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**INCIDENTAL HARASSMENT AUTHORIZATION APPLICATION FOR  
THE NAVY'S FLOATING DRY DOCK PROJECT  
AT NAVAL BASE SAN DIEGO**

**15 SEP 2020 THROUGH 14 SEP 2021**

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Submitted to:

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

Prepared by:

**Naval Facilities Engineering Command**

For:

**Naval Base San Diego**

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## ACRONYMS AND ABBREVIATIONS

|                 |   |
|-----------------|---|
| °C              | Celsius   |
| CALTRANS        | California Department of Transportation               |
| CFR             | Code of Federal Regulations                           |
| COL             | Commercial Out Lease                                  |
| cy              | cubic yards   |
| dB              | decibel   |
| Navy            | Department of the Navy                                |
| ESA             | Endangered Species Act                                |
| °F              | Fahrenheit  |
| ft              | foot/feet   |
| Hz              | hertz   |
| IHA             | Incidental Harassment Authorization                   |
| in              | inch(es)  |
| kHz             | kilohertz   |
| km              | kilometer   |
| LMR             | Living Marine Resources                               |
| m               | meter(s)  |
| min             | minute(s)   |
| MGBW            | Marine Group Boat Works                               |
| MLLW            | mean lower low water                                  |
| MMPA            | Marine Mammal Protection Act                          |
| NAVFAC          | Naval Facilities Engineering Command (SW = Southwest) |
| Navy            | U.S. Department of the Navy                           |
| NBSD            | Naval Base San Diego                                  |
| NEPA            | National Environmental Policy Act                     |
| NMFS            | National Marine Fisheries Service                     |
| NOAA            | National Oceanic and Atmospheric Administration       |
| NRSW            | Navy Region Southwest                                 |
| ONR             | Office of Naval Research                              |
| Pa              | Pascal  |
| POSD            | Port of San Diego                                     |
| PSO             | protected species observer                            |
| PTS             | permanent threshold shift                             |
| R&D             | research and development                              |
| RMS             | root mean square                                      |
| s               | second(s)   |
| SEL             | sound exposure level (SELcum = cumulative SEL)        |
| ft <sup>2</sup> | square ft   |
| SPL             | sound pressure level                                  |
| TL              | transmission loss                                     |
| TTS             | temporary threshold shift                             |
| μPa             | microPascal   |
| U.S.            | United States   |
| USACE           | United States Army Corps of Engineers                 |
| 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) for activities associated with the proposed Marine Group Boat Works (MGBW) Commercial Out Lease (COL) Floating Dry Dock (FDD) Project in the south-central part of San Diego Bay associated with Naval Base San Diego (NBSD). For this IHA application, the Navy determined that noise from pile installation activities has the potential to rise to the level of harassment under the MMPA.

One species of marine mammal has a reasonable likelihood of occurrence during the project's timeline and could thereby be exposed to sound pressure levels (SPLs) and sound exposure levels (SELs) associated with non-impulsive and impulsive underwater noise resulting from installation of piles: the California sea lion (*Zalophus californianus*).

The MGBW COL FDD Project is needed to ensure NBSD's capability to conduct berth-side repair and maintenance of vessels, thus protecting the Navy's ability to provide training and equipping of combat-capable naval forces ready to deploy worldwide. Current and projected shortfalls of dry dock space reduce overall maintenance capabilities at NBSD. In this regard, the Proposed Action furthers the Navy's execution of its congressionally mandated roles and responsibilities under 10 U.S.C. Section 5062.

The proposed FDD installation and associated dredging activities would occur at the MGBW COL site, which is approximately 335 meters (m; 1,100 feet [ft]) south of Pier 13 on NBSD. The project site would include a proposed 0.02 square kilometers (km<sup>2</sup>; 5.55-acre) water lease area as well as the proposed 0.002 km<sup>2</sup> (0.88-acre) landside lease area, which would be leased by the Navy to MGBW for a period of 30 years. The in-water Project activities would include a dredge footprint, as well as any support structures constructed for the FDD. Therefore, the total in-water activities would encompass approximately 0.03 km<sup>2</sup> (6.43 acres).

The FDD Project includes:

- 1) Dredging of approximately 165,000 cubic yards (cy) and subsequent sediment disposal activities;
- 2) Installation of two mooring dolphins, including vertical and angled structural piles, as well as fender piles;
- 3) Installation of new access structures;
- 4) Utility modifications; and
- 5) Emplacement and operation of a steel floating dry dock.

The relocation of assets, dredging and sediment disposal, utility modifications, and emplacement and operation of the proposed FDD does not have the potential to result in harassment under the MMPA. Underwater sound associated with pile installation would have the potential to harass marine mammals. The construction elements analyzed in the IHA are described below.

The proposed FDD would require the installation of two mooring dolphins—located forward and aft of the proposed FDD (Navy 2018). The mooring dolphins would each be supported by up to sixteen vertical 24-inch octagonal concrete piles (Navy 2018). The aft mooring dolphin would also require approximately two 24-inch angled steel piles (Navy 2018). Up to eight additional vertically oriented 24-inch steel piles are anticipated for the forward and aft mooring dolphins. Cast-in-place reinforced concrete caps, 9.1 by 9.1 m (30 by 30 ft), would be installed at each mooring dolphin location. Grippers would be secured to

the dolphins' concrete pile caps and used to hold the proposed FDD in position. Construction materials would be delivered by truck and the piles would likely be installed using a floating crane and an impact or vibratory pile driver aided by jetting methods.

Two pedestrian bridges and a vehicle bridge would be constructed to provide landside access and servicing to the proposed FDD. The port-side pedestrian bridge, which would provide access to the port wing deck, would be 35 m (115 ft) long and supported by a landside concrete abutment. The proposed ramp wharf would be approximately 17 by 24 m (80 by 55 ft) long and would support an 18-m (60-ft) long vehicle bridge that would provide vehicle access to the MGBW COL floating dry dock. The ramp wharf would also support the starboard pedestrian bridge, which would provide access to the starboard wing deck. The concrete ramp wharf and vehicle bridge would cover approximately 0.12 acres (ac; 5,360 square feet) and would be supported by twenty-four 24-inch octagonal concrete piles. These access structures, which would be similar to those currently provided at the south berth of the Mole Pier and other Navy piers in the vicinity, would allow for construction vehicles and heavy equipment to be used during maintenance of Navy vessels.

For piles requiring use of the vibratory driver, 10 minutes of non-impulsive sound generation per pile is assumed. The number of final strikes via an impact hammer for each pile installed would be dependent on the underlying geology and the exact placement of the pile. For example, pile-driving activities associated with the Pier 12 replacement required between 500 and 600 blows per pile (Alberto Sanchez 2019, pers. comm.). To be conservative, 600 blows per pile were assumed for impact pile driving relative to potential acoustic impacts.

This IHA application is based on the project design and is intended to cover pile driving activities that may occur between 15 September 2020 and 14 September 2021. Pile installation activities for the proposed FDD are estimated to occur on a maximum of 50 in-water work days within that period.

In this IHA application, the Navy has used National Marine Fisheries Service (NMFS) promulgated thresholds (NMFS 2018) to estimate the number of Level A (injury) and Level B (behavior) takes that would result from pile installation, as outlined in Section 6. Level A takes are not anticipated as part of the action. Empirically measured source levels from similar pile driving events as reported in the literature (California Department of Transportation [CALTRANS] 2015) were used to estimate sound source levels for this project. Underwater sound transmission loss has been modeled using "practical spreading loss," which assumes a loss of 4.5 decibels (dB) with each doubling of distance.

Transect surveys have very infrequently encountered marine mammals south of the Coronado Bridge, and very few surveys have extended as far south as the project area because of the scarcity of marine mammals in this part of the bay. There are no known haulout locations in the project area, although there are structures, such as buoys, that could be used. A single survey in February 2010 (Sorensen and Swope 2010), however, recorded two California sea lions swimming off of NBSD. This is the basis for a reasonable estimate of two California sea lions per day within the potential acoustic zones of influence (ZOIs).

Potential exposures that would constitute takes under the MMPA are calculated in Section 6, and based on this analysis, no mortality or serious injuries are anticipated. The NMFS (2018) threshold and methodology for calculating the distance to the Level A (PTS onset) threshold are used to determine the area of the Level A ZOI for each pile installation activity. If Level A ZOIs are less than 10 m (33 ft), then a minimum 10 m (33 ft) shutdown is required to reduce the likelihood for a physical interaction with Project-related equipment. For the proposed FDD Project, impact pile driving of 24-inch steel piles is the only Project-related activity expected to have a Level A acoustic ZOI beyond the 10 m (33 ft) physical interaction

ZOI (12.8 m [42 ft], rounded to 13 m [43 ft] for monitoring purposes). To further reduce the likelihood of Level A takes, a buffered shutdown zone out to 25 m (82 ft) would be implemented to halt activities that could potentially injure a marine mammal that is near in-water Project-related activities. Takes would be limited to the potential for Level A (minor injury due in the form of permanent hearing threshold shift [PTS]) and Level B (behavioral responses and possible temporary hearing threshold shift [TTS]) harassment. However, with the implementation of a buffered shutdown ZOI of 25 m (82 ft), no Level A takes are anticipated. Previously established thresholds and the aforementioned practical spreading loss model are used to determine the extent of the Level B ZOI for these activities.

Pursuant to the MMPA Section 101(a)(5)(D)<sup>1</sup>, the Navy submits this application to the NMFS for an IHA for the incidental, but not intentional, Level B taking of 368 California sea lions during pile driving activities as part of the installation of the proposed FDD, for a 1-year period beginning on approximately 15 September 2020. The anticipated take of California sea lions would be in the form of non-lethal, temporary harassment and is expected to have a negligible impact on this species. In addition, the taking would not have an immitigable adverse impact on the availability of these species for subsistence use. If in-water activities do not occur within the year anticipated, a request for renewal will be submitted and received by NMFS no later than 60 days prior to the expiration of this IHA. The renewal request will include an explanation that the activities to be conducted under the requested renewal are identical to the activities analyzed under the initial IHA, are a subset of the activities, or include changes so minor that the changes do not affect the previous analyses, mitigation and monitoring requirements, or take estimates (with the exception of reducing the type or amount of take because only a subset of the initially analyzed activities remain to be completed under the Renewal). The renewal request will also include a preliminary monitoring report showing the results of the required monitoring to date and an explanation showing that the monitoring results do not indicate impacts of a scale or nature not previously analyzed or authorized.

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.

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<sup>1</sup> 16 U.S.C. § 1371(a)(5); 50 CFR Part 216, Subpart I.

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# 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

Pursuant to the Marine Mammal Protection Act (MMPA) Section 101(a)(5)(D), the United States Navy (Navy) submits this application to National Marine Fisheries Service (NMFS) for an Incidental Harassment Authorization (IHA) for the incidental taking of marine mammal species during pile driving activities associated with the emplacement of the proposed Marine Group Boat Works (MGBW) Commercial Outlease (COL) Floating Dry Dock (FDD) Project at Naval Base San Diego (NBSD). This application is intended to cover all in-water activities that may result in takes of marine mammals between 15 September 2020 and 14 September 2021, inclusive. Code of Federal Regulations (CFR) 50 216.104 sets out 14 specific items that must be included in requests for take pursuant to Section 101(a)(5)(A) of the MMPA; Those 14 items are addressed in Sections 1 through 14 of this IHA. If in-water activities do not occur within the year anticipated, a request for renewal will be submitted and received by NMFS no later than 60 days prior to the expiration of this IHA. The renewal request will include an explanation that the activities to be conducted under the requested Renewal are identical to the activities analyzed under the initial IHA, are a subset of the activities, or include changes so minor that the changes do not affect the previous analyses, mitigation and monitoring requirements, or take estimates (with the exception of reducing the type or amount of take because only a subset of the initially analyzed activities remain to be completed under the Renewal). The renewal request will also include a preliminary monitoring report showing the results of the required monitoring to date and an explanation showing that the monitoring results do not indicate impacts of a scale or nature not previously analyzed or authorized.

