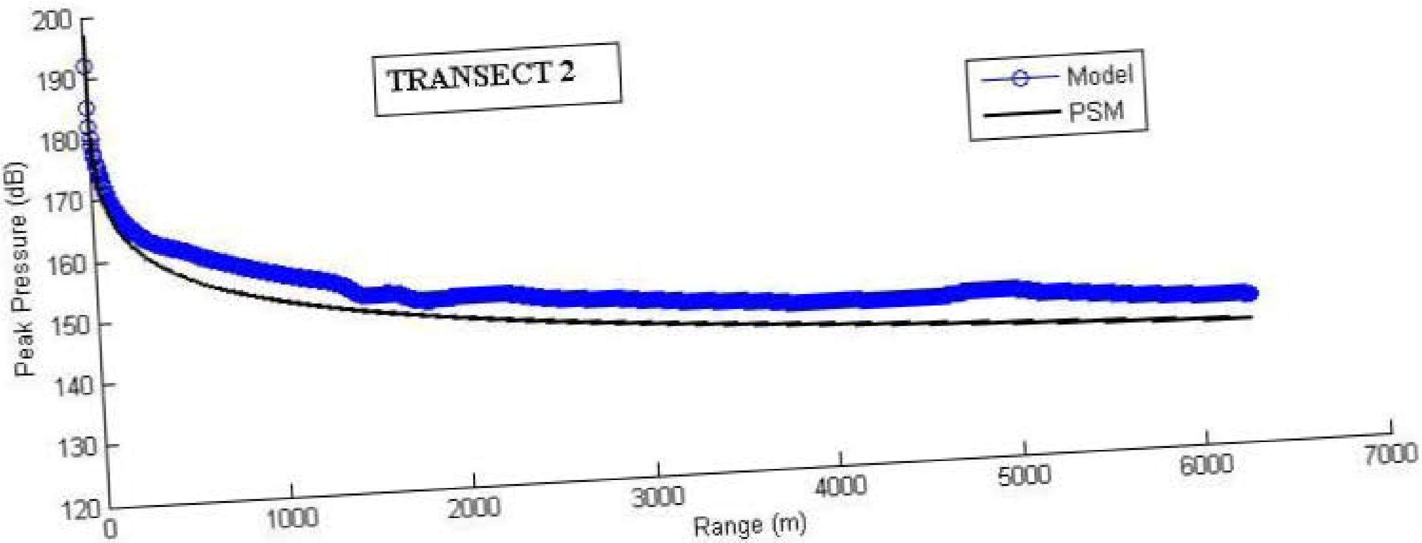



Figure 3. Comparison of peak levels calculated using PSM and Model based on a peak amplitude of 182 dB re 1 µPa, at range 10 m (or 10-m datum) .

## A note on ArcGIS raster data

The model incorporated into a map of TL, such as Fig. 1, is provided in .tif format and included in the attached zip file. Note that recovery of the model TL curve associated with a particular transect from the ArcGIS raster data will produce an artifact in that curve for ranges < 10 m as shown in Fig. 4. A simple work-around for this effect is to ensure in subsequent calculations that TL = 0 dB for range = 1 m, and TL = 10 dB for range = 10m; beyond these ranges the accuracy of the recovered TL curve will be sufficient.

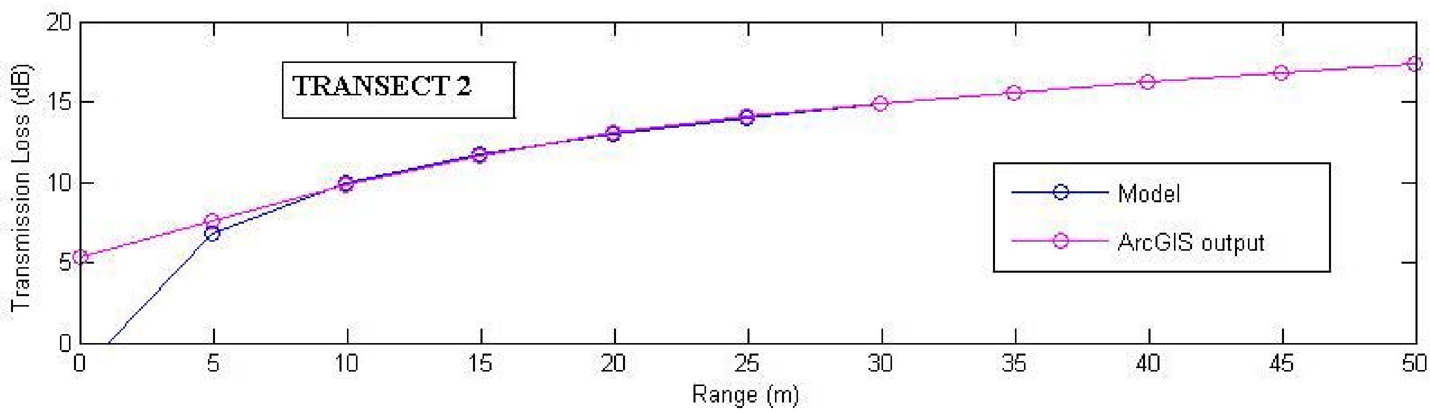



Figure 4. Comparison of ArcGIS output and Matlab model output for Transmission loss (in dB) for transect 2. The first 50 m of range is displayed.

