M&A# 20-039-03

INCIDENTAL HARASSMENT AUTHORIZATION APPLICATION FOR THE PIER 302 REPLACEMENT PROJECT AT NAVAL INFORMATION WARFARE CENTER PACIFIC BAYSIDE COMPLEX ON NAVAL BASE POINT LOMA

OCTOBER 1, 2023 THROUGH SEPTEMBER 30, 2024

Submitted to:
Office of Protected Resources,
National Marine Fisheries Service,
National Oceanic and Atmospheric Administration

Submitted by:
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List of Acronyms and Abbreviations

°C	Celsius
°F	Fahrenheit
BMPs	Best Management Practices
Caltrans	California Department of Transportation
CFR	Code of Federal Regulations
CLT	California Least Tern
CTR	California Toxic Rule
cy	cubic yards
dB	decibel
ESA	Endangered Species Act
ESTCP	Environmental Security Technology Certification Program
ft	foot/feet
ha	hectares
Hz	hertz
IHA	Incidental Harassment Authorization
in	inch(es)
kHz	kilohertz
km	kilometer(s)
l	liter
lbs	pounds
lf	linear ft
LMR	Living Marine Resources
m	meter(s)
min	minute(s)
MLLW	mean lower low water
MMPA	Marine Mammal Protection Act
NAVFAC	Naval Facilities Engineering Systems Command (SW = Southwest)
Navy	U.S. Department of the Navy
NBPL	Navy Base Point Loma
NEPA	National Environmental Policy Act
NIWC	Naval Information Warfare Center
nmi	nautical miles
NOAA	National Oceanic and Atmospheric Administration
NMFS	National Marine Fisheries Service
NRSW	Navy Region Southwest
ONR	Office of Naval Research
Pa	Pascal
POSD	Port of San Diego
ppm	parts per million
PSO	protected species observer
PTS	permanent threshold shift
R&D	research and development

re 1 µPa	referenced to 1 micropascal
RMS	root mean square
s	second(s)
SEL	sound exposure level
SERDP	Strategic Environmental Research and Development Program
sf	square ft
SPAWAR	Space and Naval Warfare Systems Command
SPL	sound pressure level
TL	transmission loss
TTS	temporary threshold shift
U.S.	United States
USACE	U.S. Army Corps of Engineers
ZOI	Zone of Influence

EXECUTIVE SUMMARY

In accordance with the Marine Mammal Protection Act (MMPA) of 1972, as amended, the United States (U.S.) Navy (Navy) is applying for an Incidental Harassment Authorization (IHA) for pile removal and pile driving activities associated with the Pier 302 Replacement Project (Project) at the Naval Information Warfare Center (NIWC) Pacific Bayside Complex on Naval Base Point Loma (NBPL). For this IHA application, the Navy determined that underwater noise from pile removal and installation has the potential to result in incidental harassment under the MMPA. This IHA application is intended to cover an approximately 12-month window during which 32 days of pile removal and installation activity would occur. A subsequent Continuation IHA application will be submitted for any remaining in-water activities that are necessary to complete the project that extend beyond the planned one-year IHA period.

Six species of marine mammals have a reasonable likelihood of occurrence during the project's timeline and could thereby be exposed to sound pressure levels (SPLs) and sound exposure levels (SELs) associated with non-impulsive and continuous noise associated with pile removal and installation:

- California sea lion (*Zalophus californianus*);
- Harbor seal (*Phoca vitulina*);
- Northern elephant seal (*Mirounga angustirostris*);
- Bottlenose dolphin (*Tursiops truncatus*);
- Common dolphin including long- and short-beaked (*Delphinus capensis* and *D. delphis*); and
- Pacific white-sided dolphin (*Lagenorhynchus obliquidens*).

NBPL is located on the peninsula of Point Loma near the mouth and along the northern edge of San Diego Bay. NBPL provides berthing and support services to Navy submarines and other fleet assets. The Naval portion of NBPL is restricted from general public access, although the adjacent waters of San Diego Bay are heavily used by the public as well as the Navy. The Project involves the removal and replacement of mammal pens, pile removal and pile driving activities, with the eventual completion of a new Pier 302 in the same footprint as the current Pier 302. Section 1.3 describes in detail the proposed activities to be conducted during this IHA period. The proposed activities with the potential to affect marine mammals within the waterways adjacent to NBPL that could result in harassment under the MMPA are pile removal by vibratory extraction, and pile installation via impact and vibratory pile driving.

NIWC Pacific Bayside Complex is a tenant command of NBPL and has separate facilities responsibilities from NBPL. Pier 302 currently houses the Navy marine mammal program pens and small program support vessels. The Proposed Action is needed to provide the Navy's marine mammal program with adequate facilities to house its marine mammals, as well as provide a safe working environment for personnel supporting the Navy's overall mission to maintain, train, and equip combat-ready Naval forces.

In this IHA application, the Navy has used National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) Technical Guidance (NMFS 2018) and User Spreadsheet (NMFS 2020a), as well as observed noise levels during pile removal and installation projects in the

San Diego and San Francisco Bay area, northern California, and Alaska, to identify the Level A (injury) and Level B (behavior) zones of influence (ZOIs) that would result from pile removal and installation, as outlined in Section 6 and presented in Table ES-1.

Table ES-1. Noise Source Data Used to Calculate Level A and B ZOIs by Demolition or Installation Method and Pile Size and Type

Method	Pile Size and Type	Noise Source Data
Pile Removal Activities		
Vibratory Extraction	18-inch Octagonal Concrete[1]	Unpublished Data (NAVFAC SW 2022) from the Navy Base San Diego Pier 6 Replacement Project
	18-inch Round Steel	The Modernization of the Alaska Marine Highway System Ferry Terminal Project at Kake, Alaska in the Hydroacoustic Pile Driving Noise Study (Denes et al. 2016)
Pile Installation Activities		
Impact Pile Driving	24-inch Octagonal Concrete	Berth 22 Reconstruction and the Noyo Bridge Replacement Projects (Caltrans 2020)
	14-inch Square Concrete	
Vibratory Hammer	6-inch Round Steel[2]	Mad River Slough Pipeline Project in the Compendium of Pile Driving Sound Data (Illingworth & Rodkin 2007)

[1] In the absence of information on vibratory extraction of 18-inch octagonal concrete piles, source data from 20-inch square concrete piles (NAVFAC SW 2022) was used as a proxy source level.

[2] In the absence of information on Vibratory Installation of 6-inch round steel piles, source data from 12-inch round steel piles (Illingworth & Rodkin 2007) was used as a proxy source level.

Source levels for pile removal and installation are typically measured at 10 m (33 ft) from a pile in order to standardize sound measurement data. For pile removal and installation activities, underwater sound transmission loss is estimated using the simple spreading loss model and compared against acoustic data reported during the projects listed above. Ambient underwater sound levels for the project area (NAVFAC SW 2020) are used as appropriate in the analysis.

Potential exposures that would constitute takes under the MMPA are calculated and described in Section 6, and based on this analysis, no mortality or serious injuries are anticipated. When Level A ZOIs are small, a 10 m (33 ft) "Physical Interaction Shutdown Zone" is generally used to reduce the risk of physical interaction between marine mammals and in-water equipment, and for this Project, an additional 10 m (33 ft) buffer has been added to the "Physical Interaction Shutdown Zone." This would provide a 20 m (66 ft) buffered shutdown zone for all marine species observed in the Project area. Additionally, one Level A ZOI has been established for impact pile driving of 24-inch octagonal concrete piles. A calculated distance of 62.4 m (205 ft) will be buffered to 70 m (230 ft). This would further reduce the likelihood of Level A harassment (minor injury due to the onset of a permanent threshold shift [PTS]), which could only occur if an animal were to remain well inside of a buffered shutdown zone for a prolonged period. Previously established acoustic data and a simple spreading loss model are used to determine the extent of the Level B ZOIs for these activities.

The Project will include continued observational monitoring of marine mammal occurrences within established ZOIs.

Pursuant to the MMPA Section 101(a)(5)(D), the Navy submits this application to the NMFS for an IHA for the incidental, but not intentional, taking of 871 marine mammals during approximately 32

days of pile removal and installation activities as part of the Project occurring during the one-year period beginning October 1, 2023 and ending September 30, 2024. The anticipated take of marine mammals would be in the form of non-lethal, temporary harassment behavioral disturbance and is expected to have a negligible impact on the species. If in-water activities do not occur within the anticipated project window, 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 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.

1.0 DESCRIPTION OF ACTIVITY

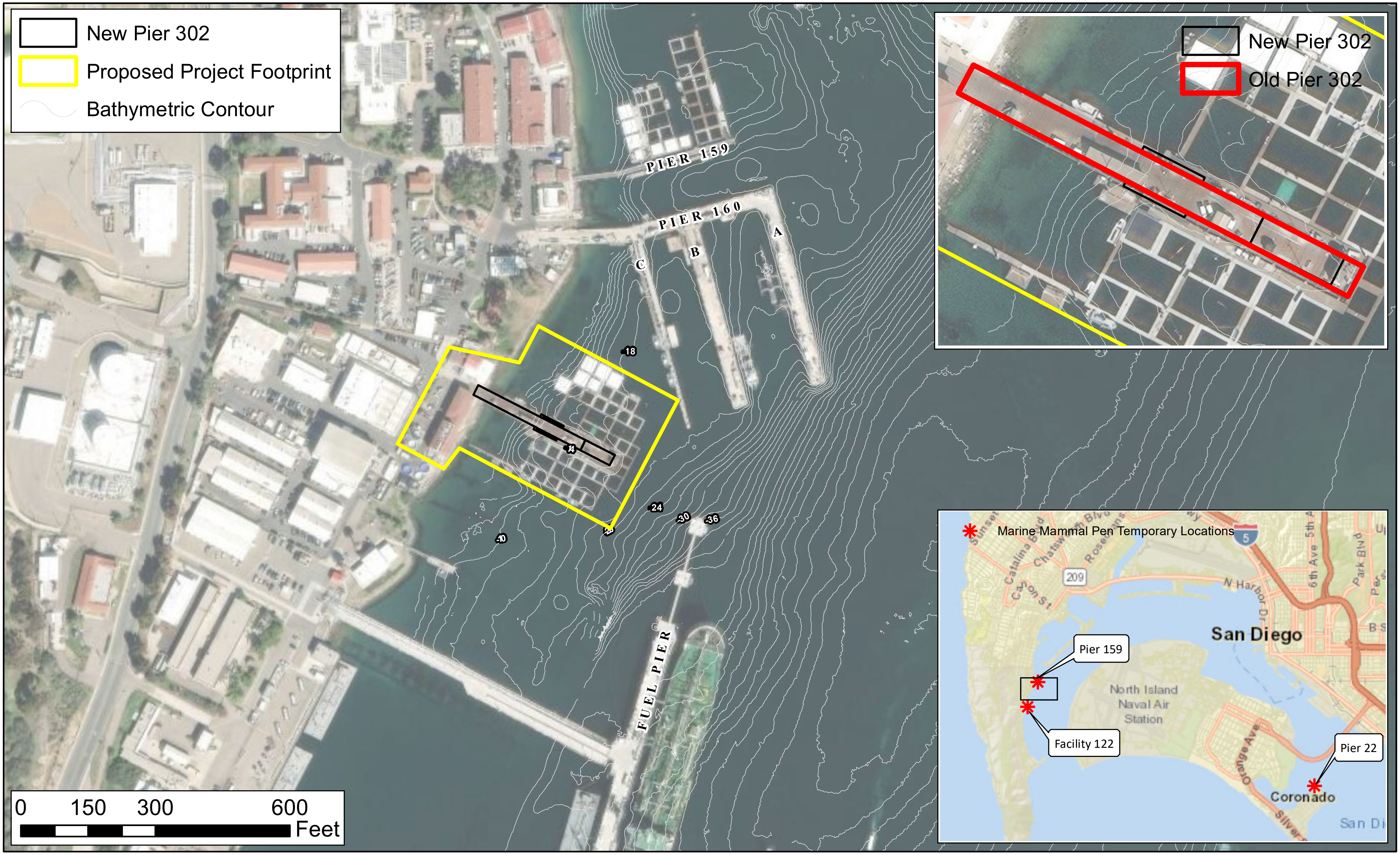
1.1 INTRODUCTION

Pursuant to the Marine Mammal Protection Act (MMPA) Section 101(a)(5)(D), The United States Navy (Navy) submits this Incidental Harassment Authorization (IHA) application to the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) for the incidental taking of marine mammal species during pile removal and pile driving activities associated with the Pier 302 Replacement Project (Project) at the Naval Information Warfare Center (NIWC) Pacific Bayside Complex on Naval Base Point Loma (NBPL), California (Figure 1-1). In-water work associated with the Project will consist of the removal and replacement of mammal pens, pile removal and pile driving activities, with the eventual completion of a new Pier 302 in the same footprint as the old Pier 302. Of those activities, only pile removal and pile driving may result in takes of marine mammals for the one-year period between October 1, 2023 through September 30, 2024. To account for the breeding/nesting season of the Endangered Species Act (ESA)-listed California least terns (CLT; *Sternula antillarum browni*), in-water pile removal and pile driving activities are expected to occur on a total of 32 days between October 1, 2023 and March 31, 2024 (183 calendar days). During this timeframe, there will be an estimated maximum of 18 days of pile removal activities and 14 days of pile driving activities. Transportation of the existing marine mammal pens out of the area prior to construction and back to the area after pier construction is complete, is not anticipated to generate noise levels capable of causing takes of marine mammals and is proposed to occur prior to, and after, the pile removal and installation activities.