## 1.2 Proposed Action

### 1.2.1 Background

NBSD is a major port for Navy ships assigned to the Pacific Fleet and is the major West Coast logistics base for surface forces of the Navy, dependent activities, and other commands. Activities at NBSD include Continuous Maintenance Availabilities and loading supplies for fleet vessels (Navy 2012, 2016). NBSD contains 12 piers (including a mole pier), two channels, and various quay walls that extend along approximately 9 kilometers (km; 5.6 miles) of shoreline (Figure 1-1). Surface ships, support vessels, and barges receive various ship support services, such as supplies and minor repair or maintenance, when berthed at NBSD. The Commander of the U.S. Pacific Fleet has identified a current and projected shortfall of dry dock space for maintenance of the Pacific Fleet. Specifically, port loading for DDG-51 class vessels is nearly at capacity fleet-wide. The annual rate of Continuous Maintenance Availabilities and need for pier laydown space is anticipated to increase with the increase in the number of vessels to be homeported at NBSD by 2020 (Navy 2012, 2016). The proposed dry dock installation and associated dredging activities would address this shortfall at NBSD and support maintenance operations for Navy LCS-2, LSD-41, and LSD-49 class vessels. While the Navy also needs dry dock facilities for the DDG-51 class of vessels, these ships will be supported at other dry dock facilities in San Diego Bay.

The southern edge of NBSD is located immediately adjacent to the MGBW National City Boatyard, a full-service facility that specializes in refits, repairs, and new construction. The MGBW National City Boatyard includes two maintenance piers, which are between 4.5 and 12.1 m (m; 15 and 40 feet [ft]) wide and extend for approximately 122 m (400 ft). According to a recent Sediment Quality Survey Report, the

existing water depth at this site ranges from approximately -9 to -17 feet mean lower low water (MLLW) (Mission Environmental LLC 2018). The Project site would include the proposed 0.02 square kilometers (km<sup>2</sup>; 5.55-acre) water lease area as well as the proposed 0.004 km<sup>2</sup> (0.88-acre) landside lease area, which would be leased by the Navy to MGBW for a period of 30 years. Therefore, the total project site area would encompass approximately 0.03 km<sup>2</sup> (6.43 acres).

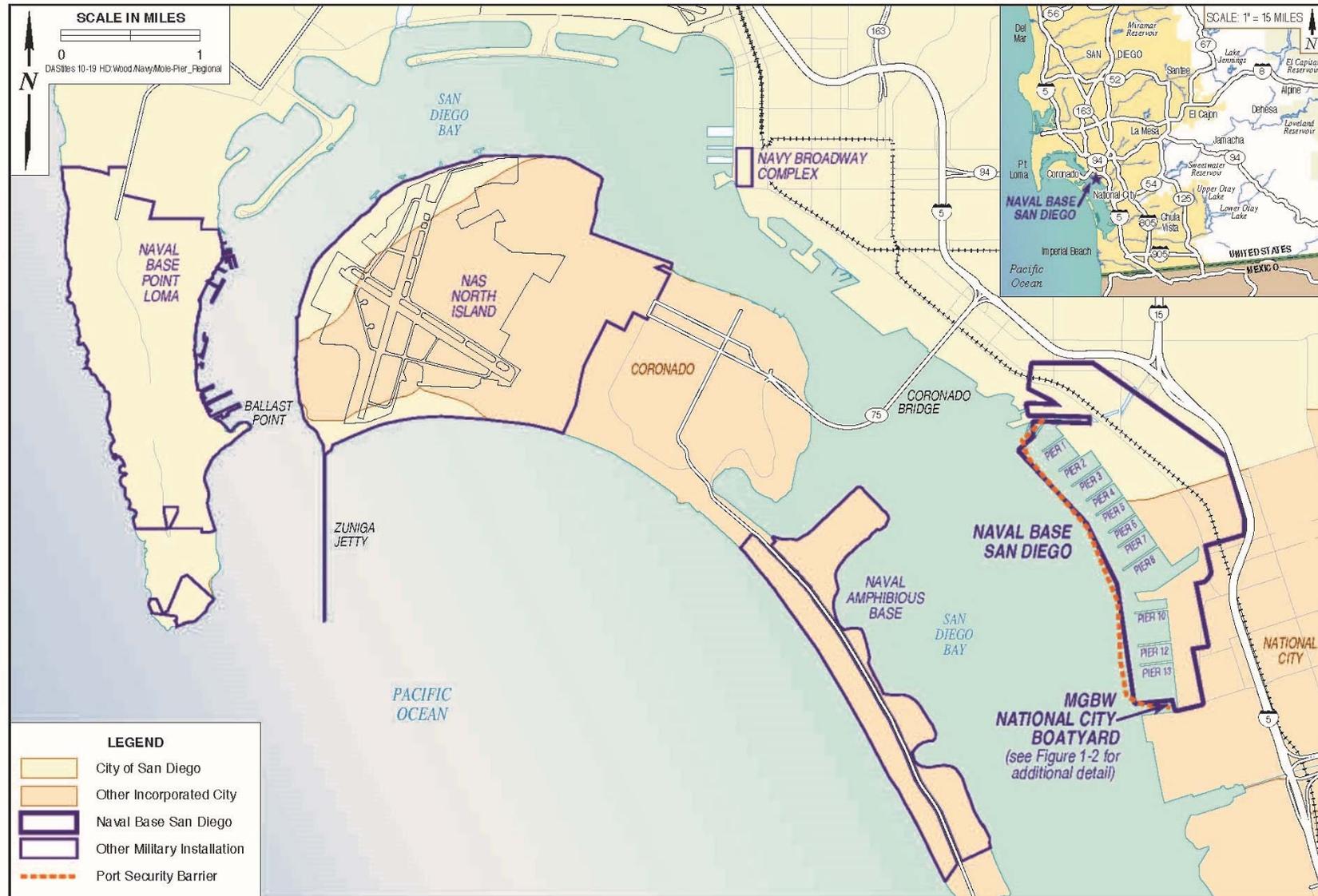


Figure 1-1. Regional Location of Naval Base San Diego

In order to address current and projected shortfall of dry dock space required for maintenance of the Pacific Fleet, the emplacement and operation of a FDD—including all required dredging and sediment disposal, as well as all required construction activities—has been proposed at the MGBW COL Site (Figure 1-2).

### **1.3 Description of Activities**

The scope of the Proposed Action includes the following:

- 6) Dredging of approximately 165,000 cubic yards (cy) and subsequent sediment disposal activities;
- 7) Installation of two mooring dolphins, including vertical and angled structural piles, as well as fender piles;
- 8) Installation of new access structures;
- 9) Utility modifications; and
- 10) Emplacement and operation of a steel floating dry dock.

The Navy has yet to determine the exact source of the proposed FDD and is currently conducting a business analysis of acquisition alternatives; however, the FDD will be constructed off-site and towed to the project area. This review includes the various capacities of potential shipyards and their locations, expected associated costs, and environmental impacts both direct and indirect. It would be possible to construct a FDD in one continuous unit, or to build and transport one in smaller lengths or modules which would then be assembled on site at MGBW. The FDD would be acquired in time for emplacement at both locations after dredging and all other required site modifications have been completed, or shortly thereafter. When an acquisition strategy has been identified, the action details and associated environmental impacts will be analyzed under the National Environmental Policy Act (NEPA) and an appropriate level of subsequent environmental documentation would be prepared. The FDD would not be self-powered or capable of maneuvering with assistance from support vessels; therefore, it would be permanently moored at MGBW COL Site (Figure 1-2).

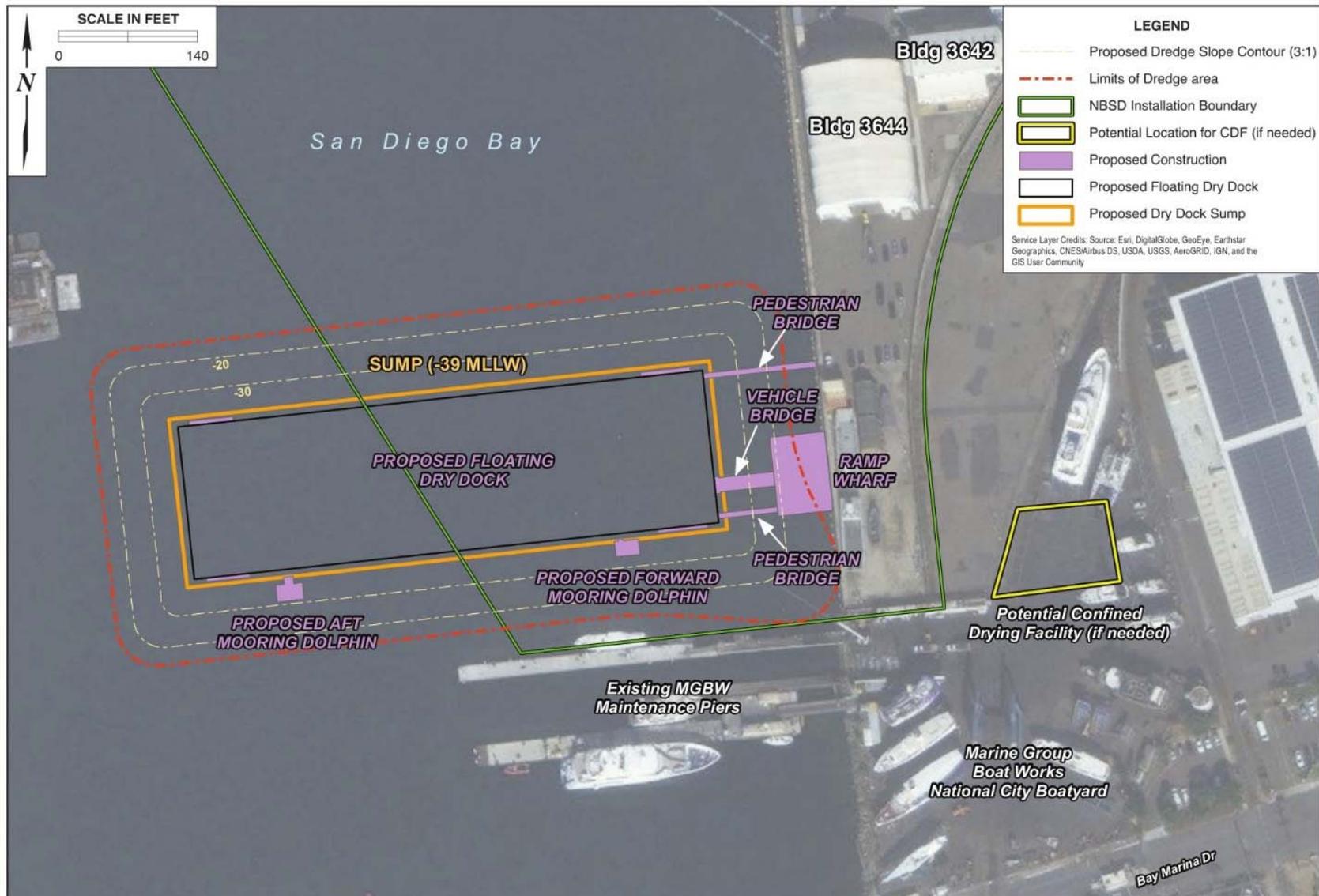


Figure 1-2. Proposed Action at the MGBW COL Site

### 1.3.1 Mooring Dolphins

The proposed FDD would require the installation of two mooring dolphins—located forward and aft of the proposed dry dock (Navy 2018; see Figure 1-2). The mooring dolphins would each be supported by up to sixteen vertical 24-inch octagonal concrete piles (Navy 2018; Table 1-1). The aft mooring dolphin would also require approximately two 24-inch angled steel-pipe piles (Navy 2018). Up to eight additional 24-inch steel piles are anticipated for the forward and aft mooring dolphins (Table 1-1). Cast-in-place reinforced concrete caps, 9.1 by 9.1 m (30 by 30 ft), would be installed at each mooring dolphin location. Grippers would be secured to the dolphins' concrete pile caps and used to hold the FDD in position. Construction materials would be delivered by truck and the piles would likely be installed using a floating crane and an impact or vibratory pile driver aided by jetting methods. The number of final strikes for each pile would be dependent on the underlying geology. For example, pile-driving activities associated with the Pier 12 replacement required between 500 and 600 blows per pile (Alberto Sanchez, pers. comm. 2019).

### 1.3.2 Fender Piles

It is anticipated that fender piles associated with the aft mooring dolphin would consist of two steel piles, 24-inches in diameter or less (Table 1-1). All piles would initially be installed using vibratory methods, followed by the use of an impact pile driver.