# Appendix B
# Ambient Underwater Sound Measurements in San Diego Bay

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# P-151 Fuel Pier MILCON

## Ambient Sound Data Acquisition

Tierra Data Inc. (TDI), in collaboration with Dr. Ken Richter of SPAWAR Systems, continue to collect, process, and analyze ambient acoustic data within the projected zone of influence (ZOI) for both impact pile driving and vibratory pile driving scheduled to take place during the construction of the P – 151 Fuel Pier MILCON within San Diego Bay. Acoustic sound modeling of the project footprint and San Diego Bay, performed by Dr. Peter Dahl of the University of Washington, bounded the area from which sound pressure level (SPL) measurements were taken. Station locations were chosen to collect ambient data in the domain of Peter Dahl's transmission loss model. While collecting data, an observational log was maintained with the date, time, depth, and GPS location of the hydrophone as well as possible sound sources noted on the surface. Table B-1 is the log for acoustic data collection from April 30 to June 1, 2012 with only the first of any noise sources noted (for brevity).

SPLs were collected at mid water depth and 1 m below the surface on 7 separate days during daylight with a calibrated omni-directional hydrophone (Reson TC 4033) with a relatively flat response from a few Hz to 80 kHz. Gear was deployed from a 20ft Boston Whaler either anchored or tied to a buoy or structure. Sound pressures were recorded in 1/3 octave bins from 3 Hz to 20 kHz every 0.01 seconds (Larson Davis 831 sound level meter) for approximately 10 minutes at each location and depth. Hence, approximately 60,000 measurements over this frequency range were collected at each location and depth on 7 occasions. Statistics on the root-mean-square (rms) pressure levels over the 0.01 second intervals for each frequency band were recorded. In addition, statistics on the rms pressure level integrated from 3 Hz to 20 kHz were recorded, as well as the instantaneous peak pressure recorded over the 10 minute recording window at each station and depth.

Figures B-1, B-2 and B-3 are spatial contour plots of the median SPL data for each 10 minute collection, median SPL data collected at 1 m below the surface, and median SPL data collected from the mid water column, respectively. Average ambient SPLs ranged between roughly 120 and 132 dB. The black crosses mark the sampling locations as described in Section 2.3.4, Figure 2-3, and Table B-1.

Additional acoustic data acquisition will now extend over longer time intervals, in additional locations, and overnight to capture potential variation in the ambient sound levels within northern San Diego Bay.