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 pile removal and pile driving 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 expiration of this IHA. The renewal request will include an explanation that the activities to be conducted under the request are identical to the activities analyzed under the initial IHA, are a subset of the activities, or include changes so minor that they do not affect the previous analyses, mitigation and monitoring requirements, or take estimates. One such change would be 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 completed 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

The facilities of NBPL are located on the peninsula of Point Loma near the mouth and along the northern edge of San Diego Bay (Figure 1). NBPL provides berthing and support services to Navy submarines and other fleet assets. The Naval portion of NBPL is restricted from public access, although the adjacent waters of San Diego Bay are heavily used by the public as well as the Navy. NIWC Pacific Bayside Complex is a tenant command of NBPL and has separate facilities from NBPL. Pier 302 currently houses the Navy marine mammal program pens and small program support vessels. The existing Pier 302 was built in 1937 and partially modified in 1987. During a 2018 engineering assessment (Collins 2018) Pier 302 was rated as having "Poor" portions of the steel beams making up the superstructure as well as several corroded concrete piles, and deteriorated



Project Location

Pier 302 Replacement Naval Information Center (NIWC) Pacific, Bayside Complex

Figure 1-1

timber decking. The current condition of the pier has inadequate load-bearing capabilities. To maintain safe and secure access to the mammal pens and small vessels utilized by the Navy marine mammal program, the assessment recommended replacement of the deck and superstructure. The Proposed Action involves several elements:

- Removal of items attached to the existing pier prior to any demolition work, including the mammal pens attached on the north and south sides, as well as gangways and floating walkways;
- Demolition of the existing pier including removal of 18-inch concrete structural piles, 18-inch steel pipe guide piles, and 14-inch timber piles;
- Construction and installation of a new cement pier and gangways as well as the installation of 24-inch structural concrete piles, 14-inch concrete guide piles, and 6-inch steel pipe guide piles, as well as the mechanical and electrical systems;
- Reinstallation of existing floating walkways, gangways, and mammal pens to the north and south of the newly constructed pier; and
- Shoreside improvements including construction of a new storm drain outlet and revetment under the base of the new pier.

The mammal pens will be floated by members of the Navy’s marine mammal program using small vessels to existing Navy facilities in northern San Diego Bay, including Pier 159, Facility 122 at Pier 99, and Pier 22. These activities would generate underwater noise similar to existing vessel traffic in the Bay and would not result in any takes of marine mammals.

Section 1.3 describes the proposed activities to be conducted during this IHA period in detail. The proposed activities with the potential to result in harassment under the MMPA are the removal of piles by use of a vibratory pile extractor to loosen and pull piles out of the mud or via pile installation using impact or vibratory hammers. Other pile removal methods, including removing piles via a hydraulic pile clipper, wire saw, underwater chainsaw, high-pressure water jet, or dead-pull, may also occur, but no Level B harassment is expected via these methods. Whereas Section 1.3 provides an overview of the entire Project, Section 2 provides more specific details on activities proposed to occur during the period of this IHA.

The Proposed Action is needed to provide the Navy’s marine mammal program with adequate facilities to house its marine mammals, as well as provide a safe working environment for personnel supporting the Navy’s overall mission to maintain, train, and equip combat-ready Naval forces.

1.3 Description of Activities

Figure 1-1 presents an overview of the Project area. The Navy would remove piles associated with the old Pier 302 and install the new pier piles over a period of approximately 32 days within the 183-day period outside of CLT nesting season over the course of the one-year IHA period.

Following top side demolition of existing pier elements and offsite fabrication of the new gangways and piles, workers would remove approximately one to five piles per day. In-water pile removal activities are anticipated to occur on up to 18 working days. Table 1-1 describes the type and number of each pile to be removed as well as the anticipated method of removal. The 18-inch round steel piles are outside of the pier footprint and act as guide piles for the Navy's marine mammal program pens.

Table 1-1. Pier 302 Piles to be Removed During this IHA Period

Pile Type	Number to be Removed	Removal Method
18-inch Octagonal Concrete[1]	22	Vibratory Extraction, Hydraulic Pile Clipper, Wire Saw, Underwater Chainsaw, High-pressure Water Jet
18-inch Round Steel	3	Vibratory Extraction
14-inch Round Timber	up to 10	Dead-pull[2]

[1] While other methods of pile removal are possible, vibratory extraction is the most likely method that will be used to extract piles. No Level A/B "take" analysis conducted on the other pile removal methods.
[2] If piles are dead-pulled no Level A/B "take" would occur.

Workers would potentially extract piles using multiple techniques including vibratory extraction, hydraulic pile clipper, wire saw, underwater chainsaw, high-pressure water jet, or dead-pull. Of these activities, only vibratory extraction will be assessed for take due to the similarity to vibratory pile installation. All other pile demolition activities will be described, but no Level A/B take analyses will be presented in the IHA application.

Existing concrete and steel piles will be removed using a vibratory extractor and pile clamp by latching on to the pile with the clamp, vibrating the pile to break surface tension, and applying upward pressure to extract the whole pile. Workers may also use the dead-pull method to remove steel or timber piles by securing the piles above the water line and applying upwards pressure to the pile. This pile removal method will not be discussed further in this document relative to MMPA "take" because no underwater noise would be generated by the activity. In the case of removal by a hydraulic pile clipper, workers would place a hydraulic clipper over each pile and lower it to one foot below the mudline, where it would be cut. The pile would remain in place below the mudline. Diver assistance may or may not be required during this specific pile removal activity. Underwater chainsaws or wire saws operated by a diver may also be used to remove piles at the mudline. Once the piles are removed or cut, a crane would remove the pile and set it onto a barge for transport. Ultimately, the contractor will use one of the above described methods depending on which proves to be most efficient. Throughout the demolition effort, material floats and collection bins would capture demolition debris before it enters the water. Workers in support boats would gather any floating debris for recycling or disposal, as appropriate.

Following the removal of existing piles, the Navy would install from one to five piles a day, depending on the type of pile. At this rate, in-water pile installation activities are anticipated to require up to 14 working days. Table 1-2 describes the type and number of each pile to be installed, as well as the anticipated method of installation.

Table 1-2. Pier 302 Piles to be Installed During this IHA Period

Pile Type	Number to be Installed	Installation Method
24-inch Octagonal Concrete[1]	30	Impact hammer
14-inch Square Concrete[1]	2	Impact hammer
6-inch Round Steel	17	Vibratory hammer

[1] With or without high-pressure water jetting occurring simultaneously.

The 24-inch octagonal concrete piles will be structural piles, which support the weight of the pier, and the 14-inch square concrete and 6-inch round steel piles will be guide piles for the gangways and marine mammal pens, respectively. Workers would install the piles in one of two ways: use of an impact hammer with, or without, water jetting or use of a vibratory hammer. New cement piles will be water jetted to within 3 meters (m; 10 feet [ft]) of tip elevation with the final 3 m (10 ft) being driven with an impact hammer. A water jet may be used as well during the installation process. New steel piles will be installed with a vibratory hammer. Section 2 provides more specific detail on the number of piles to be removed and installed, as well as the methods to be used during the period of this IHA. Once extracted, the piles will be loaded onto a support barge for eventual offloading. During pile removal, floating stick bar booms will be deployed around the active work area to provide a complete barrier to floating debris. Any floating debris will be gathered in work boats and will be disposed of or recycled as appropriate.

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 removal and installation activities to avoid and minimize potential environmental impacts. Additional minimization measures have been added to protect marine mammals as described in Section 13.

2.0 DATES, DURATION, AND LOCATION OF ACTIVITIES

2.1 Dates and Duration of Activities

For this analysis, it is assumed that the removal of up to 35 piles and installation of 49 piles would happen over approximately 32 days within the one-year IHA period (Table 2-1). Piles would be removed at a rate of from one to five per day, and installation of piles would occur at a rate of from one to four per day, depending on the type of pile. The timber piles are remnant piles from the original 1937 construction, but the total number of piles and their placement in the pier footprint are unknown. Some of these piles were cut during the 1987 modifications, but it is unknown how many of them remain nor at what depth they were cut. The ten timber piles identified in Table 2-1 are only an approximate number of piles that could interfere with the installation of the 18-inch octagonal concrete piles.

Table 2-1. Pile Type and Pile Removal and Installation Method and Duration

Method	Pile Type	# of Piles	Piles/Day	Total Estimated Days
Pile Removal Activities				
Vibratory Extraction[1]	18-inch Octagonal Concrete	22	5	5
Vibratory Extraction	18-inch Round Steel	3	1	3
Dead-pull	14-inch Round Timber	up to 10	1	10
Pile Installation Activities				
Impact Hammer[2]	24-inch Octagonal Concrete	30	4	8
	14-inch Square Concrete	2	1	2
Vibratory Hammer	6-inch Round Steel	17	5	4
Total in-water workdays				**32**

[1] While other methods of pile removal are possible, vibratory extraction is the most likely method that will be used to extract piles. No Level A/B "take" analysis conducted on the other pile removal methods (See Table 1-1).

[2] With or without high-pressure water jetting occurring simultaneously.

2.2 Project Area Description

San Diego Bay is a narrow, crescent-shaped natural embayment oriented northwest-southeast with an approximate length of 24 kilometers (km; 15 miles) and a total area of roughly 4,450 hectares (ha; 11,000 acres) (Port of San Diego [POSD] 2007). The width of the bay ranges from 0.3 km to 5.8 km (0.2 to 3.6 miles), and depths range from -23 m (-74 ft) below mean lower low water (MLLW) near the tip of Ballast Point to less than -1.2 m (-4 ft) below MLLW at the southern end (Merkel & Associates, Inc. 2009). About half of the bay is less than 4.6 m (15 ft) deep and most of it is less than 15 m (50 ft) deep (Merkel & 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. 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 & Associates, Inc. 2009). The U.S. Army Corps of Engineers (USACE) dredges the main navigation channel in San Diego Bay to maintain a depth of -14.3 m (-47 ft) below MLLW and is responsible for providing safe transit for private, commercial, and military vessels within

the Bay (NOAA 2010). Outside of the navigation channel, the Bay floor consists of platforms at depths that vary slightly. Within the North Bay, typical depths range from -11.0 m to 11.6 m (-36 to -38 ft) below MLLW to support large ship turning and anchorage (Merkel & Associates, Inc. 2009).

Water depth in the Pier 302 area ranges from approximately 0 to 6 m (0 to 20 ft) below MLLW. Southeast of the Project limits near the current Fuel Pier, water depth increases to 11 m (36 ft) below MLLW to accommodate fueling operations. Northeast of the Project limits near Pier 160-A, water depths also increase to 11 m (36 ft) below MLLW.