### 1.3.3 Access Structures at MGBW COL Site

Two pedestrian bridges and a vehicle bridge would be constructed to provide landside access and servicing to the proposed FDD at the MGBW site (Figure 1-2). The port side pedestrian bridge, which would provide access to the port wing deck, would be approximately 35 m (115 ft) long and supported by a landside concrete abutment. The proposed ramp wharf would be approximately 17 by 24 m (80 by 55 ft) long and would support an 18-m (60-ft) long vehicle bridge that would provide vehicle access to the COL floating dry dock. The ramp wharf would also support the starboard pedestrian bridge, which would provide access to the starboard wing deck. The concrete ramp wharf and vehicle bridge would cover approximately 0.12 acres (ac; 5,360 square feet) and would be supported by twenty-four 24-inch octagonal concrete piles (Table 1-1). These access structures, which would be similar to those currently provided at other Navy piers in the vicinity, and would allow for construction vehicles and heavy equipment to be used during maintenance of Navy vessels.

### 1.3.4 Floating Dry Dock Emplacement

The FDD at the MGBW COL Site would be constructed at a shipyard outside of San Diego and then barged to the MGBW COL Site. The FDD would be constructed entirely of steel with a 9,000-ton vessel-lifting capacity. It would also be designed to meet the requirements of the Navy's MIL-STD 1625D (Reference 15) and American Bureau of Shipping Standards. The minimum dimensions for the FDD are: 162 m (532-ft) length, 47 m (154-ft) outside width, a 37 m (121-ft) inside width, a pontoon height of 3.1 m (10 ft), and a wing wall height of 13 m (43 ft) above the pontoon deck. The FDD would be installed to support maintenance operations for Navy LCS-2, LSD-41, and LSD-49 class vessels.

**Table 1-1. Proposed Pile Installation Activities at the MGBW COL Site**

| Pile Size/Type                               | Pile Installation Method | Anticipated Number of Piles | Pile Location/Purpose                         | Strikes per Pile | Minutes per Pile | Assumed Daily Maximum Number of Piles Installed | Anticipated Number of Days |
|--|--------------------------|-----------------------------|---|------------------|------------------|---|----------------------------|
| 24-inch Octagonal Concrete <sup>1</sup>      | Impact Pile Driver       | 32                          | Forward and aft mooring dolphins (Structural) | 600 blows        | N/A              | 1   | 32                         |
|  | Impact Pile Driver       | 24                          | Ramp wharf and vehicle bridge (Structural)    | 600 blows        | N/A              | 3   | 8                          |
| 24-inch Steel Pipe                           | Impact Pile Driver       | 8                           | Forward and aft mooring dolphins (Structural) | 600 blows        | N/A              | 1   | 8                          |
|  | Vibratory Pile Driver    | 8                           |   | N/A              | 10 minutes       | 1   |                            |
|  | Impact Pile Driver       | 2                           | Aft mooring dolphin (Fender)                  | 600 blows        | N/A              | 1   | 2                          |
|  | Vibratory Pile Driver    | 2                           |   | N/A              | 10 minutes       | 1   |                            |
| <b>Total In-Water Pile Installation Days</b> |                          |                             |   |                  |                  |   | <b>50</b>                  |

**Notes:**

<sup>1</sup>High pressure water jetting may be used in conjunction with all concrete pile installation activities. If this pile installation technique is used, it could occur on up to 40 days of concrete pile installation.

#### **1.4 Best Management Practices, Mitigation, and Minimization Measures**

Section 11 describes the general Best Management Practices (BMPs), mitigation, and minimization measures that may be implemented for all in-water activities. BMPs are routinely used by the Navy during pile installation activities to avoid and minimize potential environmental impacts. Additional minimization measures have been added to protect marine mammals. These measures include vibratory installation of piles where possible, performance measures for impact pile driving, and marine mammal monitoring as described in Section 11.

## 2 DATES, DURATION, AND LOCATION OF ACTIVITIES

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

### 2.1 Dates and Duration of Activities

In-water work is anticipated to occur for up to 50 days from 15 September 2020 through 14 September 2021. The duration of pile installation activities is evaluated in the IHA are presented in Table 1-1.

### 2.2 Project Area Description

San Diego Bay is a narrow, crescent-shaped natural embayment oriented northwest-southeast with an approximate length of 24 km (15 miles) and a total area of roughly 4 km<sup>2</sup> (11,000 acres; Port of San Diego [POSD] 2007). The width of the bay ranges from 0.3 to 5.8 km (0.2 to 3.6 miles), and depths range from 23 m (74 ft) MLLW near the tip of Ballast Point to less than 1.2 m (4 ft) at the southern end (Merkel and Associates, Inc. 2009; see Figure 1-1). About half of the bay is less than 4.5 m (15 ft) deep and most of it is less than 15 m (50 ft) deep (Merkel and Associates, Inc. 2009).

#### 2.2.1 Bathymetric Setting

The northern and central portions of San Diego Bay have been shaped by historical dredging and filling to support large ship navigation and shoreline development; only the southernmost portion of the bay retains its natural shallow bathymetry (Merkel and Associates, Inc. 2009; Figure 2-1). 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 south end of the bay (Merkel and Associates, Inc. 2009). The United States Army Corps of Engineers (USACE) dredges the main navigation channel in San Diego Bay to maintain a depth of -47 feet MLLW and is responsible for providing safe transit for private, commercial, and military vessels within the bay (NOAA 2012a). Outside of the navigation channel, the bay floor consists of platforms at depths that vary slightly (Merkel and Associates, Inc. 2009). Within the Central Bay, typical depths range from -35 to -38 feet MLLW to support large ship turning and anchorage (Merkel and Associates, Inc. 2009). Small vessel marinas are typically dredged to depths of -15 feet MLLW (Merkel and Associates, Inc. 2009). The area around the MGBW COL site is approximately 0.01 km<sup>2</sup> (2.72 acres) with bathymetry ranging from -8 feet to -13 feet MLLW (Triton Engineers 2019). Dredging in the Project area to -39 ft MLLW in preparation of the FDD will alter the bathymetry in the area directly around the FDD (see Figure 1-2).



Figure 2-1. Bathymetric Contours Near the MGBW COL Site

### 2.2.2 Circulation, Tides, Temperature, and Salinity

Circulation within San Diego Bay is affected by its 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 on circulation characteristics:

- The North Bay – Marine Region extends from the bay mouth to the area offshore 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. Incoming tides bring cold ocean water from 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 South-Central Seasonally Hypersaline Region (i.e., with higher salt content than seawater) occurs between Glorietta Bay and Sweetwater Marsh. 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, located south of Sweetwater Marsh, receives occasional freshwater inflows from the Otay and Sweetwater Rivers. Residence time of bay water in the estuarine region may be greater than 1 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 (Chadwick et al. 1999).

San Diego Bay has mixed diurnal/semi-diurnal tides, with the semi-diurnal component being dominant (Largier 1995). The interaction between these two types of tides is such that the higher high tide occurs before the lower low tide, creating the strongest currents on the large ebb tide (Largier 1995). The tidal range (difference between MLLW and mean highest high water) is approximately 1.7 m (5.5 ft; Largier 1995). In general, tidal currents are strongest near the bay mouth, with maximum velocities of 0.5 to 1 m per second (1.6 to 3.3 ft per second; Largier 1995). Tidal current direction generally follows the center of the channel (Chadwick et al. 1999). Residence time for water in San Diego Bay increases from approximately 5 to 20 days in mid-bay to over 40 days in the South Bay (Chadwick et al. 1999). During an average tidal cycle, approximately 13 percent of the water in San Diego Bay mixes with ocean water and then moves back into the bay (POSD 2007). The complete exchange of all the water in San Diego Bay can take between 10 and 100 days, depending on the amplitude of the tidal cycle (POSD 2007). Tidal flushing and mixing are important in maintaining water quality within San Diego Bay. The tidally induced currents regulate salinity, moderate water temperature, and disperse pollutants (POSD 2007).

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 14 to 16 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 (Lapota et al 1993). In the early 1970's, the average surface temperature for San Diego Bay was estimated to be 63.3° F (17.4° C; Smith 1972), but recent average temperatures are now in excess of 66° F (18.8° C; NDBC 2019) inside of the Bay. Maximum vertical temperature gradients of about 0.3° F/ft (0.5° C/m) occur

during the summer (Smith 1972). 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 (Tierra Data, Inc. 2012).

### 2.2.3 Water Quality

Water quality is commonly assessed by measuring dissolved nutrients, dissolved oxygen, pH, turbidity, chlorophyll *a* (a measure of the amount of phytoplankton present in San Diego Bay), and coliform bacteria (Chadwick et al. 1999). Measured values for dissolved nutrients in the bay such as phosphate and silicates range from 0.9 to 4 parts per million (ppm) for silicon and 0.02 to 0.3 ppm phosphorus in the winter, to 0.3 to 1.3 ppm for silicates and 0.2 ppm phosphorus in the summer (Chadwick et al. 1999). This variation is the result of inflow of these nutrients with winter runoff, and uptake by phytoplankton growth in the summer (Chadwick et al. 1999). Dissolved oxygen levels range from approximately 4 milliliters per liter (mL/L) during the summer to 8 mL/L during the winter (Chadwick et al. 1999). These oxygen levels are typically at or near atmospheric equilibrium levels. The pH of seawater in San Diego Bay is relatively uniform, ranging from approximately 7.9 to 8.1 throughout the bay and the year (Chadwick et al. 1999).

Surface water chemistry is analyzed by the Regional Harbor Monitoring Program using primary and secondary indicators, including total and dissolved levels of copper (primary), and total and dissolved zinc and nickel (secondary). Copper concentrations in San Diego Bay show improvement in comparison with a historical baseline, and average copper concentrations do not exceed the California Toxics Rule (CTR) threshold of 5.8 micrograms per liter (µg/L) total and 4.8 µg/L dissolved. Less than 20 percent of measurements throughout the bay still exceed the CTR threshold. Both total and dissolved zinc and nickel concentrations are well below CTR threshold values used for the Regional Harbor Monitoring Program. All other dissolved and total metals have concentrations below their respective acute and chronic CTR thresholds (Amec Foster Wheeler 2016). Polycyclic aromatic hydrocarbon concentrations are also below their respective CTR threshold values (Amec Foster Wheeler 2016).

Turbidity is a measure of water clarity or murkiness and can be caused by suspended sediments transported in runoff or increased algal/bacterial growth (Tierra Data, Inc. 2010). Turbidity can also be created by natural and manmade resuspension of bottom sediments. Increased turbidity reduces the amount of light available for plant growth underwater, so it can affect the ability of San Diego Bay to support living organisms (Tierra Data, Inc. 2010). Turbidity in San Diego Bay varies, depending on the tides, seasons, and location within the bay (Tierra Data, Inc. 2010).

Chlorophyll *a* ranges from 0.2 to 25 µg/L (Chadwick et al. 1999). The highest values were measured in the South Bay in winter, when runoff carries high levels of nutrients into the South Bay. In summer, chlorophyll *a* levels return to background levels of 1 to 2 µg/L. These chlorophyll *a* levels are generally much higher than those found in the adjacent open ocean. Before 1964, when untreated sewage was still being discharged into the San Diego Bay, bacterial counts (fecal coliform) were as high as 82 milliliters in the South Bay (Chadwick et al. 1999). Since these discharges ended, bacterial counts typically remain below 10 milliliters except during some winter storms. These levels are below federal limits for water contact, implying that the San Diego Bay is generally safe for recreational use (Chadwick et al. 1999).

Current sources of pollution to San Diego Bay include underground dewatering, industries on the bay and upstream, marinas and anchorages, U.S. Naval activities, materials used for underwater hull cleaning and vessel antifouling paints, and urban runoff (Chadwick et al. 1999). Additional pollution sources include creosote-treated wood pier pilings, which are a source of polycyclic aromatic hydrocarbons, stormwater

runoff from land used for industrial, commercial, and transportation purposes, bilge water discharge, and oil spills (Chadwick et al. 1999). Changes in Navy procedures since the mid-1990s have included replacing approximately half of the pier pilings with plastic, concrete, or untreated wood, and implementing the Bilge Oily Waste Treatment System for treatment of construction and repair wastewater.

Overall, the levels of contamination in the water and sediment in San Diego Bay appear to be lower now than in previous decades, including levels of some metals and polycyclic aromatic hydrocarbons (POSD 2007). However, copper concentrations remain routinely higher than federal and state limits for dissolved copper (POSD 2007).