**Table B-1: Observational log of acoustic sample locations for data shown.**

| Date | Time | Latitude | Longitude | Median RMS Pressure | Max RMS Pressure | Location | Depth | Time | Event | Distance |
|---|---|---|---|---|---|---|---|---|---|---|
| Monday, April 30, 2012 | 2:43 PM | 32°43.427' | -117°11.472' | 121.5 | 147.4 | Site 1 | 1m | 14:42:17 GMT-07 | small bout | |
| Monday, April 30, 2012 | 2:57 PM | 32°43.424' | -117°11.472' | 122.1 | 136.1 | Site 1 | 8m | 15:08:30 GMT-07 | end - no events | |
| Monday, April 30, 2012 | 3:23 PM | 32°43.180' | -117°12.120' | 123.3 | 139.8 | Site 2 | 1m | 15:35:00 GMT-07 | end - no events | |
| Monday, April 30, 2012 | 3:35 PM | 32°43.180' | -117°12.119' | 123.2 | 140.5 | Site 2 | 8m | 15:36:00 GMT-07 | end - no events | |
| Monday, April 30, 2012 | 3:57 PM | 32°43.236' | -117°13.020' | 122.9 | 130.7 | Site 3 | 1m | 16:07:00 GMT-07 | end - no events | |
| Monday, April 30, 2012 | 4:08 PM | 32°43.235' | -117°13.020' | 130.8 | 165.9 | Site 3 | 8m | 16:18:00 GMT-07 | Navy ship & tug in channel | .3 miles |
| Monday, April 30, 2012 | 4:33 PM | 32°42.713' | -117°14.056' | 122 | 138 | Site 4 | 1m | 16:44:11 GMT-07 | end - no events | |
| Monday, April 30, 2012 | 4:45 PM | 32°42.712' | -117°14.056' | 123 | 143 | Site 4 | 6m | 16:55:00 GMT-07 | end - no events | |
| Monday, April 30, 2012 | 5:14 PM | 32°40.384' | -117°13.464' | 129.2 | 143.9 | Site 8 | 1m | 17:24:00 GMT-07 | 2 Navy boats | 500m |
| Monday, April 30, 2012 | 5:24 PM | 32°40.384' | -117°13.463' | 129.9 | 135.2 | Site 8 | 8m | 17:35:00 GMT-07 | no events | |
| Monday, April 30, 2012 | 5:49 PM | 32°39.358' | -117°13.384' | 121.1 | 138.3 | Site 9 | 1m | 18:00:00 GMT-07 | no events | |
| Monday, April 30, 2012 | 5:59 PM | 32°39.360' | -117°13.383' | 120.8 | 132.4 | Site 9 | 8m | 18:10:00 GMT-07 | no events | |
| Tuesday, May 01, 2012 | 8:45 AM | 32°43.448' | -117°11.486' | 121.5 | 134.6 | Site 1 | 1m | 08:57:00 GMT-07 | end - no events | |
| Tuesday, May 01, 2012 | 8:58 AM | 32°43.447' | -117°11.487' | 121 | 135.4 | Site 1 | 8m | 09:08:00 GMT-07 | end - no events | |
| Tuesday, May 01, 2012 | 9:17 AM | 32°43.175' | -117°12.161' | 122.6 | 148.3 | Site 2 | 1m | 09:26:00 GMT-07 | 8m Navy boat | 200m |
| Tuesday, May 01, 2012 | 9:40 AM | 32°43.171' | -117°12.165' | 124.1 | 136.9 | Site 2 | 8m | 09:34:00 GMT-07 | Navy security boats 10m - idle | |
| Tuesday, May 01, 2012 | 9:48 AM | 32°43.243' | -117°13.016' | 123.4 | 147.8 | Site 3 | 1m | 10:00:00 GMT-07 | Commercial fishing boat idles by 40m | |
| Tuesday, May 01, 2012 | 10:01 AM | 32°43.243' | -117°13.016' | 126.3 | 151.1 | Site 3 | 8m | 10:06:00 GMT-07 | Commercial crab boat - desiel - 20m | |
| Tuesday, May 01, 2012 | 10:29 AM | 32°42.711' | -117°14.067' | 122.6 | 148.7 | Site 4 | 1m | 10:39:00 GMT-07 | end - no events | |
| Tuesday, May 01, 2012 | 10:40 AM | 32°42.710' | -117°14.067' | 122.5 | 143.5 | Site 4 | 6m | 10:50:00 GMT-07 | end - no events | |
| Tuesday, May 01, 2012 | 11:04 AM | 32°41.934' | -117°13.570' | 120.3 | 137.5 | Site 5 | 1m | 11:14:00 GMT-07 | end - no events | |
| Tuesday, May 01, 2012 | 11:32 AM | 32°41.663' | -117°14.356' | 128.6 | 142.9 | bait barge | 1m | 11:42:00 GMT-07 | pulled anchor - paused and restart | |
| Tuesday, May 01, 2012 | 11:54 AM | 32°41.018' | -117°13.444' | 121 | 136.3 | Site 7 | 1m | 12:05:00 GMT-07 | end? - no events | |
| Tuesday, May 01, 2012 | 1:28 PM | 32°40.410' | -117°13.476' | 129.2 | 152.9 | Site 8 | 1m | 13:38:00 GMT-07 | end - no events | |
| Tuesday, May 01, 2012 | 1:40 PM | 32°40.408' | -117°13.474' | 129.3 | 132.2 | Site 8 | 8m | 13:51:00 GMT-07 | end - no events | |
| Tuesday, May 01, 2012 | 2:03 PM | 32°39.366' | -117°13.400' | 121.2 | 155.1 | Site 9 | 1m | 14:04:48 GMT-07 | Survey vessel engine running first 30 sec | 2m |
| Tuesday, May 01, 2012 | 2:13 PM | 32°39.366' | -117°13.399' | 122.4 | 130.5 | Site 9 | 8m | 14:15:00 GMT-07 | Navy ship in Channel | 300m |
| Tuesday, May 01, 2012 | 2:29 PM | 32°39.301' | -117°12.919' | 121.1 | 157.8 | Site 10 | 1m | 14:37:00 GMT-07 | moved cable by hand | 0m |
| Tuesday, May 01, 2012 | 2:40 PM | 32°39.300' | -117°12.920' | 119.5 | 132.3 | Site 10 | 8m | 14:51:00 GMT-07 | end - no events | |
| Wednesday, May 02, 2012 | 11:10 AM | 32°43.437' | -117°11.488' | 119.7 | 127.7 | Site 1 | 1m | 11:13:34 GMT-07 | 3m inflatible | |
| Wednesday, May 02, 2012 | 11:22 AM | 32°43.436' | -117°11.489' | 122.3 | 134.5 | Site 1 | 8m | 11:23:00 GMT-07 | 10m & 7m boats | |
| Wednesday, May 02, 2012 | 11:57 AM | 32°43.168' | -117°12.148' | 123.2 | 139.3 | Site 2 | 8m | 11:59:00 GMT-07 | 5 - 4m speed boats in a line | 100m |
| Wednesday, May 02, 2012 | 12:18 PM | 32°43.251' | -117°13.018' | 123.2 | 134.4 | Site 3 | 1m | 12:25:00 GMT-07 | 2 - 20m boats | 150m |
| Wednesday, May 02, 2012 | 12:29 PM | 32°43.248' | -117°13.014' | 124.8 | 150.9 | Site 3 | 8m | 12:31:00 GMT-07 | 14m sailboat | 200m |
| Wednesday, May 02, 2012 | 1:01 PM | 32°42.712' | -117°14.057' | 124.1 | 140.1 | Site 4 | 1m | 13:04:26 GMT-07 | 15m boat | 100m |