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 eco-regions based on circulation characteristics:

- The North Bay – Marine Region extends from the bay mouth to the area offshore of 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 Bay – 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 – 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 one month (POSD 2007). Common salinity values for the bay range from 33.3 to 35.5 practical salinity units for the bay mouth and the south bay, respectively (Chadwick et al. 1999).

San Diego Bay has mixed diurnal/semi-diurnal tides, with the semi-diurnal component being dominant. 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. The tidal range (difference between MLLW and mean highest high water) is approximately 1.7 m (5.5 ft). In general, tidal currents are strongest near the bay mouth, with maximum velocities of 0.5 to 1.0 m per second (1.6 to 3.3 feet per second) (Largier 1995). Tidal current direction generally follows the center of the channel. 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 the San Diego Bay mixes with ocean water and then moves back into the bay. The complete exchange of all the water in the 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). Water temperature in San Diego Bay ranges from 15.1 to 26.1 degrees Celsius (°C; 59.1 to 78.9 degrees Fahrenheit [°F]). This range can be attributed to thermoclines exhibited in deeper industrial/port

waters, which are typical of this geographic region (Amec Foster Wheeler Environment & Infrastructure, Inc. 2016).

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 8 to 9 °C (14 to 16 °F). Maximum water temperatures occur in July and August with minimums occurring 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 29.3 °C (84.7 °F) recorded in the south bay, and the coolest temperature, 15.1 °C (59.2 °F), recorded just north of the Coronado Bridge in January (Lapota et al. 1993). The average surface temperature is estimated to be 19.3 °C (66.8 °F; National Data Buoy Center [NDBC] 2022). Maximum vertical temperature gradients of about 0.5 °C/m (0.3 °F/ft) occur during the summer. Typical longitudinal temperature range is about 7 to 10 °C (45 to 50 °F) (about 0.3 to 0.5 °C/km) over the length of the bay during the summer (Smith 1972). 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. 2012a).

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. 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. Dissolved oxygen levels range from approximately 4 milliliters per liter (mL/L) during the summer to 8 mL/L during the winter. 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 Environment & Infrastructure, Inc. 2016). Polycyclic aromatic hydrocarbon concentrations are also below their respective CTR threshold values (Amec Foster Wheeler Environment & Infrastructure, Inc. 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. 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. 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. 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. 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. 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. However, copper concentrations remain routinely higher than federal and state limits for dissolved copper (POSD 2007).

2.2.4 Substrates and Habitats

Marine mammal occurrence in San Diego Bay is predominantly in the northern portion of San Diego Bay. Local and seasonal concentrations of marine mammals in San Diego reflect the opportunistic attraction of marine mammals in general to areas of high prey (fish) abundance; the proximity of haul-outs, resting sites, and feeding sites for pinnipeds; and, for cetaceans, the prevalence of marine conditions and access to and from the open ocean.

Sediments in San Diego Bay are relatively sandy (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 predominant habitats of the Project area are shallow subtidal (-0.7 to -4 m [-2.2 to -12 ft] below MLLW) and moderately deep (-3.7 to -6.0 m [-12 to -20 ft] below MLLW) subtidal and artificial hard substrates. Existing entire and partial piles may provide substrates for the growth of algae and invertebrates off the bottom and support more abundant fish populations than occur in the adjacent deep-water habitat. Figure 2-1 shows baseline eelgrass data collected during 2020 bay wide surveys within the Project limits (Merkel & Associates, Inc. 2021). Pre-construction eelgrass surveys will be performed closer to the start of construction in accordance with the California Eelgrass Mitigation Policy.

Eelgrass Beds in the Project Area

Pier 302 Replacement Naval Information Center (NIWC) Pacific, Bayside Complex

Figure 2-1

2.2.5 Vessel Traffic and Ambient Underwater Soundscape

As illustrated by Table 2-2 below, San Diego Bay is heavily used by commercial, recreational, and military vessels, with an average of 80,691 vessel movements (in or out of the bay) per year. This equates to about 225 vessel transits per day, a majority of which are presumed to occur during daylight hours. The number of transits does not include recreational boaters that use San Diego Bay, estimated to number 200,000 (San Diego Harbor Safety Committee 2009).

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

VESSEL TYPE	VESSEL MOVEMENTS (Total Calls by Vessel Type)[1]		
	Subtotal by Vessel Type		Total
	Cargo	Others	
Deep Draft Commercial Vessels (Cargo plus Cruise)[1]			
Cargo Ships[2]: Barge	5		**5**
Barge Bulk	5		**5**
Container Ships	52		**52**
General Cargo	90		**90**
Roll On/Roll Off	45		**45**
Cruise Ships[3]		100	**100**
Excursion Ships[4]		68,000	**68,000**
Commercial Sportfishing[5]		10,094	**10,094**
Military[6]		2,300	**2,300**
Total Annual Movements for All Vessel Types	**197**	**80,494**	**80,691**

[1] Tug traffic was not included in the above statistics since inner harbor tug movements alone exceed 7,000 for a typical year
[2] Largest vessel: 1,000 ft length, 106 ft beam, 41 ft draft
[3] Largest vessel: 1,000 ft length, 106 ft beam, 34 ft draft
[4] Largest vessel: 222 ft length, 57 ft beam, 6 ft draft
[5] Average vessel size: 123 ft length, 32 ft berth, 13 ft draft
[6] Largest vessel: 1,115 ft length, 252 ft beam (flight deck), 39 ft draft
Sources: San Diego Harbor Safety Committee (2009 and 2020)

Refer to Section 6 for background on acoustics and definitions of metrics. Acoustic monitoring of ship noise in Glacier Bay, Alaska (Kipple and Gabriele 2007), found that root mean square (RMS) sound source levels from a variety of vessel types and sizes was typically within the range of 157 to 180 decibels (dB) referenced to 1 microPascal (re 1 µPa) at 1 m. Ship noise was characterized by a broad frequency range (roughly 0.1 to 35 kilohertz [kHz]), with peak noise at higher frequencies 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). Within southern California, in the Santa Barbara Channel, large cargo ships at transit speeds range from 177 to 188 dB re 1 µPa (McKenna 2011). Ship noise in San Diego Bay thus has the potential to mask underwater sound that would otherwise emanate from the Project site to locations farther up the bay or offshore through the mouth.

The Navy has made extensive measurements of ambient underwater sound in the Project area of San Diego Bay (NAVFAC SW 2020). Based on the most recent data provided in the Compendium of Underwater and Airborne Sound Data from Pile Driving and Demolition Activities in San Diego Bay (San Diego Noise Compendium; NAVFAC SW 2020), the median ambient underwater sound pressure level (SPL) in areas of the bay subject to project construction noise averages approximately 129.6 dB re 1 µPa. For this Project, distances to the threshold for acoustic disturbance from continuous sources are based on the distances at which the Project sound source declines to ambient.

3.0 MARINE MAMMAL SPECIES AND NUMBERS

The most frequently observed marine mammal 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. Other species include bottlenose dolphin (*Tursiops truncatus*), which is regularly seen in the North Bay; harbor seal (*Phoca vitulina*), which frequently enters the North Bay; and common dolphins (both short-beaked [*Delphinus delphis*] and long-beaked [*Delphinus capensis*]), which are rare visitors in the North Bay. Additional species considered under this IHA application include northern elephant seal (*Mirounga angustirostris*) and Pacific white-sided dolphin (*Lagenorhynchus obliquidens*) based on associations with the waters of Southern California or historic records associated with San Diego Bay (NAVFAC SW and POSD 2013, NAVFAC SW 2014, 2015, 2016, 2017a-b, 2018a-b). See section 6.8.7 for a brief explanation of species excluded from this analysis. Selection of species for review is based on previous IHA applications and subsequent marine mammal monitoring efforts associated with the demolition of the former NBPL Fuel Pier and construction of the current Fuel Pier over the course of five years (NAVFAC SW 2014, 2015, 2016, 2017a-b, 2018a-b). NMFS Stock Assessment Reports (Carretta et al. 2015, 2017, 2019, and 2021) are considered in determining the estimated baseline and minimum populations of each designated stock of marine mammals that have the potential to occur within the activity area (i.e., the northern portion of San Diego Bay).

Most of the area of effect for the Project was intensively monitored during the previous IHA periods from the adjacent NBPL Fuel Pier construction project (NAVFAC SW 2014, 2015, 2016, 2017a-b, 2018a-b), with the greatest numbers occurring during the second IHA period, likely resulting from shifts in ocean and bay temperatures due to the 2015 El Niño event beginning in first IHA period (NAVFAC SW 2014, 2015). Observed numbers of marine mammals during these previous monitoring periods were used to establish local population estimates that would potentially be impacted by removal of remaining fuel pier piles and subsequent dredging. Of the five previous monitoring periods, the third, fourth, and fifth IHA period species observations are likely indicative of typical species at the Fuel Pier site (NAVFAC SW 2016, 2017a-b, 2018 a-b). Of those three IHA periods, the fourth IHA period (NAVFAC SW 2017b, 2018a) had the highest number of activity days and the highest average number of animals observed of the three most common marine mammal species (California sea lions, harbor seal, and bottlenose dolphins). For species not observed during the fourth IHA period but presented in this IHA Application (i.e., common dolphin and Pacific white-sided dolphin), observations from the second IHA period are used (NAVFAC SW 2015).

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 (ZOIs) (see Section 6.7).

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. wollebaeki*) and the extinct Japanese sea lion (*Z. japonicus*) (Carretta et al. 2019). The California sea lion is sexually dimorphic. Males may reach 317 kilograms (700 pounds) and 2.3 m (7.5 ft) in length; females grow to 109 kg (240 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 California sea lion heads, and hair around the crest gets lighter with age (NMFS 2022a).

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 California 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 the most recent 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).

3.1.2 Harbor Seal

3.1.2.1 Species Description

Harbor seals, which are members of the family Phocidae ("true seals"), with two subspecies extant in the Pacific: *P. v. stejnegeri* in the western North Pacific near Japan and *P. v. richardii* in the eastern North Pacific including the west coast of the U.S. Like all true seals, harbor seals have short forelimbs and lack external ear flaps as present in otariids such as the California sea lion. Harbor seals inhabit coastal and estuarine waters and shoreline areas from Baja California to western Alaska. Harbor seals weigh up to 129 kg (285 pounds) and measure up to 1.8 m (6 ft) in length with males slightly larger than females (NMFS 2022b).

3.1.2.2 Population Abundance

Based on post-breeding counts of individuals at known haul-outs, corrected for the proportion of the population that is out at sea, the population estimate for the California stock of harbor seal is 30,968, and the minimum population size is estimated as 27,348 (Carretta et al. 2019). The population size has increased since the 1980s and fluctuated during the past decade, with the highest counts in 2004 but lower counts in 2009 and 2012 (Carretta et al. 2016).

3.1.3 Bottlenose Dolphin

3.1.3.1 Species Description

The California coastal stock of bottlenose dolphin is distinct from the offshore population and is resident in the immediate (within 1 km of shore) coastal waters, occurring primarily between Point Conception, California, and San Quintin, Mexico. Bottlenose dolphins have a robust body and a short, thick beak. They range in length from 1.8 to 4.0 m (6 to 13 ft) and weigh from 135 to 635 kg (300 to 1,400 pounds); males are slightly larger than females. They are commonly found in groups of 2 to 15 individuals and in larger pods offshore. Coastal animals feed on benthic fish and invertebrates (NMFS 2022c).

3.1.3.2 Population Abundance

Based on photographic mark-recapture surveys conducted along the San Diego coast from 2009 to 2011 (Weller et al. 2016), two separate population size estimates were generated from open and closed mark-recapture models. The best open model generated an estimate of 515 (95% confidence interval [CI] = 470–564, coefficient of variation [CV] = 0.05) animals, while the best closed model produced an estimate of 453 (95% CI = 411–524, CV=0.06) animals. These estimates are for marked

animals only and do not include an estimated ~40% of animals that are not individually recognizable (Weller et al. 2016). The estimated fraction of unmarked animals is highly uncertain because it is unknown how often unmarked animals are resighted. The new estimates are the largest obtained for this stock, dating back to the 1980s. For comparison with previous estimates of this stock, the closed population estimate of 453 (CV=0.06) animals is used as the best estimate of abundance (Carretta et al. 2017, 2019). In the aforementioned surveys of San Diego Bay, numbers of bottlenose dolphins were highly variable (from 0 to 40).