#### **2.2.4 Substrates and Habitats**

Sediments in San Diego Bay are relatively sandy (Naval Facilities Engineering Command, Southwest [NAVFAC SW] and POSD 2013) 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. The MGBW COL site is shallow subtidal (-8 to -13 feet MLLW) with an eelgrass bed located within the site of less than 1-acre (Triton Engineers 2019; Merkel and Associates, Inc. 2018) (Figure 2-2). Over-water structures such as the existing MGBW piles and dock structures provide substrates for the growth of algae and invertebrates off the bottom and support abundant fish populations. Eelgrass present within the MGBW COL Site is important habitat for invertebrates, fish, and birds (NAVFAC SW and POSD 2013).

#### **2.2.5 Vessel Traffic and Ambient Underwater Soundscape**

As illustrated by Table 2-1 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 (Table 2-1). 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).

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 to 170 decibels (dB) referenced to 1 microPascal (re 1  $\mu$ Pa) at 1 m. 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 (National Research Council [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.

Background (ambient) noise in the south-central San Diego Bay was measured at 126 dB ( $L_{50}$ ) in 2019 (Dahl and Dall'Osto 2019). This is similar to ambient noise levels in the northern San Diego Bay ranged 126 to 137 dB ( $L_{50}$ ) in 2014, 2015, and 2016 (NAVFAC SW 2018). Sound levels in the south-central San Diego Bay are likely lower due to the reduced ship traffic relatively to the north San Diego Bay. However, when present, ship traffic generates noise levels up to 186 dB (Galli et al. 2003; Matzner and Jones 2011; McKenna 2011). Noise from non-impulsive sources associated with the Proposed Action is, therefore, assumed to become indistinguishable from background noise as it diminishes to 126 dB re 1  $\mu$ Pa with distance from the source (Dahl and Dall'Osto 2019).

**Table 2-1. Port of San Diego Average Annual Vessel Traffic**

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

**Notes:**

<sup>1</sup>Tug traffic was not included in the above statistics since inner harbor tug movements alone exceed 7,000 for a typical year.

**Data Source:** San Diego Harbor Safety Committee (2009).



Figure 2-2. Eelgrass Located within the Vicinity of the Project

### 3 MARINE MAMMAL SPECIES AND NUMBERS

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

The most frequently observed marine mammals in San Diego Bay is the California sea lion (*Zalophus californianus*), which often rests on buoys and other structures and occurs throughout the North to North-Central Bay; coastal bottlenose dolphin (*Tursiops truncatus*), which is regularly seen in the North Bay; Pacific harbor seal (*Phoca vitulina*), which frequently enters the North Bay; and common dolphins (*Delphinus* spp.), which are rare visitors in the North Bay. California gray whales (*Eschrichtius robustus*) are occasionally sighted near the mouth of San Diego Bay during their winter migration (NAVFAC SW and POSD 2013).

The project action area for marine mammals is determined by the limits of potential effects, which in this case are defined by acoustic zones of influence (see Section 6.6). Because sound transmission is impeded by natural and manmade barriers on the shore, the zone of influence is entirely south of the Coronado Bridge, and extends approximately 600 m (1,969 ft) beyond the Mole Pier, as well as slightly beyond the National City Marine Terminal to the south of the Project area (see Figure 6-1).

Based on many years of observations and numerous Navy-funded surveys in San Diego Bay (Merkel and Associates, Inc. 2008; Sorensen and Swope 2010; Graham and Saunders 2014; Tierra Data Inc. 2016), marine mammals rarely occur south of the Coronado Bay Bridge, are not known to visit NBSD with any regularity, and any occurrence in the project area would be very rare. The only species that is anticipated to occur south of the Coronado Bridge with any regularity is the California sea lion, based on the sighting of two individuals during 2010 surveys (Sorensen and Swope 2010). Therefore, only impacts to the California sea lion are evaluated in this IHA.

#### 3.1 Species Descriptions and Abundances

##### 3.1.1 California Sea Lion

###### 3.1.1.1 Species Description

The California sea lion is now considered to be a full species, separated from the Galapagos sea lion (*Z. wolfebaeki*) and the extinct Japanese sea lion (*Z. japonicus*) (Carretta et al. 2019). 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 453 kilograms (1,000 pounds) and 2.4 m (8 ft) in length; females grow to 136 kilograms (300 pounds) and 1.8 m (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 (Heath 2002).

###### 3.1.1.2 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. 2019). 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 257,606, with a minimum estimate of 233,515 (Carretta et al. 2019). 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. 2019).

## 4 AFFECTED SPECIES STATUS AND DISTRIBUTION

*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.*

The California sea lion is the only marine mammal expected to occur within the project area and may potentially be affected by project activities. The stock status, distribution, and site-specific occurrence of California sea lions is described below.

### 4.1 California Sea Lion, U.S. Stock

#### 4.1.1 Status and Management

California sea lions are protected under the MMPA and are not listed under the Endangered Species Act (ESA). The NMFS has defined one stock for California sea lions (U.S. Stock), with five genetically distinct geographic populations: Pacific Temperate, Pacific Subtropical, Southern Gulf of California, Central Gulf of California, and Northern Gulf of California. The Pacific Temperate population includes rookeries within U.S. waters and the Coronado Islands just south of the United States-Mexico border. Animals from the Pacific Temperate population range north into Canadian waters, and movement of animals between U.S. waters and Baja California waters has been documented (Carretta et al. 2019). 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 San Diego Bay. In California waters, California 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). California 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 California 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 California 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 California 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). In the nonbreeding season, adult and subadult males, and juvenile males and females (McHuron et al. 2018) migrate northward along the coast to central and northern California, Oregon, Washington, and Vancouver Island in British Columbia, and return south in the spring.

#### **4.1.3 Site-Specific Occurrence**

In San Diego Bay, in general, California sea lions regularly occur on rocks, buoys and other structures, and especially on bait barges, although numbers vary greatly. As discussed in Chapter 3, California sea lion occurrence in the project area is expected to be rare based on sighting of only two individuals in the water off of NBSD during one 2010 survey (Sorensen and Swope 2010).

#### **4.1.4 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 2013).

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 2013).

California sea lions seek a variety of structures, such as rocks, piers, and buoys and low profile docks for hauling out. These behaviors can be destructive to structures due to the weight of the animal and fouling. If California 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.

#### **4.1.5 Acoustics**

On land, California sea lions make incessant, raucous barking sounds with most of the 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 functional hearing range for California sea lions on land is 50 Hz to 75 kHz (Schusterman 1981) and in-water is 60 Hz to 39 kHz (NMFS 2018).

## 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.*

Under Section 101 (a)(5)(D) of the MMPA, the Navy requests an IHA for the take of a small numbers of California sea lions, by Level B behavioral harassment only, incidental to the emplacement of a FDD and associated modifications at the MGBW facilities. The Navy requests an IHA from 15 September 2020 to 14 September 2021.

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). The proposed activities are not anticipated to result in any Level A harassment due to the small Zones of Influence (ZOIs) anticipated from pile driving activities and the implementation of marine mammal monitoring.

### 5.1 Method of Incidental Taking

This authorization request considers noise from vibratory and impact pile driving, as well as high pressure water jetting. These activities were deemed as the only activities that have the potential to disturb or displace marine mammals or produce a temporary shift in their hearing ability (temporary threshold shift [TTS]) resulting in Level B harassment, as defined above. The project has the potential to produce a permanent shift in the ability of California sea lions to hear from steel impact pile driving resulting in Level A harassment. However, Level A zones will be fully monitored to avoid take. To further reduce the likelihood of Level A takes, a buffered shutdown zone out to 25 m (82 ft) would be implemented to halt activities that could potentially injure a marine mammal that is near in-water Project-related activities. Vibratory pile drivers will be the primary method of steel pile installation. Vibratory pile drivers also have relatively low sound levels (less than 180 dB referenced to 1 microPascal [dB re 1  $\mu$ Pa] at 10 m) that are lower than impact pile driving and are not expected to cause injury to marine mammals. All pile driving will either be delayed from starting or halted if any marine mammals approach the buffered shutdown zone (25 m [82 ft]) which would include all distances calculated for the Level A zone. No Level A take is anticipated with implementation of this buffered shutdown zone. The Proposed Action is not anticipated to affect the prey base or significantly affect other habitat features of California sea lions that would meet the definition of take.

## 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

In-water pile installation will temporarily increase the local underwater noise environment in the vicinity of the project. Pile driving can also generate airborne noise that could potentially result in disturbance to marine mammals (pinnipeds) that are hauled out; however, due to the absence of haul outs in the project area, the potential for acoustic harassment by airborne noise is considered negligible and is not analyzed.

Research suggests that increased noise may impact marine mammals in several ways and that these impacts depend on many factors. Noise impacts are discussed in more detail in Section 7. Assessing whether a sound may disturb or injure a marine mammal involves understanding the characteristics of the acoustic source and the potential effects that sound may have on the physiology and behavior of that marine mammal. Sound is important for marine mammal communication, navigation, and foraging (NRC 2003, 2005), and understanding the auditory effects from anthropogenic sound on marine mammals has continued to be researched and developed (Southall et al. 2019). Furthermore, many other factors besides the received level of sound may affect an animal's reaction, such as the animal's physical condition, prior experience with the sound, and proximity to the source of the sound.

Of the three main noise-generating activities, vibratory pile driving, and high pressure water jetting are not expected to result in Level A ZOIs that would expose marine mammals to potentially injurious noise, as defined under the MMPA. However, the noise-related impacts from these activities may result in Level B harassment. Impact pile driving could result in Level A and Level B exposure of marine mammals as defined under the MMPA. The methods for estimating the number and types of exposures are summarized below.

The following methods were used to determine exposure of California sea lions:

- Estimating the area of impact where noise levels exceed acoustic thresholds for marine mammals (Sections 6.3)
- Evaluating the potential presence of California sea lions based on historical occurrence or density or by site-specific survey as outlined in (Section 6.7)
- Estimating potential harassment exposures by using site-specific abundance, as applicable, of California sea lions calculated in the area by their probable duration during construction (Section 6.8)

These three methods are discussed in the sections that follow.

### 6.2 Description of Noise Sources

Ambient sound is a composite of sounds from multiple sources, including environmental events, biological sources, and anthropogenic activities. Physical noise sources include waves at the surface, precipitation, earthquakes, ice, and atmospheric noise, among other events. Biological sources include marine mammals, fish, and invertebrates. Anthropogenic sounds are produced by vessels (small and large), dredging, aircraft overflights, construction activities, geophysical explorations, commercial and military

sonars, and other activities. Known noise levels and frequency ranges associated with anthropogenic sources similar to those that would be used for this project are summarized in Table 6-1.

In-water construction activities associated with the proposed project include impact and vibratory pile driving, and high pressure water jetting. The sounds produced by these activities fall into two sound types: impulsive and non-impulsive (defined below). Impact pile driving produces impulsive sounds, while vibratory pile driving, and high pressure water jetting produce non-impulsive sounds. The distinction between these two general sound types is important because their potential to cause physical effects differs, particularly with regard to hearing (Ward 1997).

Impulsive sounds (e.g., explosions, seismic air gun pulses, and impact pile driving), which are referred to as pulsed sounds by Southall et al. (2007, 2019), are brief, broadband, atonal transients (Harris 1998) and occur either as isolated events or are repeated in some succession (Southall et al. 2007, 2019). Impulsive sounds are 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). Impulsive sounds generally have a greater capacity to induce physical injury compared with sounds that lack these features (Southall et al. 2007, 2019).

Non-impulsive sounds (referred to as non-pulsed in Southall et al. (2007, 2019) can be tonal, broadband, or both. They lack the rapid rise time and can have longer durations than impulsive sounds. Non-impulsive sounds can be either intermittent or continuous. Examples of non-impulsive sounds include vessels, aircraft, and machinery operations such as drilling, dredging, high pressure water jetting, pile clipping, and vibratory pile driving (Southall et al. 2007, 2019). In some environments, the duration of both impulsive and non-impulsive sounds can be extended due to reverberations.