| Date | Time | Latitude | Longitude | Median RMS Pressure | Max RMS Pressure | Location | Depth | Time | Event | Distance |
|---|---|---|---|---|---|---|---|---|---|---|
| Wednesday, May 02, 2012 | 1:12 PM | 32°42.713' | -117°14.060' | 123.1 | 153.3 | Site 4 | 6m | 13:17:30 GMT-07 | 15m boat | 100m |
| Wednesday, May 02, 2012 | 1:38 PM | 32°41.929' | -117°13.575' | 115.7 | 142.9 | 5 | | | | |
| Wednesday, May 02, 2012 | 1:44 PM | 32°41.930' | -117°13.576' | 120.2 | 162.2 | Site 5 | 1m | 13:47:30 GMT-07 | Security boat | 200m |
| Wednesday, May 02, 2012 | 2:03 PM | 32°41.739' | -117°14.163' | 125.5 | 138.9 | Site 6 | 1m | 14:07:15 GMT-07 | 20m fishing boat | |
| Wednesday, May 02, 2012 | 2:14 PM | 32°41.739' | -117°14.163' | 124.9 | 128 | bait barge | 8m | 14:14:24 GMT-07 | 20m fishing boat | 50m |
| Wednesday, May 02, 2012 | 2:25 PM | 32°41.740' | -117°14.161' | 127.5 | 135.5 | bait barge | | | | |
| Wednesday, May 02, 2012 | 2:34 PM | 32°41.031' | -117°13.441' | 120.2 | 140.8 | Site 7 | 1m | 14:34:00 GMT-07 | 30m navy vessel | 300m |
| Wednesday, May 02, 2012 | 2:53 PM | 32°40.397' | -117°13.471' | 129.1 | 137.1 | Site 8 | 1m | 14:53:01 GMT-07 | 30m Navy vessel | 150m |
| Wednesday, May 02, 2012 | 3:04 PM | 32°40.398' | -117°13.471' | 129.4 | 136.3 | Site 8 | 8m | 15:05:31 GMT-07 | Navy ship | 150m |
| Wednesday, May 02, 2012 | 3:26 PM | 32°39.301' | -117°12.911' | 119.9 | 135.1 | Site 10 | 1m | 15:31:00 GMT-07 | Sub | 400m |
| Wednesday, May 02, 2012 | 3:38 PM | 32°39.302' | -117°12.914' | 121.9 | 137.7 | Site 10 | 8m | 15:38:00 GMT-07 | 30m sailboat | 50m |
| Wednesday, May 02, 2012 | 3:57 PM | 32°39.372' | -117°13.372' | 119.5 | 136.2 | Site 9 | 1m | 15:58:00 GMT-07 | no events | |
| Wednesday, May 02, 2012 | 4:08 PM | 32°39.371' | -117°13.373' | 120 | 128.7 | Site 9 | 8m | 16:08:00 GMT-07 | no events | |
| Saturday, May 05, 2012 | 8:54 AM | 32°43.438' | -117°11.485' | 118.7 | 141.8 | Site 1 | 1m | 08:55:27 GMT-07 | Security boat | 200m |
| Saturday, May 05, 2012 | 9:06 AM | 32°43.436' | -117°11.491' | 119.8 | 137.8 | Site 1 | 1m | 08:55:27 GMT-07 | Security boat | 200m |
| Saturday, May 05, 2012 | 9:30 AM | 32°43.158' | -117°12.137' | 119.7 | 133.3 | Site 2 | 1m | 09:32:21 GMT-07 | 7m boat | 100m |
| Saturday, May 05, 2012 | 9:41 AM | 32°43.160' | -117°12.140' | 121.3 | 139.2 | Site 2 | 8m | 09:42:07 GMT-07 | 10m security boat | 70m |
| Saturday, May 05, 2012 | 10:03 AM | 32°43.241' | -117°13.027' | 122.5 | 144.9 | Site 3 | 1m | 10:03:32 GMT-07 | 15m boat | 60 m |