3.1.4 Common Dolphin (Short-Beaked and Long-Beaked)

3.1.4.1 Species Description

The California/Oregon/Washington stock of short-beaked common dolphin and the California stock of long-beaked common dolphin both occur in coastal southern California waters. While the long-beaked common dolphin is a nearshore species, the short-beaked common dolphin is widely distributed between the coast and at least 556 km (300 nautical miles [nmi]) offshore (Navy 2017b). The short-beaked and long-beaked species were only recently separated and are difficult to distinguish at sea. All common dolphins are slender, with a relatively long beak sharply demarcated from the melon, a high, moderately falcate dorsal fin, and a unique crisscross color pattern. Adult long-beaked common dolphins range from 1.8 to 2.6 m (6 to 8.5 ft) long with weights ranging from 45.3 to 226.8 kg (160 to 500 pounds), whereas the short-beaked species average approximately 1.8 m (6 feet) in length and average 77.1 kg (170 pounds) in weight (NMFS 2022d, 2022e).

3.1.4.2 Population Abundance

The distribution and abundance of common dolphins in coastal California waters varies considerably with oceanographic conditions; therefore, a multi-year average abundance estimate is appropriate (Carretta et al. 2017). The most recent estimate of short-beaked common dolphin abundance is 969,861 animals (Carretta et al. 2019). This estimate includes new correction factors for animals missed during the surveys. Similarly, the abundance estimate for long-beaked common dolphins in California, Oregon and Washington waters is 101,305 (Carretta et al. 2019).

3.1.5 Pacific White-Sided Dolphin

3.1.5.1 Species Description

The Pacific white-sided dolphin is a North Pacific endemic and one of the most abundant pelagic species of dolphins found in the cold-temperate waters of this region. These dolphins are boldly marked, with a dark gray or black dorsal surface and light gray sides, with light gray "suspender stripes" originating near the melon and angling toward the blowhole across each side into the light gray flank patch. The beak is dark with a narrow stripe extending to the bicolored dorsal fin. The beak is dark, with a narrow stripe extending to the bicolored flipper. The dorsal fin has a darker leading edge with light gray covering two-thirds of the posterior portion. Adults range from 1.7 to 2.4 m (5.5 to 8 ft) in length and weigh 136.1 to 181.4 kg (300 to 400 pounds), with males slightly larger than females (NMFS 2022f).

3.1.5.2 Population Abundance

As summarized by Carretta et al. (2017), the most recent estimate of abundance for Pacific white-sided dolphins of California, Oregon, and Washington waters is 26,814 animals with an estimated minimum population size of 21,195 animals.

3.1.6 Northern Elephant Seal

3.1.6.1 Species Description

The largest of the "true seals", this highly sexually dimorphic seal is found only in the eastern North Pacific. Males are significantly larger than females, with males reaching lengths of over 4.0 m (13 ft) and weights of 1,996 kg (4,400 pounds) and females reaching lengths of over 3.0 m (10 ft) and 590 kg (1,300 pounds) (NMFS 2022g). Both sexes are relatively large and have a large head. Their distinctive profile makes them unlikely to be misidentified with other species that their range overlaps with. Only young individuals could be mistaken for a sea lion or fur seal at sea if viewed quickly or from a distance (Navy 2017b).

3.1.6.2 Population Abundance

Based on elephant seals at U.S. rookeries in 2010, Lowry et al. (2014) reported that 40,684 pups were born. They then applied a multiplier of 4.4 to estimate approximately 179,000 elephant seals. This multiplier is derived from life tables based on published elephant seal fecundity and survival rates and reflects a population with approximately 23% pups. The population is estimated to have grown at 3.8% annually since 1988 (Lowry et al. 2014). The minimum estimated population size is 81,368 (Carretta et al. 2019).

3.2 Spatial Distribution

Density assumes that marine mammals are uniformly distributed within a given area, although this is rarely the case. Marine mammals are usually clumped in areas of greater importance, for example, areas of high productivity, lower predation, safe calving, foraging, etc. The site-specific surveys of northern San Diego Bay, along with years of monitoring efforts at the NBPL Fuel Pier during the previous pier replacement project, provide high resolution of the distribution of marine mammals within the affected area.

3.3 Submergence

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

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

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

4.0 AFFECTED SPECIES STATUS AND DISTRIBUTION

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 U.S.-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. 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 U.S. 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 & 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 m ake 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 California 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 50 km (31 miles) 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. The closest potential haul-out locations to Pier 302 are docks associated with Pier 160 approximately 100 m (333 ft) to the north and docks at the end of Pier 99 approximately 550 m (1,804 ft) to the south; however, these docks are in constant use for Navy operations and training activities. California sea lions are expected to haul-out at those locations but are unlikely to remain for very long due to the high levels of activity. California sea lions also haul-out at barges associated with the Everingham Brothers Bait Barge Company that are from 700 to 1,000 m (0.4 to 0.5 nmi) southeast of the Project area. Beyond these man-made structures, there are no known natural haul-out locations in the vicinity of the Project area. As discussed in Chapter 3, California sea lion occurrence in the area surrounding the Project site is expected.

The fourth IHA period of the NBPL Fuel Pier Replacement Project recorded 2,263 individuals over 152 days of monitoring activity (NAVFAC SW 2017b; 2018a). This equates to an average of 14.9 California sea lions observed per day. Rounding to the nearest whole number leads to 15 individuals per day expected to be in the vicinity of the Pier 302. As a result, the Navy believes that the monitoring data from the fourth IHA period for the Fuel Pier Replacement Project represent the most conservative numbers of California sea lions that are likely to occur.

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 California 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 haul-outs (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).

4.2 Harbor Seal (California Stock)

4.2.1 Status and Management

Harbor seals are protected under the MMPA and are not listed as threatened or endangered under the ESA. NMFS has defined five distinct stocks on the U.S. west coast including California, Oregon/Washington Coast, Washington Northern Inland Waters, Southern Puget Sound, and Hood Canal. The Project site is located within the boundaries of the California Stock which is not considered depleted under the MMPA (Carretta et al. 2021).

4.2.2 Distribution

Harbor seals are considered abundant throughout most of their range from Baja California to the eastern Aleutian Islands. An unknown number of harbor seals also occur along the west coast of Baja California, at least as far south as Isla Asuncion, which is about 161 km (100 miles south of Punta

Eugenia. Peak numbers of harbor seals haul-out on land during late May to early June, which coincides with the peak of their molt. They favor sandy, cobble, and gravel beaches (Stewart and Yochem 1994), with multiple haul-outs identified along the California mainland and Channel Islands (Carretta et al. 2016).

There are limited at-sea density estimates for pinnipeds within southern California. Harbor seals do not make extensive pelagic migrations but do travel 300 to 500 km (186 to 311 miles) on occasion to find food or suitable breeding areas (Carretta et al. 2016). Based on likely foraging strategies, Grigg et al. (2009) reported seasonal shifts in harbor seal movements based on prey availability. When at sea, they remain in the vicinity of haul-out sites and forage close to shore in shallow waters. In relationship to the entire California stock, harbor seals do not have a significant mainland California distribution south of Point Mugu due to beach urbanization and potential disturbance impacts.

4.2.3 Site-Specific Occurrence

Harbor seals are relatively uncommon within San Diego Bay. Similar to California sea lions, harbor seals haul-out on rocks, buoys and other structures. As stated above in Section 4.1.3, the nearest haul-outs are a pair of active Navy docks, one north and one south of the Pier 302, with a pair of bait barges further from the Project area to the south. The fourth IHA period of the NBPL Fuel Pier Replacement Project recorded 88 individuals over 152 days of monitoring activity (NAVFAC SW 2017b; 2018a). This equates to an average of 0.6 harbor seals observed per day and, rounded to the nearest whole number, to 1.0 individual per day expected to be in the vicinity of Pier 302. Because the fourth year IHA period of the Fuel Pier Replacement Project produced what is considered a typical number of species observations, it represents the best available and conservative estimate for numbers of harbor seals that are likely to occur.

4.2.4 Behavior and Ecology

Harbor seals prefer sheltered coastal waters and feed on schooling benthic and epibenthic fish species in shallow water (Bonnell and Dailey 1993). While not studied in the bay, specific prey species have been studied in other California waters (Stewart and Yochem 1985, 1994; Oxman 1993; Henry et al. 1995). Of particular note to San Diego Bay are these potential prey species: specklefin midshipman, plainfin midshipman, jack mackerel, shiner surfperch, yellowfin goby, and English sole. Harbor seals also eat octopus, two species of which are found in the bay (NAVFAC SW and POSD 2013). Although their ecological niche in the bay has not been studied, this pinniped is not likely to play a significant role because of their low numbers (NAVFAC SW and POSD 2013). Harbor seals mate at sea and females give birth during the spring and summer although the “pupping season” varies by latitude.

4.2.5 Acoustics

In air, harbor seal males produce a variety of low-frequency (<4 kHz) vocalizations, including snorts, grunts, and growls. Male harbor seals produce communication sounds in the frequency range of 100 to 1,000 Hz (Richardson et al. 1995). Pups make individually unique calls for mother recognition that contain multiple harmonics with main energy below 0.34 kHz (Bigg 1981; Thomson and Richardson 1995). Harbor seals hear nearly as well in air as underwater and had lower thresholds than California sea lions (Kastak and Schusterman 1998). Kastak and Schusterman (1998) reported airborne low frequency (100 Hz) sound detection thresholds at 65.4 dB re 20 µPa for harbor seals. In air, they hear

frequencies from 0.25 kHz – 30 kHz and are most sensitive from 6 to 16 kHz (Richardson et al. 1995; Terhune and Turnbull 1995; Wolski et al. 2003).

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

4.3 Bottlenose Dolphin (California Coastal Stock)

4.3.1 Status and Management

Bottlenose dolphins are protected under the MMPA and are not listed as threatened or endangered under the ESA. NMFS has defined two distinct stocks on the U.S. west coast including California Coastal and California/Oregon/Washington Off-Shore. The Project site is located within the boundaries of the California Coastal Stock. The U.S. stock is not considered strategic or depleted under the MMPA (Carretta et al. 2019).

4.3.2 Distribution

The bottlenose dolphin California Coastal stock occurs at least from Point Conception south into Mexican waters, at least as far south as San Quintin, Mexico. In southern California, animals are found within 500 m (152.4 ft) of the shoreline 99 percent of the time and within 250 m (76.2 ft) 90 percent of the time (Hanson and Defran 1993). Occasionally, during warm-water incursions such as during the 1982–1983 El Niño events, their range extends as far north as Monterey Bay (Wells et al. 1990). Bottlenose dolphins in the Southern California Bight – the coastal waters between Point Conception and just south of the Mexican border - appear to be highly mobile within a narrow coastal zone (Defran et al. 1986) and exhibit little seasonal site fidelity within the Southern California Bight (Defran and Weller 1999) and along the California coast; over 80 percent of the dolphins identified in Santa Barbara, Monterey, and Ensenada have also been identified off San Diego (Navy 2010).

As seen in the Navy's marine mammal surveys of San Diego Bay (Merkel and Associates 2008, Tierra Data, Inc. 2012b, NAVFAC SW 2014), bottlenose dolphins have occurred sporadically and in highly variable numbers and locations.

4.3.3 Site-Specific Occurrence

The fourth IHA period of the NBPL Fuel Pier Replacement Project recorded 67 individuals over 152 days of monitoring activity (NAVFAC SW 2017b, 2018a). This equates to an average of 0.4 bottlenose dolphin observed per day. Rounding to the nearest whole number leads to 1.0 individuals per day expected to be in the vicinity of Pier 302. Because the fourth year IHA period of the previous Fuel Pier Replacement Project produced what is considered a typical number of species observations, it represents the best available and conservative estimate for numbers of harbor seals that are likely to occur.