**Table 6-1. Representative Levels of Underwater Anthropogenic Noise Sources**

| Noise Source             | Frequency Range (Hz) | Sound Level  | References   |
|--------------------------|----------------------|--|--|
| Dredging operations      | 20–20,000            | clamshell/bucket dredge maximum = 124 dB RMS re: 1 $\mu$ Pa at 150 m; excavator dredge maximum = 148 dB RMS re: 1 $\mu$ Pa at 60 m | Richardson et al. 1995; Reine et al. 2014; Jones et al. 2015         |
| Small vessels            | 860–8,000            | 141–175 dB RMS re: 1 $\mu$ Pa at 1 m   | Galli et al. 2003; Matzner and Jones 2011; Sebastianutto et al. 2011 |
| Large ship               | 20–1,000             | 176–186 dB re: 1 $\mu$ Pa <sup>2</sup> sec SEL at 1 m  | McKenna 2011   |
| Tug docking gravel barge | 200–1,000            | 149 dB at 100 m  | Blackwell and Greene 2002  |

**Abbreviations:** dB = decibel; Hz = Hertz; RMS = root mean square; sec = second; SEL = sound exposure level, dB re 1  $\mu$ Pa = decibels (dB) referenced to (re) 1 micro ( $\mu$ ) Pascal (Pa)

### 6.3 Sound Exposure Criteria and Thresholds

Under the MMPA, the NMFS has defined levels of harassment for marine mammals. Level A harassment is defined as “[a]ny 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 “[a]ny 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.”

To date, no studies have been conducted that examine impacts to marine mammals from pile-driving sounds from which empirical noise thresholds have been established. Currently, NMFS uses underwater sound exposure thresholds to determine when an activity could result in impacts to a marine mammal defined as Level A (injury) or Level B (disturbance including behavioral and TTS) harassment (NMFS 2005). The NMFS (2018) has recently developed acoustic threshold levels for determining the onset of permanent threshold shift (PTS) in marine mammals in response to underwater impulsive and non-impulsive sound sources. The criteria use cumulative sound exposure level (SEL) metrics (dB SELcum) and peak pressure (dB PEAK) rather than the previously used dB root mean square (RMS) metric. NMFS equates the onset of PTS, which is a form of auditory injury, with Level A harassment under the MMPA, and with “harm” under the ESA. Level B harassment occurs when marine mammals are exposed to impulsive underwater sounds above 160 dB RMS re 1  $\mu$ Pa, such as from impact pile driving, and to non-impulsive underwater sounds above 120 dB RMS re 1  $\mu$ Pa, such as from vibratory pile driving (NMFS 2005) (Table 6-2). The onset of TTS is a form of Level B harassment under the MMPA and a form of “harassment” under the ESA. All forms of harassment, either auditory or behavioral, constitute “incidental take” under these statutes.

**Table 6-2. Injury and Disturbance Threshold Criteria for Underwater and Airborne Noise**

| Marine Mammals           | Underwater Vibratory Pile-Driving Noise<br>(non-impulsive sounds)<br>(re 1 $\mu$ Pa) |                                  | Underwater Impact Pile-Driving Noise<br>(impulsive sounds)<br>(re 1 $\mu$ Pa) |                                  |
|--------------------------|--|----------------------------------|---|----------------------------------|
|                          | PTS Onset (Level A)<br>Threshold   | Level B<br>Disturbance Threshold | PTS Onset (Level A)<br>Threshold <sup>1</sup>                                 | Level B<br>Disturbance Threshold |
| Otariidae<br>(sea lions) | 219 dB SELcum <sup>4</sup>   | 120 dB RMS                       | 232 dB PEAK <sup>2</sup><br>203 dB SELcum <sup>3</sup>                        | 160 dB RMS                       |

**Notes:**

<sup>1</sup>Dual metric acoustic thresholds for impulsive sounds. Whichever results in the largest isopleth for calculating PTS onset is used in the analysis.

<sup>2</sup>Flat weighted or unweighted peak sound pressure within the generalized hearing range.

<sup>3</sup>Cumulative sound exposure level over 24 hours.

**Abbreviations:**  $\mu$ Pa = microPascal; dB = decibel; PTS = permanent threshold shift; RMS = root mean square; SEL = sound exposure level;

#### 6.4 Limitations of Existing Noise Criteria

The application of the 120 dB RMS re 1  $\mu$ Pa behavioral threshold can sometimes be problematic because this threshold level can be either at or below the ambient noise level of certain locations. The 120 dB RMS re 1  $\mu$ Pa threshold level for non-impulsive noise originated from research conducted by Malme et al. (1984, 1986) for California gray whale response to continuous industrial sounds, such as drilling operations.

To date, there is no research or data supporting a response by pinnipeds or odontocetes to non-impulsive sounds from vibratory pile driving as low as the 120 dB threshold. Southall et al. (2007) reviewed studies conducted to document the behavioral responses of harbor seals and northern elephant seals to non-impulsive sounds under various conditions. They concluded that those limited studies suggest that exposures between 90 dB and 140 dB RMS re 1  $\mu$ Pa generally do not appear to induce strong behavioral responses. As discussed in Section 2.2.5, recent measurements recorded in the south-central San Diego

Bay resulted in an average ambient underwater noise level of 126 dB RMS (Dahl and Dall'Osto 2019). Therefore, 126 dB RMS is the threshold used for Level B disturbance for non-impulsive underwater sound in this IHA.

## 6.5 Auditory Masking

Natural and artificial sounds can disrupt behavior through auditory masking or interference with a marine mammal's ability to detect and interpret other relevant sounds, such as communication and echolocation signals (Wartzok et al. 2004). Masking occurs when both the signal and masking sound have similar frequencies and either overlap or occur very close to each other in time. A signal is very likely to be masked if the noise is within a certain "critical bandwidth" 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. 2004). For example, in delphinid subjects, relevant signals needed to be 17 to 20 dB louder than masking noise at frequencies below 1 kHz to be detected and 40 dB greater at approximately 100 kHz (Richardson et al. 1995). Noise at frequencies outside of a signal's critical bandwidth will have little to no effect on the detection of that signal (Wartzok et al. 2004).

Additional factors influencing masking are the temporal structure of the noise and the behavioral and environmental context in which the signal is produced. Continuous noise is more likely to mask signals than intermittent noise of the same amplitude; quiet "gaps" in the intermittent noise allow detection of signals that would not be heard during continuous noise (Brumm and Slabbekoorn 2005). The behavioral function of a vocalization (e.g., contact call, group cohesion vocalization, echolocation click) and the acoustic environment at the time of signaling may both influence the call source level (Holt et al. 2011), which directly affects the chances that a signal will be masked (Nemeth and Brumm 2010). Miksis-Olds and Tyack (2009) showed that manatees modified vocalizations differently during increased noise, depending on whether or not a calf was present.

Masking noise from anthropogenic sources could cause behavioral changes if the masking disrupts communication, echolocation, or other hearing-dependent behaviors. As noted above, noise frequency and amplitude both contribute to the potential for vocalization masking; noise from pile driving typically covers a frequency range of 10 Hz to 1.5 kHz, which is likely to overlap with the frequencies of vocalizations produced by species that may occur in the project area. Amplitude of noise from both impact and vibratory pile-driving methods is variable and may exceed that of marine mammal vocalizations within an unknown range of each incident pile. Depending on the animal's location and vocalization source level, this range may vary over time.

Based on the frequency overlap between noise produced by both vibratory and impact pile driving (10 Hz to 1.5 kHz), animals that remain in a project area during steel pile driving may be vulnerable to masking for the duration of pile driving (typically 2 hours or less, intermittently over the course of a day depending on site and project). Energy levels of vibratory pile driving are less than half that of impact pile driving; therefore, the potential for masking noise would be limited to a small radius around a pile. The likelihood that vibratory pile driving would mask relevant acoustic signals for marine mammals is negligible. In addition, most marine mammal species that may be subject to masking are transitory within the project area. Possible behavioral reactions to vocalization masking include changes to vocal behavior (including cessation of calling), habitat abandonment (short- or long-term), and modifications to the acoustic structure of vocalizations (which may help signalers compensate for masking) (Brumm and Slabbekoorn 2005; Brumm and Zollinger 2011). Given the relatively high source levels for most marine mammal

vocalizations, the Navy has estimated that masking events would occur concurrently within the zones of behavioral harassment estimated for vibratory and impact pile driving (see Section 6.6.2, Underwater Noise from Pile Driving) and are therefore taken into account in the exposure analysis.

## 6.6 Modeling Potential Noise Impacts from Pile Driving

### 6.6.1 Underwater Sound Propagation

Pile driving will generate underwater noise that potentially could result in disturbance to sea lions swimming by the project area. Transmission loss (TL) underwater is the decrease in acoustic intensity as an acoustic pressure wave propagates out from a source until the source becomes indistinguishable from ambient sound. TL parameters vary with frequency, temperature, sea conditions, current, source and receiver depth, water depth, water chemistry, bottom composition and topography. A standard sound propagation model (called “practical spreading loss”) was used to estimate the range from pile-driving activity to various expected sound pressure levels (SPLs) at potential project structures. This model follows a geometric propagation loss based on the distance from the driven pile, resulting in a 4.5 dB reduction in level for each doubling of distance from the source. In this model, the SPL at some distance away from the source (e.g., a driven pile) is governed by a measured source level, minus the TL of the energy as it dissipates with distance. Practical spreading loss is generally used to estimate TL where bathymetry varies and empirical measurements are not available, as is the case in south-central San Diego Bay. The equation for TL with practical spreading loss is:

$$TL = 15 \log_{10} \left( \frac{R_1}{R_2} \right)$$

where

$TL$  is the transmission loss in dB,

$R_1$  is the distance of the modeled SPL from the driven pile, and

$R_2$  is the distance from the driven pile of the initial measurement.

The degree to which underwater noise propagates away from a noise source is dependent on a variety of factors, most notably by bathymetry and the presence or absence of reflective or absorptive conditions, including the sea surface and sediment type. The TL model described above was used to calculate the expected noise propagation from each installation method, using representative source levels to estimate the ZOI or area exceeding the noise criteria. The extent of the representative ZOIs is depicted in Figure 6-1 using representative notional pile locations.

### 6.6.2 Underwater Noise from Pile Driving

The intensity of pile driving sound is greatly influenced by factors such as the type of pile, the type of driver, and the physical environment in which the activity takes place. To determine reasonable SPLs from pile driving, studies with similar properties to the proposed project were evaluated. Table 6-3 presents received SPL at a distance of 10 m (33 ft) from the pile, with RMS and Peak levels relative to 1  $\mu\text{Pa}$  and cumulative SELs relative to 1 microPascal squared second (re 1  $\mu\text{Pa}^2 \cdot \text{s}$ ) during impact pile driving.

**Table 6-3. Single-Strike Underwater Noise Source Levels Used for Impact Pile Driving**

| Pile Size/Type             | Peak SPL <sup>1</sup><br>(dB re 1 $\mu$ Pa) | RMS SPL <sup>1</sup><br>(dB re 1 $\mu$ Pa) | SEL <sup>1</sup><br>(dB re 1 $\mu$ Pa <sup>2</sup> s) |
|----------------------------|---|--|---|
| 24-inch Octagonal Concrete | 188   | 176  | 166   |
| 24-inch Steel Pipe         | 207   | 194  | 178   |

**Notes:**

<sup>1</sup>All SPLs are unattenuated; single strike SEL are the proxy sources levels presented for impact pile driving and were used to calculate distances to PTS.

**Data Source:** CALTRANS 2015

**Abbreviations:**

dB re 1  $\mu$ Pa = decibels referenced to a pressure of 1 microPascal (measures underwater SPL); dB re 1  $\mu$ Pa<sup>2</sup>s = decibels referenced to a pressure of 1 microPascal squared per second (measures underwater SEL); RMS = root mean square; SEL = sound exposure level; SPL = sound pressure level

Source levels associated with non-impulsive (continuous) sound sources, any of which may be used, are provided in Table 6-4. These sources include: 1) a vibratory driver to assist the installation steel piles; and 2) use of high-pressure water jetting to install concrete piles. Data from the most similar activities reported in the Acoustic Compendium for San Diego Bay (NAVFAC SW 2018) or by CALTRANS (2015) have been used as proxies for the proposed activities the MGBW COL Site. Each of these sources is assumed to operate for 10 minutes; this is a conservative assumption given that the contractor will be allowed flexibility to combine and use the most efficient methods. For the purpose of generating Level B take estimates, the maximum RMS SPL is the only relevant criterion; peak SPLs and SELs for continuous noise sources are not usually measured and would only exceed thresholds less than a meter from the source.