| Saturday, May 05, 2012 | 10:14 AM | 32°43.244' | -117°13.028' | 124.9 | 135.9 | Site 3 | 8m | 10:14:59 GMT-07 | 3m inflatable and 9m boat | 60m |
| Saturday, May 05, 2012 | 10:56 AM | 32°42.698' | -117°14.043' | 121.5 | 137.9 | Site 4 | 1m | 10:56:28 GMT-07 | 3m inflatable | 35m |
| Saturday, May 05, 2012 | 11:06 AM | 32°42.697' | -117°14.042' | 122.9 | 144.5 | Site 4 | 7m | 11:07:39 GMT-07 | 15m boat (same boat as Event 3 in Site 4 1m session) | 20m |
| Saturday, May 05, 2012 | 11:35 AM | 32°41.733' | -117°14.168' | 123.7 | 128.9 | bait barge | 1m | 11:35:51 GMT-07 | 10m boat | 20m |
| Saturday, May 05, 2012 | 11:46 AM | 32°41.733' | -117°14.168' | 128.3 | 145.6 | bait barge | 8m | 11:48:22 GMT-07 | 5 5m boats on tour | 25m |
| Saturday, May 05, 2012 | 12:15 PM | 32°41.019' | -117°13.436' | 117.6 | 144.8 | Site 7 | 1m | 12:15:30 GMT-07 | several boats | 200m |
| Saturday, May 05, 2012 | 12:33 PM | 32°40.419' | -117°13.441' | 130.5 | 143.2 | Site 8 | 1m | 12:38:36 GMT-07 | 13m sailboat (mininal effect) | 25m |
| Saturday, May 05, 2012 | 12:44 PM | 32°40.420' | -117°13.441' | 131 | 148.6 | Site 8 | 8m | 12:52:13 GMT-07 | F16(?) jet right above us | 300m |
| Tuesday, May 15, 2012 | 10:50 AM | 32°43.433' | -117°11.495' | 116 | 163.4 | Site 1 | 1m | 10:54 | 28ft 2xOB | 200m |
| Tuesday, May 15, 2012 | 11:03 AM | 32°43.431' | -117°11.493' | 120.1 | 161.2 | Site 1 | 8m | 11:11 | 28ft 2xOB | 200m |
| Tuesday, May 15, 2012 | 11:22 AM | 32°43.161' | -117°12.138' | 119.1 | 134.6 | Site 2 | 1m | 11:31 | 30ft Sailboat | 25m |
| Tuesday, May 15, 2012 | 11:33 AM | 32°43.162' | -117°12.137' | 121.3 | 137.1 | Site 2 | 8m | 11:36 | 21ft IO | 75m |
| Tuesday, May 15, 2012 | 11:51 AM | 32°43.245' | -117°13.010' | 121.7 | 138.6 | Site 3 | 1m | 11:53 | 16ft OB | 40m |
| Tuesday, May 15, 2012 | 12:01 PM | 32°43.248' | -117°13.010' | 122.7 | 157.3 | Site 3 | 8m | 12:08 | 80ft 2xIn | 60m |
| Tuesday, May 15, 2012 | 12:28 PM | 32°42.693' | -117°14.057' | 119.5 | 137.8 | Site 4 | 1m | 12:38 | 70ft 2xIN | 30m |
| Tuesday, May 15, 2012 | 12:39 PM | 32°42.690' | -117°14.057' | 130.3 | 147.9 | Site 4 | 8m | 12:47 | 30ft IO | 10m |
| Tuesday, May 15, 2012 | 12:59 PM | 32°41.738' | -117°14.161' | 122.1 | 138.4 | bait barge | 1m | 12:59 | 50ft In | 60m |
| Tuesday, May 15, 2012 | 1:10 PM | 32°41.739' | -117°14.162' | 123.8 | 139.7 | bait barge | 8m | 13:10 | 30ft In | 30m |
| Tuesday, May 15, 2012 | 1:27 PM | 32°40.395' | -117°13.468' | 126.9 | 134.4 | Site 8 | 1m | No Events | | |
| Tuesday, May 15, 2012 | 1:39 PM | 32°40.397' | -117°13.467' | 127.8 | 131.3 | Site 8 | 8m | No Events | | |