4.3.4 Behavior and Ecology

The coastal stock utilizes a limited number of fish prey species with up to 74 percent being various species of surfperch or croakers, a group of non-migratory year-round coastal inhabitants (Defran et al. 1999; Allen et al. 2006). For southern California, common croaker prey species include spotfin croaker, yellowfin croaker, and California corbina, while common surfperch species include barred surfperch and walleye surfperch (Allen et al. 2006). The corbina and barred surfperch are the most common surf zone fish where bottlenose dolphins have been observed foraging (Allen et al. 2006). Defran et al. (1999) postulated that the coastal stock of bottlenose dolphins showed significant movement within their home range (Central California to Mexico) in search of preferred but patchy concentrations of nearshore prey (i.e., croakers and surfperch). Bearzi et al (2009), in an analysis of bottlenose dolphins in the vicinity of Santa Monica, also concluded that low individual re-sighting rates indicates a large bottlenose dolphin distribution influenced by prey distribution. After finding concentrations of prey, animals may then forage within a more limited spatial extent to take advantage of this local accumulation until such time that prey abundance is reduced; the dolphins then shift location once again to be over larger distances (Defran et al.1999; Bearzi et al. 2009). Specific prey items of bottlenose dolphins along the California coast were studied by Defran et al. (1986). San Diego Bay bottlenose dolphins forage on species such as jack mackerel, Cortez grunt, striped mullet, and black croaker, white sea bass, white croaker, spotted croaker, yellowfin croaker, California corbina, queenfish, Pacific mackerel, Pacific bonito, and sierra (NAVFAC SW and POSD 2013).

4.3.5 Acoustics

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

Temporary threshold shifts (TTS) in hearing have been experimentally induced and behavioral responses observed in captive bottlenose dolphins (Ridgway et al. 1997; Schlundt et al. 2000, 2006; Nachtigall et al. 2003, 2004; Finneran et al. 2002, 2005, 2007). Ridgway et al. (1997) observed changes in behavior at the following minimum levels for 1 second tones: 186 dB re 1 µPa at 3 kHz, 181 dB re 1 µPa at 20 kHz, and 178 dB re 1 µPa at 75 kHz. TTS levels were 194 to 201 dB re 1 µPa at 3 kHz, 193 to 196 dB re 1 µPa at 20 kHz, and 192 to 194 dB re 1 µPa at 75 kHz.

Schlundt et al. (2000) exposed bottlenose dolphins to intense tones (0.4, 3, 10, 20, and 75 kHz); the animals demonstrated altered behavior at source levels of 178 to 193 dB re 1 µPa, with TTS after exposures between 192 and 201 dB re 1 µPa at 1 m (though one dolphin exhibited TTS after exposure at 182 dB re 1 µPa). Nachtigall et al. (2003) determined threshold for a 7.5 kHz pure tone stimulus. No shifts were observed at 165 or 171 dB re 1 µPa, but when the sound level reached 179 dB re 1 µPa, the animal showed the first sign of TTS. Recovery apparently occurred rapidly, with full recovery apparently within 45 minutes following sound exposure. In another experiment, TTS occurred after 30 minutes of exposure to 160 dB re 1 µPa at 4 to 11 kHz. TTS occurred at test frequencies of 8 to 16 kHz but was negligible or absent at higher frequencies (Nachtigall et al. 2004).

4.4 Common Dolphin (Short-Beaked and Long-Beaked)

4.4.1 Status and Management

Both species of common dolphin are protected under the MMPA and are not listed as threatened or endangered under the ESA. Neither of the two stocks of common dolphins (classified as California/Oregon/Washington stock for short-beaked and California Stock for long-beaked) are considered strategic or depleted under the MMPA (Carretta et al. 2019).

4.4.2 Distribution

Short-beaked common dolphins are the most abundant cetacean off California and are widely distributed between the coast and at least 300 nmi offshore. In contrast, long-beaked common dolphins generally occur within 50 nmi of shore. Both species of common dolphin appear to shift their distributions seasonally and annually in response to oceanographic conditions and prey availability (Carretta et al. 2016). The long-beaked species apparently prefers shallower, warmer water than the short-beaked common dolphin (Perrin 2009). Both tend to be more abundant in coastal waters during warm-water months (Bearzi 2005).

4.4.3 Site-Specific Occurrence

Common dolphins are present in the coastal waters outside of San Diego Bay, but infrequently enter the bay (NAVFAC SW and POSD 2013). However, several sightings of common dolphins in the Project area during the previous fuel pier demolition and construction project in 2014 prompted their inclusion in the second year IHA application for that project. More sightings occurred during the second IHA period for the previous Fuel Pier Replacement Project (NAVFAC SW 2015). Given the lack of observations during the fourth IHA period, the Navy believes the monitoring data from the second IHA period for the previous Fuel Pier Replacement Project represent the most conservative on numbers of short- or long-beaked common dolphins that are likely to occur. The second IHA period of the previous Fuel Pier Replacement Project recorded 850 individuals over 100 days of monitoring activity (NAVFAC SW 2015). This equates to an average of 8.5 common dolphins observed per day. Rounding to the nearest whole number leads to 9.0 individuals per day expected to be in the vicinity of Pier 302. Since the two species could not be distinguished in the field, the same estimate of individuals is used as a combined estimate for both species.

4.4.4 Behavior and Ecology

Common dolphins are often found in large herds of hundreds or even thousands. They are extremely active, fast moving, and engage in spectacular aerial behavior. They are noted for riding bow and stern waves of boats, often changing course to bow ride the pressure waves of fast-moving vessels and even large whales. Common dolphins can be frequently seen in association with other marine

mammal species. They feed on squid and small, schooling fish, sometimes working together to herd fish into tight balls, and occasionally taking advantage of fishing activities to feed on fish escaping from nets or discarded by fishermen (American Cetacean Society 2004).

Common dolphins are an intermittent transient visitor to San Diego Bay and are commonly observed during the late spring and early summer when bait fish (anchovies and sardines) arrive in increasing numbers. Common dolphins have primarily been observed in the north and north central Bay in pods of 6 to less than 100 animals. The animals typically move rather quickly through the area in tight alignment and have been occasionally observed riding the bow wave of large ships.

4.4.5 Acoustics

While no empirical data on hearing ability exists for common dolphins, functional hearing for both the short- and long-beaked common dolphin is estimated to occur between approximately 150 Hz and 160 kHz, placing them among the group of cetaceans that can hear mid-frequency sounds (Southall et al. 2007).

Recorded *Delphinus* sp. vocalizations (which are similar among species within this genus) include whistles, chirps, barks, and clicks; clicks and whistles have dominant frequency ranges of 23 to 67 kHz and 0.5 to 18 kHz, respectively (Ketten 1998). Maximum source levels of approximately 170 dB re 1 µPa at frequencies of 25 and 35 kHz were reported for common dolphins sounds off southern California (Fish and Turl 1976). Best sensitivity was observed at 60 to 70 kHz, with responses evoked up to 152 kHz. At this maximum frequency, the stimulus sound level required to evoke a response was 127 dB re 1 µPa received level. Sensitivity decreased more quickly at the higher frequencies than the lower ones, with the resulting U-shaped audiogram for this species similar to that of other dolphins (Finneran et al. 2009).

4.5 Pacific White-Sided Dolphin (California/Oregon/Washington, Northern and Southern Stocks)

4.5.1 Status and Management

The stock structure of Pacific white-sided dolphins is dynamic and poorly understood. While the northern and southern stocks are differentiated based on distribution, genetics, and morphological characters, the two forms mix off Southern California (Carretta et al. 2017). Neither of the two stocks of Pacific white-sided dolphins is considered strategic or depleted under the MMPA.

4.5.2 Distribution

As summarized by Carretta et al. (2017), Pacific white-sided dolphins are endemic to temperate waters of the North Pacific Ocean and are common both on the high seas and along the continental margins. Off the U.S. west coast, Pacific white-sided dolphins occur primarily in shelf and slope waters. Sighting patterns from aerial and shipboard surveys conducted in California, Oregon and Washington suggest seasonal north-south movements, with animals found primarily off California during the colder water months and shifting northward into Oregon and Washington as water temperatures increase in late spring and summer (Carretta et al. 2017).

4.5.3 Site-Specific Occurrence

Given the lack of observations during the fourth IHA period, the Navy believes the monitoring data from the second IHA period for the previous Fuel Pier Replacement Project represent the most conservative numbers of Pacific white-sided dolphins that are likely to occur (NAVFAC SW 2015). The

second IHA period of the previous Fuel Pier Replacement Project recorded 27 individuals over 100 days of monitoring activity. This equates to an average of 0.3 Pacific white-sided dolphins observed per day. Rounding to the nearest whole number leads to 1.0 individuals per day expected to be in the vicinity of Pier 302.

4.5.4 Behavior and Ecology

Pacific white-sided dolphins are highly social and commonly occur in groups of less than a hundred but can form herds containing several thousands of individuals. They often associate with Risso's dolphins and short-beaked common dolphins, and occasionally feed in association with California sea lions and mixed species aggregations of seabirds. Cohesiveness of dolphin groups differences according to behavior: dispersed subgroups while milling, socializing, and feeding, and more tightly grouped while traveling and resting. Pacific white-sided dolphins are highly acrobatic and exhibit a variety of leap types.

These dolphins feed opportunistically on a variety of prey, such as squid and small schooling fish (capelin, sardines, and herring) (NMFS 2022f). Pacific white-sided dolphins can live more than 40 years with males reaching sexual maturity around 10 years and females around 8 to 11 years of age.

4.5.5 Acoustics

Whistles are in the frequency range of 2 to 20 Hz (Richardson et al. 1995). Peak frequencies of the pulse trains for echolocation fall between 50 and 80 kHz; the peak amplitude is 170 dB re 1µPa (Fahner et al. 2004). Tremel et al. (1998) measured the underwater hearing sensitivity of the Pacific white-sided dolphin from 75 Hz through 150 kHz with the greatest sensitivities from 4 to 128 kHz.

4.6 Northern Elephant Seal (California Stock)

4.6.1 Status and Management

The California breeding stock of northern elephant seal is not considered strategic or depleted under the MMPA. Populations of northern elephant seals in the U.S. and Mexico have recovered after being reduced to near extinction by hunting, undergoing a severe population bottleneck and loss of genetic diversity with the population reduced to only an estimated 10-30 individuals. There are two distinct populations of northern elephant seals: (1) a breeding population in Baja California, Mexico, and (2) a breeding population on U.S. islands off California. Northern elephant seals in the San Diego region could be from either population (Carretta et al. 2021).

4.6.2 Distribution

Northern elephant seals breed and give birth in California (U.S.) and Baja California (Mexico), primarily on off-shore islands. Spatial segregation in foraging areas between males and females is evident from satellite tag data (Carretta et al. 2016; Lowry et al. 2014).

4.6.3 Site-Specific Occurrence

Northern elephant seals occur in the southern California Bight and have the potential to occur in San Diego Bay (NAVFAC SW and POSD 2013), but the only recent documentation of occurrence near the Project area was in 2015 during the second year of the previous Fuel Pier IHA period (NAVFAC SW 2015) when a single distressed juvenile was observed hauled out on the beach to the west of Pier 99, approximately 0.6 km (0.3 nmi) south of the Project area. A second juvenile was also observed in

2015 near the NBPL Harbor Drive Annex (T. McConchie, personal communication), which is approximately 3.3 km (1.8 nmi) north of the Project area.

4.6.4 Behavior and Ecology

Northern elephant seals are found in coastal areas and deeper waters of the California Current Large Marine Ecosystem (Carretta et al. 2016). The foraging range of northern elephant seals extends thousands of kilometers offshore from the breeding range into the central North Pacific Transition Zone; however, their range is not considered to be continuous across the Pacific (Simmons et al. 2010). Adult males and females segregate while foraging and migrating (Simmons et al. 2010; Stewart and DeLong 1995). Adult females mostly range west to about 173° W, between the latitudes of 40° N and 45° N, whereas adult males range farther north into the Gulf of Alaska and along the Aleutian Islands to between 47° N and 58° N (Le Boeuf et al. 2000; Stewart and DeLong 1995).