**Table 6-4. Underwater Noise Source Levels Modeled for Non-Impulsive Sources**

| Pile Size/Type             | Pile Installation Method    | RMS SPL <sup>1</sup><br>(dB re 1 $\mu$ Pa) |
|----------------------------|-----------------------------|--|
| 24-inch Octagonal Concrete | High-pressure water jetting | 158 <sup>^</sup>                           |
| 24-inch Steel Pipe         | Vibratory install           | 160 <sup>*</sup>                           |

**Notes:**

<sup>1</sup> All SPLs are unattenuated

**Data Sources:** <sup>^</sup> = NAVFAC SW 2018 (high pressure jetting as used on 16-inch round and 24-by-30-inch concrete piles); <sup>\*</sup> = CALTRANS 2015.

**Abbreviations:**

dB re 1  $\mu$ Pa = decibels referenced to a pressure of 1 microPascal (measures underwater SPL); RMS = root mean square

For the analyses that follow, the TL model described above was used to calculate the expected noise propagation from pile driving. For vibratory and impact behavioral zones and peak injury zones, a representative source level (see Table 6-3 and Table 6-4) was used to estimate the area exceeding the noise criteria. For vibratory pile-driving distances to the PTS thresholds, the TL model described above incorporated the auditory weighting functions for each hearing group, using a single frequency as described in the NMFS Spreadsheet (NMFS 2018). For impact pile-driving distances to the PTS thresholds for 24-inch steel and 24-inch concrete piles, the TL model described above incorporated frequency

weighting adjustments by applying the auditory weighting function over the entire 1-second SEL spectral datasets from impact pile driving.

Table 6-5 summarizes the calculated distances to the underwater marine mammal thresholds during pile driving methods at the MGBW COL Site. Adjusted maximum distances are provided where the extent of noise reaches land prior to reaching the calculated radial distance to the threshold. Areas encompassed within the threshold (or ZOI) were calculated using the location of a representative pile that might be driven. Pile locations were chosen to model the greatest possible affected areas; typically these locations would be at the seaward end of a pier that extends the farthest into the marine environment. Figure 6-1 illustrates the extent and area of each ZOI for a pile representing the worst-case extent of noise propagation (furthest from the shore). Level A ZOIs that are less than 1 m (3.3 ft; Table 6-5) are not depicted in the figure. Protected Species Observers (PSOs) would be positioned to monitor the project area (Figure 6-1).

**Table 6-5. Calculated Radial Distance(s) to Underwater Noise Thresholds and Areas Encompassed within the Thresholds from Pile Installation Activities at the MGBW COL**

| Pile Size/Type <sup>1</sup> | Pile Installation Method <sup>2</sup> | Minor Injury <sup>3</sup> | (PTS Onset) Level A <sup>3</sup> | Behavioral Disturbance <sup>4,5</sup> | Level B <sup>6</sup>   |
|-----------------------------|---------------------------------------|---------------------------|----------------------------------|---------------------------------------|--|
|                             |                                       | Radial Distance (m)       | ZOI Area (km <sup>2</sup> )      | Radial Distance (m)                   | ZOI Area (km <sup>2</sup> )  |
| 24-inch Octagonal Concrete  | Impact Pile Driver                    | 4 <sup>7</sup>            | N/A                              | 117                                   | 0.027-0.043<br>(0.043/NA) [Source 1]<br>(0.036/NA) [Source 2]<br>(0.027/NA) [Source 3] |
|                             | High Pressure Water Jetting           | <1                        | N/A                              | 1,359                                 | 2.75<br>(1.57/1.18)  |
| 24-inch Steel Pipe          | Impact Pile Driver                    | 13                        | N/A                              | 1,848                                 | 3.68<br>(2.76/0.92)  |
|                             | Vibratory Pile Driver                 | <1                        | N/A                              | 1,848                                 | 3.68<br>(2.76/0.92)  |

**Notes:**

<sup>1</sup> Sound source levels measured at 10 m (33 ft) distance.

<sup>2</sup> See Table 6-3 and Table 6-4 for source levels used to calculate the acoustic ZOIs.

<sup>3</sup> Distances to Level A thresholds were calculated based on SELcum using the 2018 NMFS User Spreadsheet (NMFS 2018), which assumes practical spreading loss. Project assumptions include: maximum of 600 strikes per pile, 10-minute duration for all non-impulsive sounds except for high-pressure water jetting (20-minutes), 1 pile installed per day for mooring dolphin structural piles and 3 piles per day for the wharf and vehicle bridge piles. Weighting Factor Adjustments of 2 kHz for impact pile driving and 2.5 kHz for non-impulsive sounds, and the representative frequency range for Otariids.

<sup>4</sup> Distances to Level B thresholds were calculated using practical spreading loss model.

<sup>5</sup> Level B ZOIs were calculated to the average ambient underwater noise value of 126 dB re 1  $\mu$ Pa within the project area (Dahl and Dall'Osto 2019).

<sup>6</sup> Level B ZOI areas were calculated separately for open water versus areas around piers where the structure's influence on sound propagation is uncertain; however, take calculations are based on the full combined ZOI areas.

<sup>7</sup> Per Table 1-1, impact pile driving for the mooring dolphins and wharf/bridges were 1 per day and 3 per day, respectively. The impact pile driving ZOI associated with the wharf/bridges resulted in the larger of the two ZOIs at 4 m (13.1 ft).

**Abbreviations:**

dB re 1  $\mu$ Pa = decibels referenced to a pressure of 1 microPascal; km<sup>2</sup> = square kilometers; m = meters; N/A = not applicable because the ZOI is contained within the shutdown zone (less than 10 m [33 ft] from source); PTS = permanent threshold shift; RMS = root mean square; SEL = sound exposure level; SELcum = Cumulative sound exposure level over 24 hours; ZOI = Zone of Influence (area encompassed within acoustic threshold boundary).

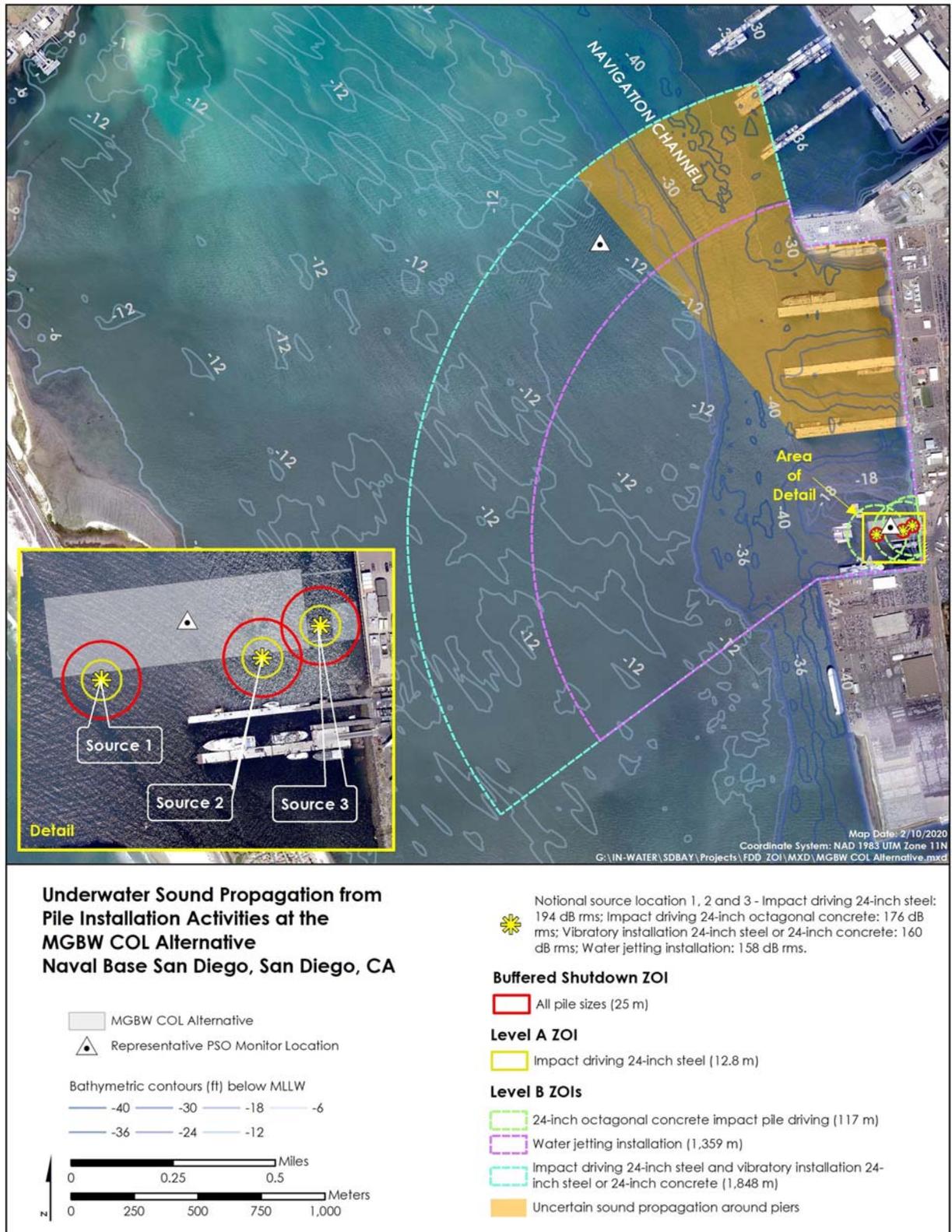


Figure 6-1. Underwater Sound from Impact and Vibratory Pile Driving and Water Jetting at the MGBW COL Site.

## 6.7 Basis for Estimating Take by Harassment

The U.S. Navy is seeking authorization for the potential taking of small numbers of California sea lions in the project area as a result of pile driving during construction activities associated with the MGBW COL Site. California sea lions are present in San Diego Bay year-round, but as previously discussed, they are considered to be very rare south of the Coronado Bay Bridge (Sorensen and Swope 2010). The takes requested are expected to have no more than a minor effect on individual animals and no effect on the sea lion population in general. 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 the source of the noise.

Potential exposures that would constitute takes under the MMPA are calculated in Section 6, and based on this analysis, no mortality or serious injuries are anticipated. The NMFS (2018) threshold and methodology for calculating the distance to the Level A (PTS onset) threshold are used to determine the area of the Level A ZOI for each pile installation activity. If Level A ZOIs are less than 10 m (33 ft), then a minimum 10 m (33 ft) shutdown is required to reduce the likelihood for a physical interaction with Project-related equipment. For the MGBW COL Site, impact pile driving of 24-inch steel piles is the only Project-related activity expected to have a Level A acoustic ZOI beyond the 10 m (33 ft) physical interaction ZOI for (13 m [43 ft]). To further reduce the likelihood of Level A takes, a buffered shutdown zone out to 25 m (82 ft) would be implemented to halt activities that could potentially injure a marine mammal that is near in-water Project-related activities. Takes would be limited to the potential for Level A (minor injury due in the form of permanent hearing threshold shift [PTS]) and Level B (behavioral responses and possible temporary hearing threshold shift [TTS]) harassment. However, with the implementation of a buffered shutdown ZOI of 25 m (82 ft), no Level A takes are anticipated. Previously established thresholds and the aforementioned practical spreading loss model were used to determine the extent of the Level B ZOI for these activities.

Potential Level B takes would occur if sea lions are present within any of the ZOIs identified in Table 6-5 and Figure 6-1. There are no known haulouts in the project area, although there are structures, such as buoys, that could be used. Sea lions observed in the area would likely be swimming and/or foraging. 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.

## 6.8 Description of Take Calculation and Exposure Estimates

To quantitatively assess exposure of California sea lions to pile driving noise levels over the NMFS threshold guidance, the potential number of sea lions in the project area ( $N=2$  [based on data in Sorensen and Swope 2010]) for all pile driving activities were multiplied by the maximum ZOI ( $3.68 \text{ km}^2$ ) for all activities, and then by the maximum number of days for each activity (see Table 1-1 for the number of days per activity). To conservatively determine the number of animals potentially exposed in the ZOI, the following equation was used:

$$\text{Exposure estimate} = N \times Z \times \text{maximum days of each activity}$$

where

$N = 2$  (Based on two sea lions/day potentially in the project area);

$Z = 3.68$  (The maximum area where noise exceeds the noise threshold value).