| Date | Time | Latitude | Longitude | Median RMS Pressure | Max RMS Pressure | Location | Depth | Time | Event | Distance |
|---|---|---|---|---|---|---|---|---|---|---|
| Thursday, May 24, 2012 | 10:08 AM | 32°43.440' | -117°11.475' | 126.7 | 144.5 | site 1 | 1 m | 10:11:55 | 30 m tour boat | 200 m |
| Thursday, May 24, 2012 | 10:21 AM | 32°43.438' | -117°11.474' | 128.1 | 138.6 | site 1 | 8m | 10:22:01 | Navy tug at 300 m and Navy whaler at 100 m | |
| Thursday, May 24, 2012 | 10:46 AM | 32°43.161' | -117°12.126' | 129.5 | 142.2 | site 2 | 1m | 10:47:00 | 15 m boat and tour boat 30m at 200 m | 70 m |
| Thursday, May 24, 2012 | 11:05 AM | 32°43.247' | -117°12.997' | 131.3 | 135.5 | site 3 | 1m | 11:05:50 | 10 m boat | 50 m |
| Thursday, May 24, 2012 | 11:20 AM | 32°43.246' | -117°12.996' | 124.7 | 138 | site 3 | 15 m | 11:24:57 | high speed navy rib boat 9 m | 200 m |
| Thursday, May 24, 2012 | 11:49 AM | 32°42.717' | -117°14.051' | 129.3 | 128.3 | Site 4 | 1 m | 11:58:47 | 10 m sail boat | 50 m |
| Thursday, May 24, 2012 | 12:02 PM | 32°42.717' | -117°14.051' | 124.8 | 144.2 | site 4 | 7m | 12:03:48 | 3m infatable | 30m |
| Thursday, May 24, 2012 | 12:30 PM | 32°41.738' | -117°14.165' | 124.4 | 135.4 | bait barge | 1m | 12:32:40 | navy rib boat 8 m speeding | 400m |
| Thursday, May 24, 2012 | 12:04 PM | 32°41.737' | -117°14.165' | 132.9 | 141.2 | bait barge | 12 m | 12:44:25 | 20 m fishing boat | 400 m |
| Thursday, May 24, 2012 | 1:08 PM | 32°41.024' | -117°13.434' | 123.8 | 137.7 | site 7 | 1m | no events | | |
| Friday, June 01, 2012 | 9:33 AM | 32°43.438' | -117°11.484' | 123.8 | 144.1 | 1 | 1 | 9:40:52 | 1 | 30 |
| Friday, June 01, 2012 | 9:47 AM | 32°43.437' | -117°11.486' | 125.5 | 143.4 | 1 | 28 feet | 9:50:30 | 15 foot boat | 30 meters |
| Friday, June 01, 2012 | 10:14 AM | 32°43.163' | -117°12.130' | 124.1 | 140.5 | 2 | 1 | 10:16:03 | 25 foot | 300 yards |
| Friday, June 01, 2012 | 10:28 AM | 32°43.161' | -117°12.132' | 124.8 | 144.6 | 2 | 45 feet | 10:37:55 | police boat 20 foot | 500 feet |
| Friday, June 01, 2012 | 10:52 AM | 32°43.239' | -117°13.016' | 121.3 | 132.3 | 3 | 1 | 10:57:45 | 45 foot | 30 feet |
| Friday, June 01, 2012 | 11:04 AM | 32°43.246' | -117°13.017' | 127 | 141 | 3 | 7 meters | 11:05:13 | 30 foot sail boat | 200 feet |
| Friday, June 01, 2012 | 11:34 AM | 32°42.704' | -117°14.058' | 118.5 | 136.5 | 4 | 1 | 11:35:47 | 50 foot | 50 foot |
| Friday, June 01, 2012 | 11:45 AM | 32°42.705' | -117°14.059' | 120.4 | 143.2 | 4 | 27 feet | 11:46:43 | 40 foot sailboat | 60 feet |
| Friday, June 01, 2012 | 12:21 PM | 32°41.727' | -117°14.175' | 118.9 | 130.6 | bait barge | 1 | | | |
| Friday, June 01, 2012 | 12:34 PM | 32°41.727' | -117°14.173' | 123.6 | 151.1 | bait barge | 50 feet | 12:36:47 | 60 foot in-engine boat | 50 feet |
| Friday, June 01, 2012 | 2:52 PM | 32°41.907' | -117°13.580' | 113.4 | 134.6 | 5 | 1 | 14:55:35 | 20 ft | 120 feet |
| Friday, June 01, 2012 | 3:12 PM | 32°41.028' | -117°13.440' | 116.3 | 130.5 | 7 | 1 | | | |
| Friday, June 01, 2012 | 3:25 PM | 32°41.028' | -117°13.440' | 123 | 138.4 | 7 | 12 feet | 15:28:04 | 12 ft | 125 feet |
| Friday, June 01, 2012 | 3:42 PM | 32°40.399' | -117°13.479' | 125.2 | 134.8 | 8 | 1 | | | |
| Friday, June 01, 2012 | 3:54 PM | 32°40.399' | -117°13.478' | 125.7 | 130.6 | 8 | 26 feet | 15:58:18 | 24 ft | 450 feet |
| Friday, June 01, 2012 | 4:15 PM | 32°39.358' | -117°13.378' | 116.4 | 136.7 | 9 | 1 | | | |
| Friday, June 01, 2012 | 4:27 PM | 32°39.357' | -117°13.380' | 115.4 | 130.3 | 9 | 50 feet | | | |