4.6.5 Acoustics

Burgess et al. (1998) detected possible vocalizations in the form of click trains that resembled those used by males for communication in air. The audiogram of the northern elephant seal indicates that this species is well-adapted for underwater hearing; sensitivity is best between 3.2 and 45 kHz, with greatest sensitivity at 6.4 kHz and an upper frequency cutoff of approximately 55 kHz (Kastak and Schusterman 1999).

5.0 HARRASMENT AUTHORIZATION REQUEST

Under Section 101 (a)(5)(D) of the MMPA, the Navy requests an IHA for the take of a small number of marine mammals, by Level B behavioral harassment only, incidental to the removal and installation of piles related to Pier 302. The Navy requests an IHA for proposed activities that will be conducted during a one-year period beginning October 1, 2023 and ending September 30, 2024.

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 implementation of a buffered Level A ZOI for harbor seals and northern elephant seals during impact pile driving of 24-inch octagonal concrete piles. The remaining level A ZOIs generated from pile removal and installation activities are smaller than the 20-m (66-ft) buffered shutdown zone created to reduce physical interaction with Project-related equipment.

5.1 Method of Incidental Taking

This authorization request considers noise from pile removal via vibratory extraction, and pile installation via impact hammer (with or without water jetting), and vibratory hammer. For the purposes of the MMPA Level B take analysis in the following sections, use of a hydraulic pile clipper, wire saw, underwater chainsaw, or high-pressure water jet will not be considered because these activities are not expected to behaviorally harass marine mammals. Extraction via vibratory hammer and installation via vibratory hammer and impact hammer are the only Project related activities that are considered to have the potential to disturb or displace marine mammals or produce a TTS resulting in Level B harassment, as defined above, and will therefore be the focus of this quantitative take analysis.

Based on the available data associated with pile removal and installation, there is small potential for marine mammals to experience permanent threshold shift (PTS) during pile removal and install resulting in Level A take. However, Level A ZOIs will be fully monitored to avoid take. To further eliminate the likelihood of Level A takes, a buffered shutdown zone out to 20 m (66 ft) would be implemented to halt activities that could potentially injure a marine mammal that is near in-water Project-related activities. All pile-removal and installation activities will either be delayed from starting or halted if any marine mammals approach any buffered Level A shutdown zone. No Level A take is anticipated with implementation of these buffered shutdown zones.

In-water pile-removal and installation activities include a range of potential methodologies and sound sources (e.g., impact hammer, vibratory hammer). To provide a realistic worst-case scenario, the Navy has estimated takes by assuming pile removal and installation sound generating activities listed in Table 2-1 will occur on separate days. The total number of in-water workdays is estimated at 32. This analysis predicts 871 exposures for all species (see Section 6 for estimates of exposures by species) that could be classified as Level B harassment under the MMPA. The Navy's mitigation procedures, presented in Section 11, include monitoring of mitigation zones during pile removal and installation activities. The Navy believes that these mitigation measures will be effective in avoiding marine mammal exposures to sound levels that would constitute Level A harassment.

6.0 NUMBERS AND SPECIES EXPOSED

6.1 Introduction

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

The proposed Project activities as outlined in Sections 1 and 2 have the potential to take marine mammals by Level A and B harassment through construction activities involving in-water pile removal and installation. Other activities, including the transport of marine mammal pens into and out of the Project area, as well as land-side improvements, are not expected to result in take as defined under the MMPA. These Project-related activities are not anticipated to generate airborne noise beyond operation of combustion engines; however, if airborne noise levels do reach harassment level, it is assumed that if any animals are hauled out, based on the location of the Project, the individuals at some point would enter the water and be captured as Level B take as they pass through the various calculated ZOIs discussed below.

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), 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.

Sound sources associated with pile removal and/or installation are not expected to result in Level A exposures of marine mammals as defined under the MMPA. All Level A ZOIs are smaller than 20 m (66 ft), with the exception of impact pile driving of 24-inch octagonal concrete piles, with a Level A ZOI for harbor seals and northern elephant seals of 62.4 m. This level A ZOI will be buffered to 70 m to ensure no Level A take of PW during this action (see Table 6-6, 6-8, Figure 6-2, and Appendix A). Combined with the BMPs identified in Section 11, 13, and the Marine Mammal Monitoring Plan, this buffered Level A ZOI is expected to stop all in-water sound producing activities prior to potential exposure to Level A thresholds. However, the noise-related impacts discussed in this application may result in Level B harassment. The methods for estimating the number and types of exposures to Level B harassment are summarized below.

The following methods were used to determine exposure of marine mammals:

- Estimating the area of impact where noise levels exceed acoustic thresholds for marine mammals (Sections 6.7)
- Evaluating the potential presence of marine mammals based on historical occurrence or by site specific survey as outlined in (Section 6.9)
- Estimating potential harassment exposures by multiplying the estimated daily site-specific abundance of marine mammals by their probable exposure duration during pile removal activities (Section 6.9).

6.2 Fundamentals of Sound

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

Due to the wide range of pressure and intensity encountered during measurements of sound, a logarithmic scale is used, based on the dB, which, for sound intensity, is 10 times the log10 of the ratio of the measurement to reference value. For SPL, the amplitude ratio in dB is 20 times the log10 ratio of measurement to reference. Hence each increase of 20 dB in SPL reflects a 10-fold increase in signal amplitude (whether expressed in terms of pressure or particle motion). That is, 20 dB means 10 times the amplitude, 40 dB means 100 times the amplitude, 60 dB means 1,000 times the amplitude, and so on. Because the dB is a relative measure, any value expressed in dB is meaningless without an accompanying reference. In describing underwater sound pressure, the reference amplitude is usually 1 µPa, and is expressed as dB referenced to 1 µPa ("dB re 1 µPa"). For in-air sound pressure, the reference amplitude is usually 20 µPa and is expressed as "dB re 20 µPa."

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

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

Table 6-1. Definitions of Acoustical Terms

Term	Definition
Decibel, dB	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for water is 1 microPascal (µPa) and for air is 20 µPa (approximate threshold of human audibility).
Sound Pressure Level, SPL	Sound pressure is the force per unit area, usually expressed in µPa where 1 Pascal equals 1 Newton exerted over an area of 1 square m. The SPL is expressed in dBs as 20 times the logarithm to the base 10 of the ratio between the pressure exerted by the sound to a reference sound pressure. SPL is the quantity that is directly measured by a sound level meter.
Frequency, Hz	Frequency is expressed in terms of oscillations, or cycles, per second or Hz. Typical human hearing ranges from 20 Hz to 20 kHz.
Peak Sound Pressure, dB re 1 µPa	Peak SPL is based on the largest absolute value of the instantaneous sound pressure over the frequency range from 20 Hz to 20 k Hz. This pressure is expressed in this application as dB re 1 µPa.
Root-Mean-Square (RMS), dB re 1µPa	The RMS level is the square root of the mean of the squared pressure level(s) as measured over a specified time-period. For pulses, the RMS has been defined as the average of the squared pressures over the time that comprise that portion of waveform containing 90 % of the sound energy for one impact pile driving impulse.
Sound Exposure Level (SEL), dB re 1 µPa^2 sec	Sound exposure level is a measure of energy. Specifically, it is the dB level of the time integral of the squared-instantaneous sound pressure, normalized to a 1-sec period. It can be an extremely useful metric for assessing cumulative exposure because it enables sounds of differing duration, to be compared in terms of total energy.
Waveforms, µPa over time	A graphical plot illustrating the time history of positive and negative sound pressure of individual pile strikes shown as a plot of µPa over time (i.e., seconds).
Frequency Spectrum, dB over frequency range	The amplitude of sound at various frequencies, usually shown as a graphical plot of the mean square pressure per unit frequency (µPa^2/Hz) over a frequency range (e.g., 10 Hz to 10 kHz in this application).
A-Weighting Sound Level, dBA	The SPL in dBs as measured on a sound level meter using the A- or C-weighting filter network. The A-weighting filter de-emphasizes the low and high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective human reactions to noise.
Ambient Noise Level	The background sound level, which is a composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location. In the case of the Project area, the ambient underwater noise level is 129.6 dB re 1 µPa (NAVFAC SW 2020).

6.3 Description of Noise Sources

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

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

Noise Source	Frequency Range (Hz)	Source Level	Reference
Dredging	1 - 500	161–186 dB RMS re: 1 µPa at 1 s	Richardson et al. 1995; DEFRA 2003; Reine et al. 2014
Small vessels	860 - 8,000	141–175 dB RMS re: 1 µPa at 1 m	Galli et al. 2003; Matzner and Jones 2011; Sebastianutto et al. 2011
Large ship	20 - 1,000	157–188 dB re: 1 µPa^2sec SEL at 1 m	McKenna 2011; Kipple and Gabriele 2007
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 µPa at 1 m = decibels (dB) referenced to (re) 1 micro (µ) Pascal (Pa) at 1 m; m = meter

6.3.1 Ambient Noise

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

As discussed in the five IHA applications for the adjacent project, the NBPL Fuel Pier demolition and replacement project (Navy 2013b, 2014, 2015, 2016, and 2017a), underwater noise levels in the Project area are commonly 126 to 137 dB re 1µPa, with an overall average of approximately 129.6 dB re 1µPa, and higher maximum RMS and Peak SPL readings (in excess from 150 dB re 1µPa) due to passing ships in the Navigation Channel (NAVFAC SW 2020). As such, it would be unlikely to elicit biologically significant behavioral reactions, especially considering that there are not associated stimuli (e.g., a moving vessel) to suggest an approaching threat.

6.3.2 In-Water Pile Removal and Installation Noise

The sounds produced by in-water construction activities fall into two sound types: impulsive and continuous (defined below). Impact pile driving produces impulsive sounds, while the equipment used to extract piles, such as a vibratory hammer, produces continuous sounds. The distinction between these two general sound types is important because their potential to cause physical effects differs, particularly regarding 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). Pile removal and installation activities included in the Project are anticipated to generate both impulsive and continuous sounds.

Continuous 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. Examples of continuous sounds include vessels, aircraft, and machinery operations such as drilling, dredging, and vibratory pile driving (Southall et al. 2007, 2019). In some environments, the duration of both impulsive and continuous sounds can be extended due to reverberations.

6.4 Sound Exposure Criteria and Thresholds

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

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, the 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 2018). The NMFS has developed acoustic threshold levels for determining the onset of permanent threshold shift (PTS) in marine mammals in response to underwater impulsive and continuous sound sources (Table 6-3). The criteria use cumulative sound exposure level (SEL) metrics (dB SEL_{CUM}) and peak pressure (dB PEAK) rather than the previously used dB RMS metric. The 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 µPa, such as from impact pile driving, and to continuous underwater sounds above 120 dB RMS re 1 µPa, such as from vibratory pile driving (NMFS 2005) (Table 6-3). 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.

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

Behavioral harassment (Level B) is considered to have occurred when marine mammals are exposed to sounds at or above 160 dB RMS re 1µPa for impulse sounds (e.g., impact pile driving) and 120 dB RMS re 1µPa for continuous noise (e.g., vibratory hammer or extractor), but below injurious thresholds. Level B harassment may or may not result in a stress response. The application of the 120 dB RMS re 1µPa threshold can sometimes be problematic because this threshold level can be either at or below the ambient noise level of certain locations including San Diego Bay. As a result, these levels are considered precautionary (74 FR 41684).