The following assumptions were used to calculate potential exposures to impact and vibratory pile driving noise for each threshold:

- Each animal can be “taken” via Level B harassment once every 24 hours.
- When different activities may occur during the same day, the pile type, size, and installation method that produces the largest ZOI (refer to total ZOIs – *Open Water* and *Around Piers* summed in Table 6-5) were used to estimate exposure of marine mammals to noise impacts.

The use of two California sea lions per day is a conservative estimate because surveys in San Diego Bay have shown very few California sea lions in the area (Merkel and Associates, Inc. 2008; Sorensen and Swope 2010; Graham and Saunders 2014; Tierra Data Inc. 2016). A more realistic estimate of density of animals based on the number of surveys would be less than two individuals per day because these animals are rarely in the area. However, while anecdotal observations of California sea lions transiting through the area have been noted (Navy Marine Mammal Program, pers. comm.), two animals per day was used as a conservative estimate of the potential animals in the area on any given day.

Note that site conditions will dictate methods for pile installation. Results presented in Table 6-6 provide estimates of Level B take based on the equipment type and installation method used. For example, it is possible that high pressure water jetting may be required to assist with the installation of all concrete piles over an estimated 40 days of pile driving. If we assume that jetting may occur on all 40 days of concrete pile installation, this method would result in 294 takes and would exceed the number of takes from impact pile driving of concrete piles (236 take). The total Level B takes requested for construction is 368 takes (Table 6-6).

**Table 6-6. Estimates of Potential Level B Takes of California Sea Lions by Pile Installation Activity at the MGBW COL Site**

| Pile Size/Type               | Pile Installation Method                 | Anticipated Number of Piles | Pile Location                    | Level B Take | Maximum Take Requested (By Technique) <sup>1,2</sup> |
|------------------------------|--|-----------------------------|----------------------------------|--------------|--|
| 24-inch Octagonal Concrete   | Impact Pile Driver                       | 32                          | Forward and aft mooring dolphins | 236          |  |
|                              |  | 24                          | Ramp wharf and vehicle bridge    | 59           |  |
|                              | High Pressure Water Jetting <sup>3</sup> | 32                          | All concrete piles               | <b>294</b>   | <b>294</b>   |
| 24-inch Steel Pipe           | Impact Pile Driver                       | 8                           | Forward and aft mooring dolphins | 59           |  |
|                              | Vibratory Pile Driver                    | 8                           |                                  | <b>59</b>    | <b>59</b>  |
|                              | Impact Pile Driver                       | 2                           | Aft mooring dolphin              | 15           |  |
|                              | Vibratory Pile Driver                    | 2                           |                                  | <b>15</b>    | <b>15</b>  |
| <b>Total Takes Requested</b> |  |                             |                                  |              | <b>368</b>   |

**Notes:**

<sup>1</sup>When both impulsive (i.e., Impact) and non-impulsive (i.e., vibratory, pile clipping, water jetting) occur on the same pile in a day, the larger of the takes is used (see bold numbers).

<sup>2</sup>One (1) pile installed per day for all activities with the exception of installation of 24-inch concrete Octagonal piles at three (3) piles per day (see Table 1-1).

<sup>3</sup>Assumes that high pressure water jetting could occur on a potential 40 days of impact pile driving of concrete piles (see Table 1-1).

## 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 Potential Effects Resulting from Underwater Noise

The effects of pile driving on marine mammals are dependent on several factors, including the species, size, 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 distance between the pile and the animal; and the sound propagation properties of the environment. Impacts on 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 farther 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 that are soft (e.g., sand) will absorb or attenuate the sound more readily than hard substrates (e.g., rock), which may reflect the acoustic wave. Soft porous substrates will also likely require less time to drive the pile, and possibly less forceful equipment, which will ultimately decrease the intensity of the acoustic source (Dahl et al. 2015).

Potential impacts on 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 may also occur, though the type and severity of these effects are more difficult to define due to limited studies addressing the behavioral effects of impulsive as well as non-impulsive sounds on marine mammals. Potential effects can range from brief acoustic effects such as behavioral disturbance, tactile perception, physical discomfort, slight injury of the internal organs and temporary to permanent impairment of the auditory system to death of the animal (Yelverton et al. 1973; O'Keefe and Young 1984; Ketten 1995; Navy 2001; Dahl et al. 2015; Finneran 2015; Kastelein et al. 2016, 2018).

##### 7.1.1.1 Physiological Responses

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 damage to the ear from a pressure wave can rupture the tympanum, fracture the ossicles, damage the cochlea, cause hemorrhage, and leak cerebrospinal fluid into the middle ear (Ketten 2004). Sub-lethal impacts also include hearing loss, which is caused by exposure to perceptible sounds. Moderate injury implies partial hearing loss. Permanent hearing loss (also called PTS) can occur when the hair cells of the ear are damaged by a very loud event, as well as prolonged exposure to noise. Instances of TTS and/or auditory fatigue are well documented in marine mammal literature as being one of the primary avenues of acoustic impact. TTS has been documented in controlled settings using captive marine mammals exposed to strong SELs at various frequencies (Ridgway et al. 1997; Kastak et al. 1999; Finneran et al. 2005; Finneran et al. 2015). While injuries to other sensitive organs are possible, they are less likely since pile driving impacts are almost entirely acoustically mediated. Based on the mitigation measures outlined in Chapter 11 and the conservative modeling assumptions discussed

in Chapter 6, California sea lions may be present, but would be expected in very low numbers. Therefore, sea lions that are present during construction may experience auditory effects, but will not cause population-level impacts or affect the continued survival of the species.

#### 7.1.1.2 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, its biological and social status (including age and sex), and its behavioral state and activity at the time of exposure. Habituation occurs when an animal's response to a stimulus wanes with repeated exposure, usually in the absence of unpleasant associated events (Wartzok et al. 2004). 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 or differences in individual tolerance levels 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; NRC 2003; Wartzok et al. 2004). Indicators of disturbance may include sudden changes in the animal's behavior or avoidance of the affected area. A marine mammal may show signs that it is startled by the noise and/or it may swim away from the sound source and avoid the area. Increased swimming speed, increased surfacing time, and cessation of foraging in the affected area would indicate disturbance or discomfort. Pinnipeds may increase their haulout time, possibly to avoid in-water disturbance.

Controlled experiments with captive marine mammals showed pronounced behavioral reactions, including avoidance of loud sound sources (Ridgway et al. 1997; Finneran et al. 2003) and an increase in the respiration rate of harbor porpoises (*Phocoena phocoena*) (Kastelein et al. 2013). Observed responses of wild marine mammals to loud pulsed sound sources (typically including seismic guns or acoustic harassment devices and pile driving) have been varied, but these responses often consist of avoidance behavior or other behavioral changes that suggest discomfort (Morton and Symonds 2002; also see reviews in Gordon et al. 2004; Wartzok et al. 2004; and Nowacek et al. 2007). Some studies of acoustic harassment and acoustic deterrence devices have found habituation in resident populations of seals and harbor porpoises (see the review in Southall et al. 2007). Blackwell et al. (2004) found that ringed seals (*Phoca hispida*) exposed to underwater pile-driving sounds in the 153 to 160 dB RMS range tolerated this noise level and did not seem unwilling to dive and did not react strongly to pile-driving activities. Responses of two pinniped species to impact pile driving at the San Francisco-Oakland Bay Bridge East Span Seismic Safety Project were mixed (CALTRANS 2001; Thorson and Reyff 2006; Thorson 2010). Harbor seals were observed in the water at distances of approximately 400 to 500 m from the pile-driving activity and exhibited no alarm responses, although several showed alert reactions. None of the seals appeared to remain in the area, although they may have been transiting to the haulout site or feeding areas. One of these harbor seals was even seen to swim to within 150 m of the pile-driving barge during pile driving. Several sea lions, however, were observed at distances of 500 to 1,000 m swimming rapidly and porpoising away from pile-driving activities. Both harbor seals and sea lions continued feeding on dense schools of herring that occasionally occurred during pile driving (CALTRANS 2001). Observations at other construction sites, such as the Navy's Point Loma fuel pier project, indicated that sea lions typically did not respond behaviorally to pile driving (NAVFAC SW 2014, 2015, 2016, 2017a,b, 2018a,b). The reasons

for these differences are not known and probably reflect the context of construction activities and the previous experiences of the animals.

Observations of marine mammals on NAVBASE Kitsap at Bangor during the Test Pile Program project concluded that pinniped (harbor seal and California sea lion) foraging behaviors decreased slightly during construction periods involving impact and vibratory pile driving, and both pinnipeds and harbor porpoise were more likely to change direction while traveling during construction (HDR 2012). Pinnipeds were more likely to dive and sink when closer to pile-driving activity, and a greater variety of other behaviors were observed with increasing distance from pile driving.

During the first year of Explosive Handling Wharf #2 (EHW-2) construction monitoring, only California sea lions and harbor seals were detected within the shutdown and behavioral disturbance zones (Primary Surveys) and outside the WRA (Outside Boat Surveys). The sample size for California sea lions was too small during pile driving to identify any trends in responses to construction (Hart Crowser 2013).

A comprehensive review of acoustic and behavioral responses to noise exposure by Nowacek et al. (2007) concluded that one of the most common behavioral responses is displacement. To assess the significance of displacements, it is necessary to know the areas to which the animals relocate, the quality of that habitat, and the duration of the displacement in the event that they return to the pre-disturbance area. Short-term displacement may not be of great concern unless the disturbance happens repeatedly. Similarly, long-term displacement may not be of concern if adequate replacement habitat is available.

Marine mammals encountering pile-driving operations over a project's construction time frame would likely avoid affected areas in which they experience noise-related discomfort, limiting their ability to forage or rest there. As described in the section above, individual responses to pile-driving noise are expected to vary. Some individuals may occupy a project area during pile driving without apparent discomfort, but others may be displaced with undetermined effects. Avoidance of the affected area during pile-driving operations would reduce the likelihood of injury impacts, but would also reduce access to foraging areas. The ZOI is only a small portion of foraging habitat utilized in San Diego Bay in general. Noise-related disturbance may also inhibit some marine mammals from transiting the area. There is a potential for displacement of marine mammals from affected areas due to these behavioral disturbances during the in-water construction season. However, in some areas, habituation may occur, resulting in a decrease in the severity of the response. Since pile driving activities will only occur during daylight hours, sea lions swimming, foraging, or resting in a project area at night will not be affected. Effects of pile-driving activities will be experienced by individual sea lions but will not cause population-level impacts or affect the continued survival of the species.

## **7.2 Conclusions Regarding Impacts to Species or Stocks**

Individual California sea lions may be exposed to SPLs during pile driving operations at NBSD that may result in Level B Behavioral harassment. Any California sea lions 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 sea lions 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 Section 6. This level of effect is not anticipated to have any detectable adverse impact to the sea lion population recruitment, survival, or recovery.

## 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 California sea lions located in NBSD ZOI that have no subsistence requirements. Therefore, no impacts on the availability of species or stocks for subsistence use are considered.

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## 9 IMPACTS TO 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 in-water activities at NBSD are expected to have little if any effects on the distribution of California sea lions within the project area. Only small numbers of California sea lions are expected to be present during construction and there are no haul out structures within the project area. Therefore, the main impact issue associated with the proposed activity will be temporarily elevated noise levels and the associated direct effects on sea lions, as discussed in Sections 6 and 7. The most likely impact to habitat will occur from pile driving effects on likely California sea lion prey (i.e., fish) and minor impacts to the immediate substrate during the installation 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, high pressure water jetting). 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) and 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 fish, 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  $\mu$ Pa 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 (Scholik and Yan 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 (NAVFAC SW 2014). 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 areas likely impacted by the FDD Project are relatively small compared to the available habitat in San Diego Bay. The Navy's marine mammal surveys in the Project area (Sorensen and Swope 2010) have documented very few California sea lions and the affected areas are used little, if at all, as foraging habitat. As a result, the installation 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 (NAVFAC SW 2014). Any behavioral avoidance by fish of the disturbed area would still leave significantly large areas of fish and marine mammal foraging habitat in other areas of San Diego Bay.