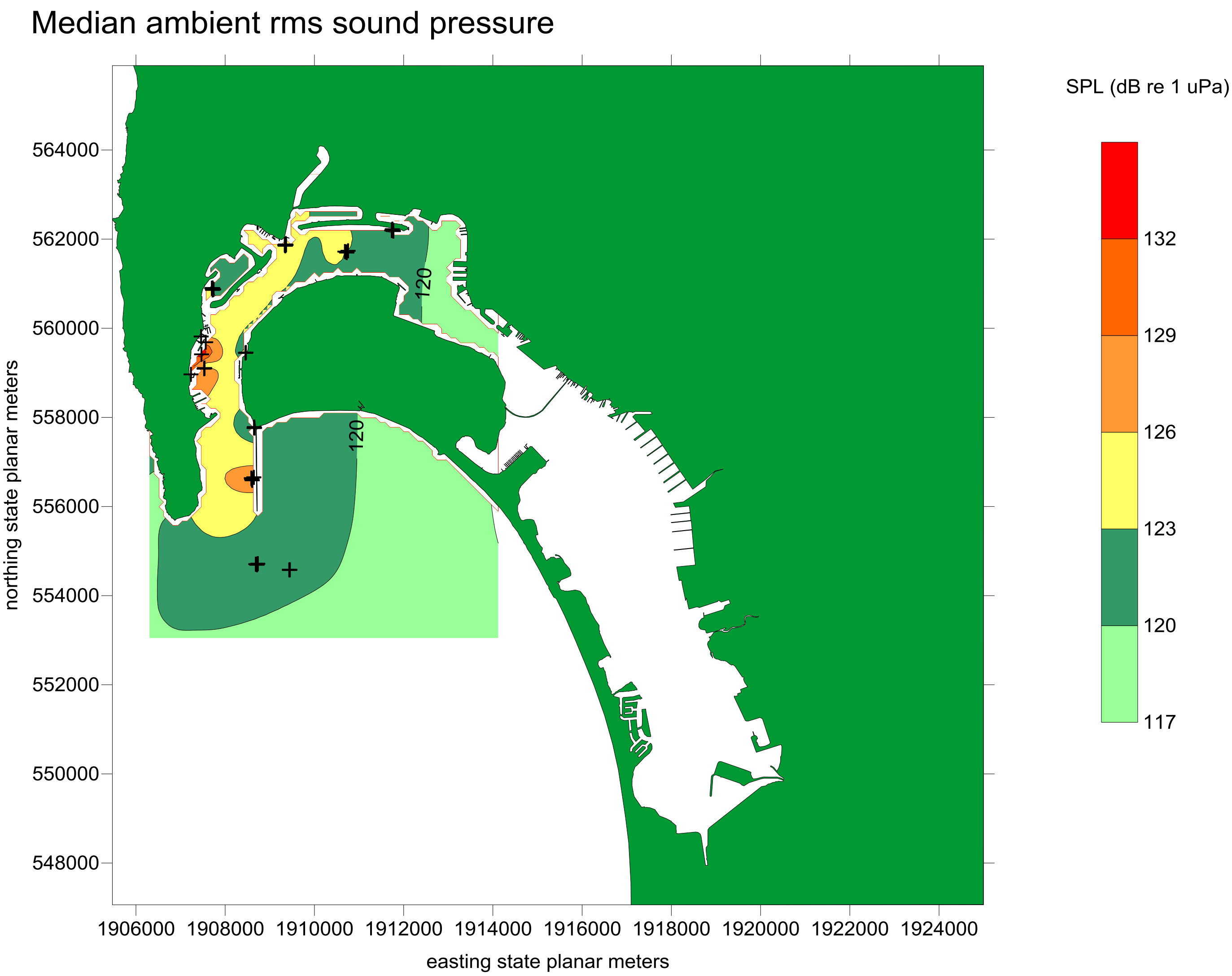


**Figure B-1: Median ambient SPL, averaged through depth.**

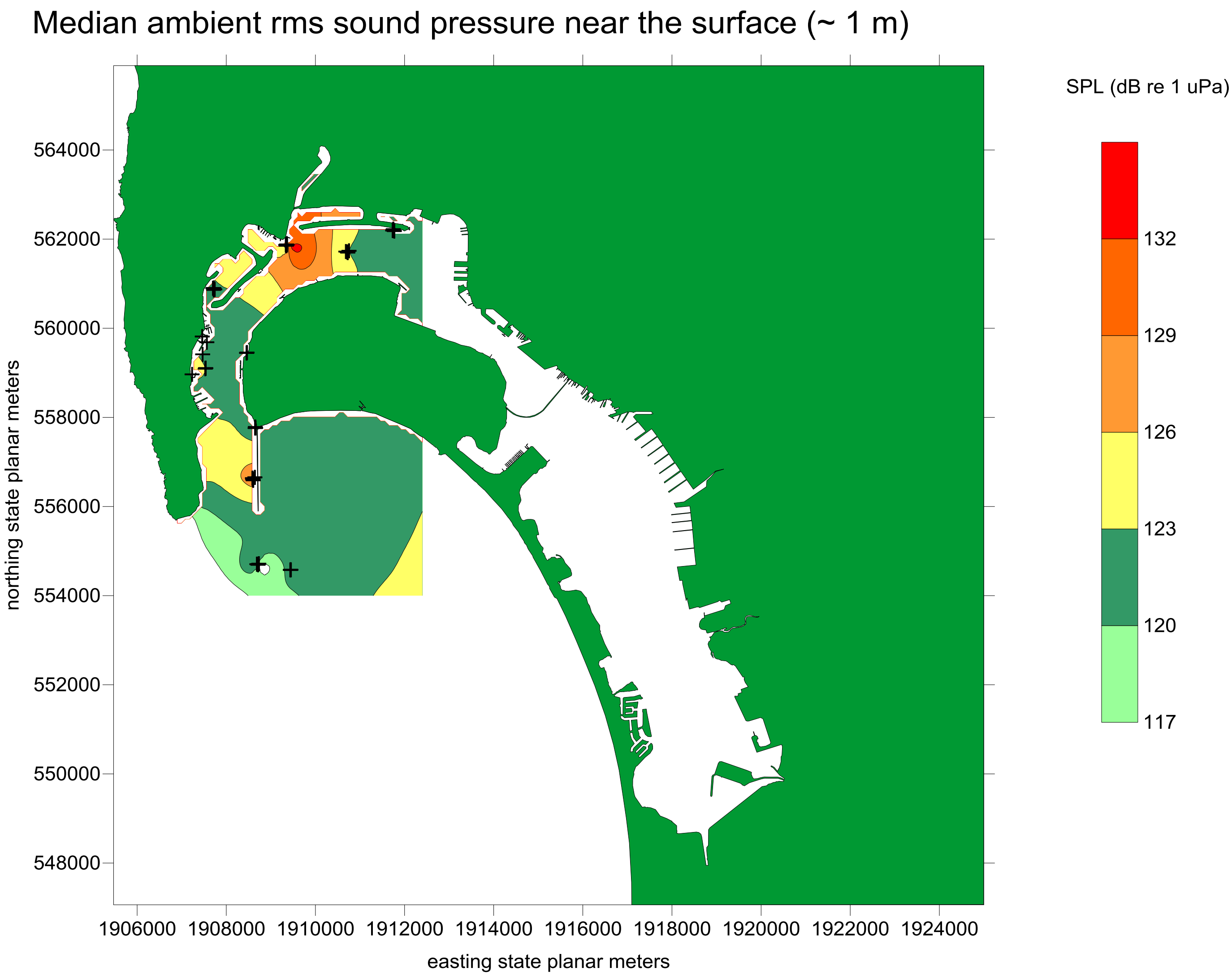


**Figure B-2: Median ambient SPL, measured 1 m below the surface.