Table 6-3. Injury and Disturbance Threshold Criteria for Underwater Noise by Marine Mammal Hearing Group

Marine Mammal Hearing Group	Underwater Continuous Noise Thresholds (re 1 µPa)		Underwater Impulsive Noise Thresholds (re 1 µPa)	
	Level A Threshold[1] (PTS Onset)	Level B Threshold (Disturbance)	Level A Threshold[1] (PTS Onset)	Level B Threshold (Disturbance)
Low-Frequency Cetaceans[4]	199 dB SEL_{CUM}	120 dB RMS	219 dB Peak[2] 183 dB SEL_{CUM}[3]	160 dB RMS
Mid-Frequency Cetaceans	198 dB SEL_{CUM}		230 dB Peak[2] 185 dB SEL_{CUM}[3]	
High-Frequency Cetaceans[4]	173 dB SEL_{CUM}		202 dB Peak[2] 155 dB SEL_{CUM}[3]	
Phocidae	201 dB SEL_{CUM}		218 dB Peak[2] 185 dB SEL_{CUM}[3]	
Otariidae	219 dB SEL_{CUM}		232 dB Peak[2] 203 dB SEL_{CUM}[3]	

[1] Dual metric acoustic thresholds for impulsive sounds. Whichever results in the largest isopleth for calculating PTS onset is used in the analysis.
[2] Flat weighted or unweighted peak sound pressure within the generalized hearing range.
[3] Cumulative sound exposure level over 24 hours.
[4] No Low- or High-Frequency Cetaceans are anticipated to appear in the Project study area and PTS and TTS thresholds are included here for informational purposes only.
Abbreviations: µPa = microPascal; dB = decibel; PTS = permanent threshold shift; RMS = root mean square; SEL = sound exposure level; cum = cumulative

6.5 Limitations of Existing Noise Criteria

The application of the 120 dB RMS re 1 µPa 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 µPa threshold level for continuous noise originated from research conducted by Malme et al. (1984, 1986) for California gray whale response to continuous industrial sounds, such as drilling operations.

To date, there is no research or data supporting a response by pinnipeds or odontocetes to continuous sounds, such as from vibratory pile driving, as low as the 120 dB re 1µPa threshold. Southall et al. (2007) reviewed studies conducted to document the behavioral responses of harbor seals and northern elephant seals to continuous sounds under various conditions. They concluded that those limited studies suggest that exposures between 90 dB and 140 dB RMS re 1 µPa generally do not appear to induce strong behavioral responses. While the Level B threshold criteria for continuous noise is 120 re 1 µPa, noise from continuous sources associated with the Project is assumed to become indistinguishable from background noise as it diminishes to 129.6 dB re 1 µPa with distance from the source (NAVFAC SW 2020). This value is used as a local baseline ambient noise value for all noise sources to be employed during pile removal activities.

6.6 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 a calf was present.

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 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 smaller 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). 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 removal and installation and are therefore considered in the exposure analysis.

6.7 Modeling Potential Noise Impacts from Pile Removal and Installation

In this IHA application, the Navy has used NMFS Technical Guidance and User Spreadsheet (NMFS 2018 and 2020a), and acoustic data from several sources to identify the Level A (injury) and Level B (behavior) ZOIs that would result from pile removal and installation activities. Table 6-4 below details what sources were used for each method of demolition and installation by pile size and type.

Table 6-4. Noise Source Data Used to Calculate Level A and B ZOIs by Demolition or Installation Method and Pile Size and Type

Method	Pile Size and Type	Noise Source Data
Pile Removal Activities		
Vibratory Extraction	18-inch Octagonal Concrete[1]	Unpublished Data (NAVFAC SW 2022) from the Navy Base San Diego Pier 6 Replacement Project
	18-inch Round Steel	The Modernization of the Alaska Marine Highway System Ferry Terminal Project at Kake, Alaska in the Hydroacoustic Pile Driving Noise Study (Denes et al. 2016)
Pile Installation Activities		
Impact Pile Driving	24-inch Octagonal Concrete	Berth 22 Reconstruction and the Noyo Bridge Replacement Projects (Caltrans 2020)
	14-inch Square Concrete	
Vibratory Hammer	6-inch Round Steel[2]	Mad River Slough Pipeline Project in the Compendium of Pile Driving Sound Data (Illingworth & Rodkin 2007)

[1] In the absence of information on vibratory extraction of 18-inch octagonal concrete piles, source data from 20-inch square concrete piles (NAVFAC SW 2022) was used as a proxy source level.

[2] In the absence of information on Vibratory Installation of 6-inch round steel piles, source data from 12-inch round steel piles (Illingworth & Rodkin 2007) was used as a proxy source level.

6.7.1 Underwater Sound Propagation

Pile removal and installation activities would generate underwater noise that potentially could result in disturbance to marine mammals swimming by the Project area. Maximum distances to Level A thresholds for cumulative sound exposure were calculated using the current NMFS Technical Guidance and User Spreadsheet (NMFS 2018 and 2020a). Observed noise levels during pile removal and installation projects in the San Diego and San Francisco Bay area, northern California, and Alaska have been compiled and provide real-world examples of sound loss between source and far field points (see Table 6-4). The compiled source data include observed distances at which a given noise source attenuated to the ambient sound level of San Diego Bay.

6.7.2 Underwater Noise from Pile Removal and Installation

The intensity of pile removal or installation sound is greatly influenced by factors such as the type of pile, the type of equipment, and the physical environment in which the activity takes place. To determine reasonable SPLs from pile removal or installation, activities with the same or similar properties to the proposed Project were evaluated. Table 6-5 presents measured or calculated maximum mean SPLs for impulsive and non-impulsive sources at 10 m (33 ft) from the pile. In the case of the source levels for vibratory extraction of steel and concrete piles, data were not available at source (10 m [33 ft]). As a result, the source levels were back-calculated to 10 m (33 ft) based on data collected at varying ranges and an assumed 15LogR transmission loss. For the 18-inch octagonal concrete piles, unpublished data (NAVFAC SW 2022) for vibratory extraction of multiple 20-inch square concrete piles at distances ranging from 49 to 79 m (161 to 259 ft) were used to identify a source level. Based on these data points, the maximum mean calculated source value was 162 dB RMS. For the steel piles, Denes et al. (2016) measured 152.4 dB RMS at 17 m (56 ft) for a single pile, leading to a calculated source level of 155.9 dB RMS (rounded up to 156 dB RMS). For impact pile driving, maximum mean values for the pile sizes and types have been used for the proposed Project activities (Caltrans 2020). For vibratory pile driving of the 6-inch round steel piles, source date for 12-inch round steel piles (Illingworth & Rodkin 2007) was used as a proxy for the 6-inch steel round piles. All data points present both a realistic and conservative approach to determining monitoring ZOIs for Project-related activities.

Table 6-5. Source Levels, Durations, and Blow Count for Removal and Installation Activities Likely to Occur at Project Site

Method	Pile Size and Type	Peak Sound Pressure (dB re 1 μPa)[1,2]	Mean Maximum RMS SPL (dB re 1 μPa)[1,2]	SEL (dB re 1 μPa^2 sec)[1,2]	Estimated Duration per Pile (mm:ss)[3]	Estimated Blow Count per Pile[3]
Pile Removal Activities						
Vibratory Extraction	18-inch Octagonal Concrete[4]	-	162[5]	-	15:00	N/A
	18-inch Steel Pipe	-	156[6]	-	15:00	N/A
Pile Installation Activities						
Impact Pile Driving	24-inch Octagonal Concrete	188	176	166	N/A	500
	14-inch Square Concrete	183	166	154	N/A	250
Vibratory Hammer	6-inch Round Steel[7]	171	155	155	1:00	N/A

[1] References for source level data by pile type and activity are in Table 6-4 above.
[2] As measured, or calculated, at 10 m (33 ft).
[3] Estimated durations and blow counts as provided by the construction contractor.
[4] In the absence of information on vibratory extraction of 18-inch octagonal concrete piles, source data from20-inch concrete square piles NAVFAC SW 2022) was used as a proxy source level.
[5] The maximum mean calculated source value for 20-inch square concrete piles (NAVFAC 2022) was 162 dB RMS based on unpublished data from the Pier 6 Replacement Project.
[6] Table 20 in Denes et al. (2016) records a value of 152.4 dB RMS at 17 m (56 ft) for vibratory extraction. This data point, and a transmission loss of 15LogR, was used to back-calculate a value of 155.9 dB RMS at 10 m (33 ft) (rounded to 156 dB RMS).
[7] In the absence of information on Vibratory Installation of 6-inch round steel piles, source data from 12-inch round steel piles (Illingworth & Rodkin 2017) was used as a proxy source level.
Abbreviations: μPa = microPascal; dB = decibel; RMS = root mean square; SPL = sound pressure level; m = meters

For the analyses that follow, the previously observed source levels and durations identified in Table 6-5 and the estimated numbers of piles to be removed and installed per day from Table 2.1 were utilized. Distances to Level A (onset PTS) thresholds were calculated using Single Strike SEL, Peak, or dB RMS Source Levels. Of those three acoustics metrics, the maximum distance to the Level A acoustic threshold is shown in Table 6-6. Appendix A presents all the data using the NMFS Technical Guidance and User Spreadsheets (NMFS 2018 and 2020a).

Pile installation activities may include pile driving with or without high-pressure water jetting occurring simultaneously. To combine sound levels from a vibratory source and an impact source, such as in this case, the Level A ZOI from the impact source would be used, and the largest Level B ZOI would be used (USDOT 1995, WSDOT 2020, NMFS 2020a). No Level A take would occur from high-pressure water jetting, and the largest Level B zone for the Project would be generated from impact pile driving.

Table 6-6. Projected Distances to Underwater Level A Thresholds by Marine Mammal Hearing Group

Method	Pile Type and Size	Maximum RMS SPL (dB re 1 µPa)[1]	Duration (hours/ day)	Projected Distances to Level A Thresholds (m [ft])		
				MF	PW	OW
Pile Removal Activity						
Vibratory Extraction	18-inch Octagonal Concrete	162	1.25	0.8 (2.6)	5.6 (18.4)	0.4 (1.3)
	18-inch Round Steel	156[2]	0.25	0.1 (1.6)	0.8 (11.5)	0.1 (0.7)
Pile Installation Activity						
Impact Pile Driving	24-inch Octagonal Concrete	176	1.33	4.1 (13.4)	**62.4 (204.7)**	4.5 (14.8)
	14-inch Square Concrete	166	0.25	0.2 (3.3)	2.5 (8.2)	0.2 (3.6)
Vibratory Hammer	6-inch Round Steel	155	0.07	0.0 (0.0)	0.3 (1.0)	0.0 (0.0)

[1] As measured at 10 m (33 ft)

[2] Table 20 in Denes et al. (2016) records a value of 152.4 dB RMS at 17 m (56 ft) for vibratory extraction. This data point, and a transmission loss of 15LogR, was used to back-calculate a value of 156 dB RMS at 10 m (33 ft).

Note: Bolded values are greater than the buffered shutdown zone of 20 m (66 ft) and will be monitored as shutdown zones to ensure no Level A takes of harbor seals or northern elephant seals occur during impact pile driving of 24-inch octagonal concrete piles.

Abbreviations: RMS = root mean square, dB re 1 µPa = decibels referenced to a pressure of 1 microPascal, m = meters, ft = feet, MF = mid-frequency cetaceans, PW = phocid pinnipeds, OW = otariid pinnipeds

For this Project, the distance to the Level B threshold was determined using practical spreading loss (15LogR). Although real-time data for certain pile types exist for the adjacent NBPL Fuel Pier Project, practical spreading loss was determined to be the most conservative criterion. The expected radial distances to Level B behavioral disturbance thresholds and corresponding areas within the ZOIs are summarized in Table 6-7. Table 6-8 summarizes all Level A and B ZOIs to be monitored during construction. Figures 6-1 and 6-2 depict the extent of the buffered Level A and Level B ZOIs associated with noise propagation specific to each of the pile removal and installation methods as well as the buffered shutdown zone of (20 m [66 ft]) from the source.