An eelgrass bed of less than 1 acre is located within the MGBW COL site and would be removed as a result of dredging for the Project. Removal of the eelgrass bed will be mitigated through the NMFS-approved

California Eelgrass Mitigation Policy. Loss of the bed will be mitigated through coordination with the USACE and a mitigation bank in San Diego Bay. Therefore, impacts to eelgrass that provides habitat for California sea lion prey would result, but would be mitigated. Further, loss of the bed would represent a very small percentage of the overall existence of eelgrass in San Diego Bay in general.

### **9.3 Summary of Impacts to Marine Mammal Habitat**

Given the short daily duration of noise associated with individual pile driving and the relatively small areas being affected, pile driving 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 is not likely to have a permanent, adverse effect on California sea lion foraging habitat in 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 NBSD are not expected to have any habitat-related effects that could cause significant or long-term consequences for individual California sea lions or the population. As previously discussed, California sea lions do not occur in large numbers nor are they expected to use the project area as frequent foraging habitat. Based on the discussions in Section 9, there will be no impacts to California sea lions resulting from loss or modification of marine mammal habitat.

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## 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. The Navy proposes to employ a number of mitigation measures, discussed below, in an effort to minimize the number of marine mammals potentially affected. NMFS will be notified of any change to the monitoring protocol(s) identified below, or in the corresponding marine mammal monitoring plan.

### 11.1 Mitigation for Pile Driving Activities

#### 11.1.1 Proposed Measures

1. Level A and Level B Harassment ZOI During Pile Driving
  - a. During all pile driving activities, regardless of predicted SPLs, a buffer will be added to the required 10 m (33 ft) Level A injury prevention (shutdown) zone. To simplify monitoring efforts, if an animal is observed within 25 m (82 ft) of active pile driving, regardless of pile size, pile driving will be stopped until the individual(s) has left the zone of its own volition, or not been sighted for 15 minutes. Due to swim speeds of marine mammals potentially in the project area, adding a buffer to a Level A ZOI is considered as appropriate to reduce the likelihood of a Level A take associated with pile installation.
  - b. The Level A/B harassment ZOIs will be monitored throughout the time required to drive a pile. If a marine mammal is observed entering the Level B ZOI, an exposure would be recorded and behaviors documented. Work would continue without cessation, unless the animal approaches or enters the buffered shutdown zone, at which point pile driving will shut down.
2. Marine Mammal Visual Monitoring
  - a. Monitoring will be conducted for a 25 m (82 ft) buffered shutdown zone (as described above and illustrated in Figure 6-1) and within the Level B ZOIs before, during, and after pile driving activities. Monitoring will take place at least 30 minutes prior to initiation through 30 minutes post-completion of installation activities.
  - b. Monitoring will be conducted by qualified PSOs. All PSOs would be trained in marine mammal identification and behaviors, and have experience conducting marine mammal monitoring or surveys. Trained PSOs will be placed at 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 shutdown/delay procedures, when applicable, by notifying the construction operator of a need for a shutdown.
  - c. PSOs will be deployed with a clear view of the buffered shutdown zone and ZOIs. The number of PSOs may vary depending on the construction activity and applicable size of the ZOI(s).
  - d. Prior to the start of pile driving activity, the buffered shutdown zone and Level B ZOIs will be monitored for at least 30 minutes to ensure that they are clear of marine mammals. Pile driving

- will only commence once PSOs have declared the buffered shutdown zones clear of marine mammals; Animals will be allowed to remain in the Level B ZOI and their behavior will be monitored and documented.
- e. If a marine mammal enters the buffered 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 minutes have passed without re-detection of the animal.
  - f. If a marine mammal species not covered in the IHA enters the Level B harassment zone, all pile driving activities shall be halted until the animal(s) has been observed to have left the Level B ZOI, or has not been observed for at least one hour. NMFS will be notified immediately with the species, and precautions made during the encounter. Pile installation will be allowed to proceed if the above measures are fulfilled for non-IHA species.
  - g. In the unlikely event of conditions, such as heavy fog, that prevent the visual detection of marine mammals in the buffered 25 m (82 ft) shutdown zone, activities with the potential to result in Level A harassment will not be initiated. Impact pile driving would be curtailed, but vibratory pile driving would be allowed to continue if such conditions arise after the activity has begun.
  - h. If the take of a marine mammal species approaches the take limits specified in the IHA, NMFS will be notified, and appropriate steps will be discussed.
4. 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 FDD Project will utilize soft-start techniques recommended by NMFS for impact pile driving. These measures are as follows:
- a. Prior to the start of pile driving each day, or after each break of more than 30 minutes, the soft-start procedure will be used (i.e., at least three unfueled hammer blows separated by 30 seconds, with full-power on the fourth blow) to allow any undetected animals in the area to leave of its own volition prior to a fueled blow.
5. Daylight Construction - Pile driving will only be conducted at least 30 minutes after sunrise and up to 30 minutes before sunset. This time restriction may be changed, depending on the lighting conditions at the Project site. NMFS will be notified of any change to the monitoring protocol(s).

### **11.1.2 Measures Considered but not Proposed**

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) fine sediment that remains 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**

All PSOs utilized for mitigation activities will be experienced biologists with training in marine mammal detection and behavior. Based on recent monitoring experience such as the Point Loma Fuel Pier (NAVFAC SW 2014, 2015, 2016, 2017a,b, 2018a,b), the Navy expects that visual mitigation will be highly effective. Visual detection conditions in 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 Harbor Safety Committee 2009). Fog is anticipated on 10-20% of the days, typically in late night and early morning hours (San Diego Harbor Safety Committee 2009) and

could occasionally limit visibility for marine mammal monitoring. However, PSOs 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 highly 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 during the period of this IHA. A marine mammal monitoring plan will be developed further and submitted to NMFS for approval well in advance of the start of construction during the IHA period. The monitoring plan includes visual observation protocols only, and will not include acoustic measurements.

#### 13.1.1 Visual Marine Mammal Observations

The Navy will collect sightings data and behavioral responses to construction for marine mammal species observed in the region of activity during the period of construction. All PSOs will be trained in marine mammal identification and behaviors.

#### 13.1.2 Methods of Monitoring

The Navy will monitor the Level A (shutdown) and Level B ZOIs before, during, and after pile-driving activities. Based on NMFS requirements, the Marine Mammal Monitoring Plan will include the following procedures:

- PSOs will be primarily located on boats, docks, and piers at the best vantage point(s) in order to properly see the entire buffered shut down zone.
- PSOs will be located at the best vantage point(s) to observe the zones associated with behavioral impact thresholds.
- When there are two or more PSOs, all will be in radio communication with each other to enhance tracking of marine mammals that may be moving through the area to minimize duplicate observation records of the same animal by different PSOs (i.e., a re-sighting).
- One land-/pier-/barge-based PSO (“Command” position) will be stationed with clear view of the Level A and buffered shutdown zone(s) and will be responsible for the collection of pile driving start and stop times, identification of all marine protected species in the vicinity of the pile being installed, and notifying the contractor if construction must be delayed or stopped due to the presence of marine protected species within the buffered shutdown zones.
- During all observation periods, PSOs will use binoculars and the naked eye to search continuously for marine mammals.
- Distances to animals will be based on the best estimate of the PSO, relative to known distances to objects in the vicinity of the PSO.
- Bearing to animals will be determined using a compass.

- In-water activities will be curtailed under conditions of fog or poor visibility that might obscure the presence of a marine mammal within the buffered shutdown zone.
- Pre-Activity Monitoring:
  - The buffered shutdown and Level B ZOIs will be monitored for 30 minutes prior to in-water construction activities. If a marine mammal is present within the buffered shutdown zone, the activity will be delayed until the animal(s) leave the buffered shutdown zone. Activity will resume only after the PSO has determined that, through sighting or by waiting at least 15 minutes, the animal(s) has moved outside the shutdown zone. If a marine mammal is observed approaching the buffered shutdown zone, the PSO who sighted that animal will notify all other PSOs of its presence to ensure the animal is fully tracked if it moves between different sightlines of the PSOs.
- During Activity Monitoring:
  - If a marine mammal is observed entering the Level B ZOI, pile driving will be completed without cessation. If the animal enters, or directly approaches the buffered shutdown zone, all pile driving activities will be halted. If an animal is observed within the shutdown zone during pile driving, then pile driving will be stopped as soon as it is safe to do so. Pile driving will only resume once the PSO has determined that the animal has left the shutdown zone of its own volition or has not been re-detected for a period of 15 minutes.
  - All times when the hammer is off, but pile driving has not completely stopped for the day, will also be monitored.
- Post-Activity Monitoring:
  - Monitoring of the project area will continue for 30 minutes following the completion of the activity.

### 13.1.3 Data Collection

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

- Date and time that pile driving begins or ends;
- Construction activities occurring during each observation period;
- Weather parameters identified in the monitoring plan (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 90 calendar days of the completion of pile driving activities. The results would be summarized in tabular and graphical forms and include summary metrics of sound values based upon the data from the piles monitored for this IHA period. 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).
- Pre- and post-activity observational survey-specific data:
  - Dates and time monitoring is initiated and terminated,
  - Description of any observable marine mammal behavior in the immediate area during monitoring,
- 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 sound levels occurring at the time of this observable behavior,
  - Actions performed to minimize impacts to marine mammals,
  - Times when pile driving is stopped due to presence of marine mammals within the shutdown zones and time when pile driving resumes.
- Summary of monitoring results:
  - Summary of the detections of marine mammals, species and numbers observed, sighting rates and distances, and behavioral reactions during pile driving,
  - 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.*

The U.S. Navy is one of the world's leading organizations in assessing the effects of human activities the marine environment including marine mammals. From 2004 through 2013, the Navy has funded over \$240M specifically for marine mammal research. Navy scientists work cooperatively with other government researchers and scientists, universities, industry, and non-governmental conservation organizations in collecting, evaluating, and modeling information on marine resources. They also develop approaches to ensure that these resources are minimally impacted by existing and future Navy operations. It is imperative that the Navy's research and development (R&D) efforts related to marine mammals are conducted in an open, transparent manner with validated study needs and requirements. The goal of the Navy's R&D program is to enable collection and publication of scientifically valid research as well as development of techniques and tools for Navy, academic, and commercial use. Historically, R&D programs are funded and developed by the Navy's Chief of Naval Operations Energy and Environmental Readiness and Office of Naval Research (ONR), Code 322 Marine Mammals and Biological Oceanography Program. Primary focus of these programs since the 1990s is on understanding the effects of sound on marine mammals, including physiological, behavioral and ecological effects.

ONR's current Marine Mammals and Biology Program thrusts include, but are not limited to: (1) monitoring and detection research; (2) integrated ecosystem research including sensor and tag development; (3) effects of sound on marine life (such as hearing, behavioral response studies, physiology [diving and stress], and the Population Consequences of Acoustic Disturbance model; and (4) models and databases for environmental compliance.

To manage some of the Navy's marine mammal research programmatic elements, in 2011, OPNAV N45 developed a new Living Marine Resources (LMR) R&D Program (<http://www.lmr.navy.mil/>). The goal of the LMR R&D Program is to identify and fill knowledge gaps and to demonstrate, validate, and integrate new processes and technologies to minimize potential effects to marine mammals and other marine resources. Key elements of the LMR program include:

- Providing science-based information to support Navy environmental effects assessments for research, development, acquisition, testing, and evaluation as well as Fleet at-sea training, exercises, maintenance, and support activities.
- Improving knowledge of the status and trends of marine species of concern and the ecosystems of which they are a part.
- Developing the scientific basis for the criteria and thresholds to measure the effects of Navy-generated sound.
- Improving understanding of underwater sound and sound field characterization unique to assessing the biological consequences resulting from underwater sound (as opposed to tactical applications of underwater sound or propagation loss modeling for military communications or tactical applications).
- Developing technologies and methods to monitor and, where possible, mitigate biologically significant consequences to living marine resources resulting from naval activities, emphasizing those consequences that are most likely to be biologically significant.

**Other National Department of Defense Funded Initiative** - Strategic Environmental Research and Development Program and Environmental Security Technology Certification Program are the Department of Defense's environmental research programs, harnessing the latest science and technology to improve environmental performance, reduce costs, and enhance and sustain mission capabilities. The Programs respond to environmental technology requirements that are common to all of the military Services, complementing the Services' research programs. Both the Strategic Environmental Research and Development Program and Environmental Security Technology Certification Program promote partnerships and collaboration among academia, industry, the military Services, and other Federal agencies. They are independent programs managed from a joint office to coordinate the full spectrum of efforts, from basic and applied research to field demonstration and validation.

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