**

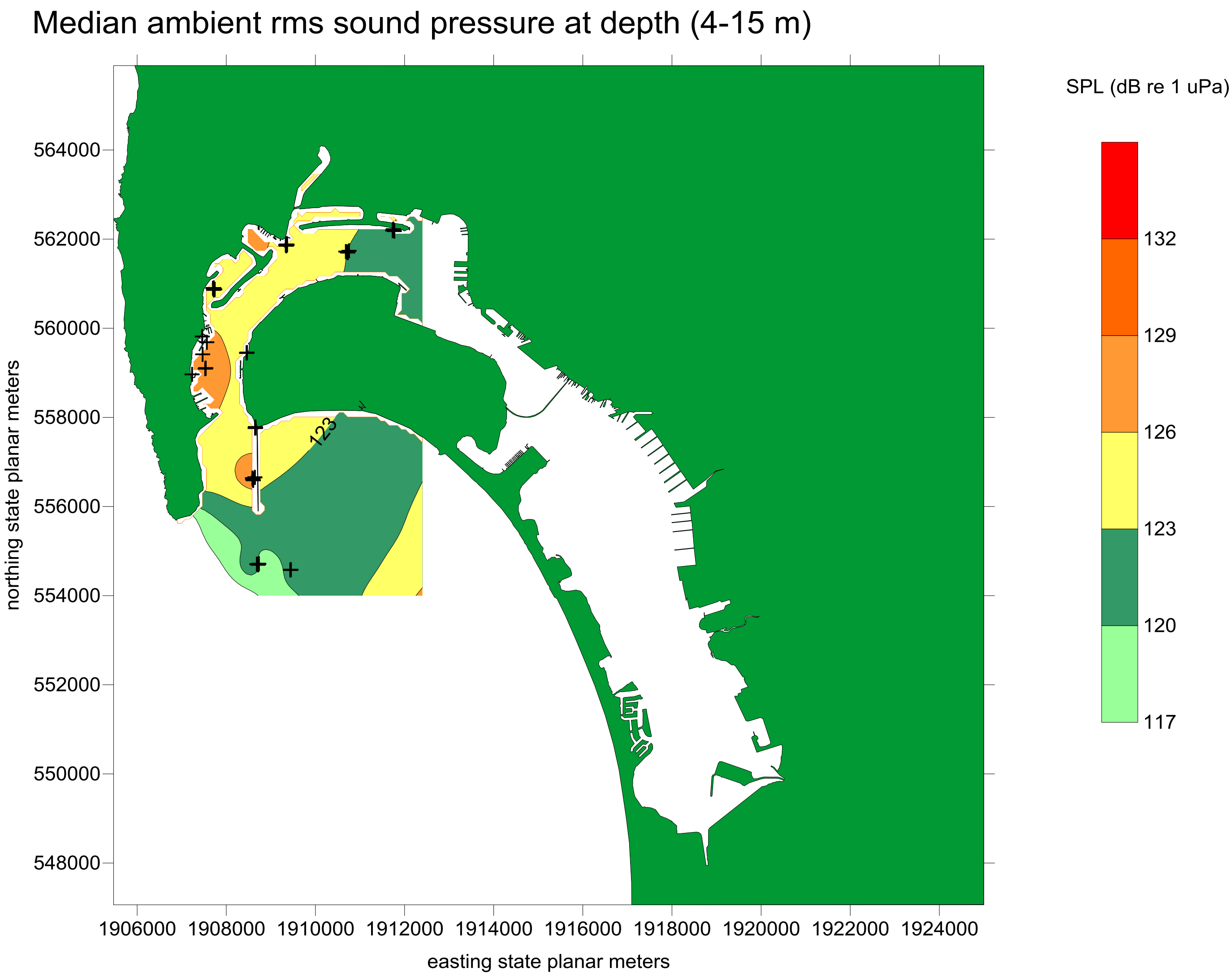


**Figure B-3: Median ambient SPL, measured 1 at mid water column**

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