Table 6-7. Distances to Underwater Level B Thresholds and ZOI Areas within the Thresholds from Pile Removal and Installation

Method	Pile Type and Size	Maximum RMS SPL (dB re 1 µPa)	Projected Distance to and Area of Level B Thresholds[1,2]	
			Distance (m [ft])	Area (km^2[sq. miles])
Pile Removal Activities				
Vibratory Extraction	18-inch Octagonal Concrete	162	1,445 (4,742)	3.13 (1.21)
	18-inch Round Steel	156	575 (1,888)	0.68 (0.26)
Pile Installation Activities				
Impact Pile Driving[3]	24-inch Octagonal Concrete	176	117 (383)	0.041 (0.016)
	14-inch Square Concrete	166	25 (82)	<0.01 (<0.01)
Vibratory Hammer	6-inch Round Steel	155	494 (1,619)	0.45 (0.18)

[1] The Level B ZOIs for continuous pile removal and installation activities are based on the distance for noise to decay to ambient levels (129.6 dB re 1µPa), while 160 dB was used for impulsive sound.

[2] Assumes Practical Spreading Loss

[3] With or without High-pressure Water Jetting

Abbreviations: dB re 1 µPa = decibels referenced to a pressure of 1 microPascal, km^2 = square kilometers, m = meters, ft = feet, RMS = root mean square, ZOI = Zone of Influence

Table 6-8. Monitored Distances to Level A and B ZOIs

Method	Pile Type and Size	Monitored Level A ZOIs [m (ft)]			Monitored Level B ZOIs [m (ft)]
		MF	PW	OW	
Pile Removal Activities					
Vibratory Extraction	18-inch Octagonal Concrete Piles	20 (66)	20 (66)	20 (66)	1,445 (4,742)
	18-inch Round Steel Piles	20 (66)	20 (66)	20 (66)	575 (1,888)
Pile Installation Activities					
Impact Pile Driving	24-inch Octagonal Concrete Piles	20 (66)	70[1] (230)	20 (66)	117 (383)
	14-inch Square Concrete Piles	20 (66)	20 (66)	20 (66)	25 (82)
Vibratory Hammer	6-inch Round Steel Piles	20 (66)	20 (66)	20 (66)	494 (1,619)

[1] Level A ZOI buffered from 62.5 m up to 70 m.

In order to ensure no Level A take of harbor seals and northern elephant seals during impact pile driving of 24-inch octagonal concrete piles, the calculated 62.4 m ZOI will be buffered to 70 m.

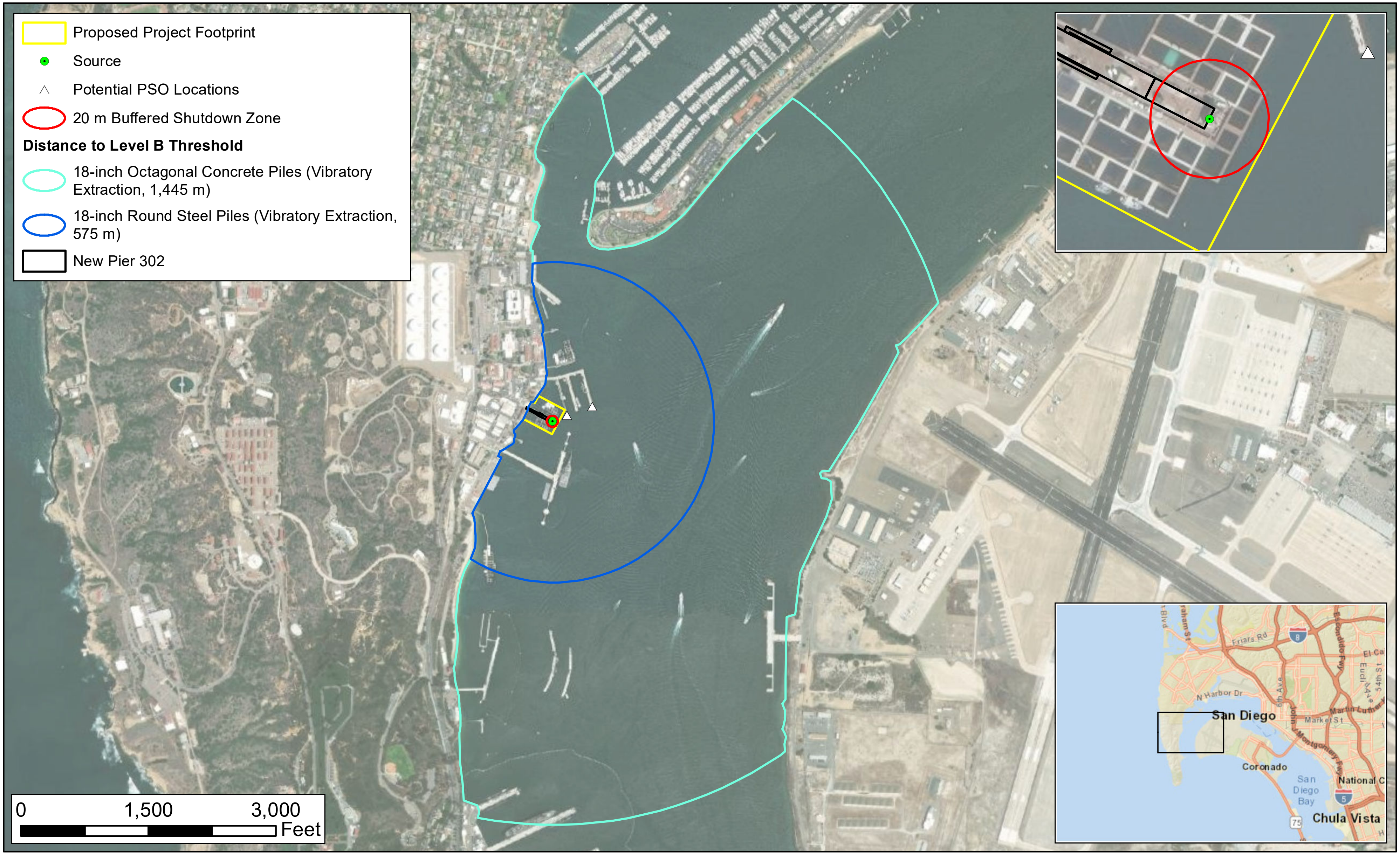
6.8 Basis for Estimating Take by Harassment

The U.S. Navy is seeking authorization for the potential taking, by Level B harassment only, of California sea lions, harbor seals, northern elephant seals, bottlenose dolphins, common dolphins, and Pacific white-sided dolphins in northern San Diego Bay resulting from activities associated with the removal and installation of piles during the Project. Marine mammals are present to varying degrees in San Diego Bay year-round, with California sea lions being the most common. The takes requested are expected to have no more than a minor effect on individual animals and no effect on the various marine mammal populations 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.

Level A (PTS onset) takes, as well as risks of physical injury, would not occur for all analyzed species with the implementation of the proposed buffered Level A shutdown zones during in-water pile removal and installation activities (Table 6-8).

Potential Level B takes would occur throughout pile removal and installation activities if marine mammals are present within the Level B ZOIs (Table 6-7 and 6-8, and Figures 6-1 and 6-2). Marine mammals 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 marine mammals and would not result in population-level impacts.

Beyond the size of the ZOIs associated with pile removal and installation activities, estimated takes are based on the expected daily number of individuals of a species, based on previously observed total species counts divided by days of activity observed during marine mammal monitoring efforts during the first five IHA periods at the Fuel Pier. Most of the estimated daily number of individuals species used in this analysis are based on the fourth year IHA monitoring report from the previous Fuel Pier Replacement Project (NAVFAC SW 2017b). This monitoring period had the highest number of activity days and the highest average number of animals observed per day for the three most common species and likely represents the species presence and numbers in San Diego Bay. The second year IHA monitoring report from the previous Fuel Pier Replacement Project is used for



N
W E
S

Level B ZOIs for Pier 302 Pile Removal Activities using Practical Spreading Loss

Pier 302 Replacement Naval Information Center (NIWC) Pacific, Bayside Complex

Figure 6-1

N W E S

Level A and B ZOIs for Pier 302 Pile Installation Activities using Practical Spreading Loss

Pier 302 Replacement Naval Information Center (NIWC) Pacific, Bayside Complex

Figure 6-2

species that were not observed during the fourth IHA period (NAVFAC SW 2015). As in previous IHA applications in the area, this data represents the most conservative estimate of species richness and abundance data. An average of all five years of Fuel Pier monitoring data would dilute these conservative estimates. Given those conditions, marine mammal observations for these two monitoring periods, as opposed to averaging all five, provide the most conservative estimate of species richness and abundance for the general Project area, which overlaps with the Fuel Pier Project area.

6.8.1 California Sea Lion

California sea lions are present in northern San Diego Bay year-round and are by far the most numerous marine mammals in the bay as reported during previous IHA monitoring periods at the Fuel Pier (NAVFAC SW 2014, 2015, 2016, 2017a-b, 2018a-b). The local population comprises adult females and sub-adult males and females, with adult males being less common (Merkel and Associates, Inc. 2008; Navy 2010; Tierra Data 2012b; NAVFAC SW 2014).

Based on the observations presented in NAVFAC SW (2017b, 2018a), an average of 14.9 California sea lions per day (rounded to 15 per day) were observed during the fourth IHA period of the Fuel Pier Replacement Project. This expected daily individual count was used to calculate the Level B take for California sea lions over the 32 days of pile removal and installation activities under the Project.

Potential takes would likely involve sea lions that are loafing on, or in the vicinity of, structures or moving through the area in route to foraging areas or structures where they haul out. California sea lions that are taken could exhibit behavioral changes such as increased swimming speeds, increased surfacing time, or decreased foraging. Most likely, California sea lions may move away from the sound source and be temporarily displaced from the areas of pile removal and installation. As was observed during monitoring for the Fuel Pier Project (NAVFAC SW 2014, 2015, 2016, 2017a-b, 2018a-b), with or without the bait barges, sea lions are expected to remain concentrated in the northern part of the bay, and potentially be hauled out or swimming in the general vicinity of the Project site. Minimal reactions were observed from animals that were observed swimming or resting on structures within the Level B ZOIs (NAVFAC SW 2014, 2015, 2016). 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.

6.8.2 Harbor Seal

Based on the observations presented in NAVFAC SW (2017b, 2018a), an average of 0.6 harbor seals per day (rounded to 1 per day) were observed during the fourth IHA period of the Fuel Pier Replacement Project. This expected daily individual count was used to calculate the Level B take for harbor seals.

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

6.8.3 Bottlenose Dolphin

Bottlenose dolphins can occur at any time of year in northern San Diego Bay. Based on the observations presented in NAVFAC SW (2017b, 2018a), an average of 0.4 bottlenose dolphins per day (rounded to the 1 per day) were observed during the fourth IHA period of the Fuel Pier Replacement Project. This expected daily individual count was used to calculate the Level B take for bottlenose dolphin.

Potential takes could occur if bottlenose dolphins move through the area on foraging trips when pile removal or driving would occur. Bottlenose dolphins that are taken could exhibit behavioral changes such as increased swimming speeds, increased surfacing time, or decreased foraging. Most likely, bottlenose dolphins may move away from the sound source and be temporarily displaced from the areas of pile removal. There are no indications that bottlenose dolphins use or regularly occur in the area near Pier 302. Hence, any exposure to Project-generated sound is likely to be transient and at relatively long distances from animals in the area. Therefore, potential takes by disturbance will have a negligible short-term effect on individual bottlenose dolphins and would not result in population-level impacts.

6.8.4 Common Dolphin (Short-Beaked and Long-Beaked)

Common dolphins are generally abundant in the outer coastal waters, but they do occasionally occur in San Diego Bay (NAVFAC SW and POSD 2013). Based on the observations presented in NAVFAC SW (2015), an average of 8.5 common dolphins per day (rounded to 9 per day) were observed during the fourth IHA period of the Fuel Pier Replacement Project. This expected daily individual count was used to calculate the Level B take for common dolphins.

It is expected that common dolphins would move rapidly through the Project area as seen during the first two IHA periods of the Fuel Pier Replacement Project. Therefore, potential takes by disturbance will have a negligible short-term effect on individual common dolphins and would not result in population-level impacts.

6.8.5 Pacific White-Sided Dolphin

Pacific white-sided dolphins are more commonly seen offshore but were documented in the Fuel Pier Replacement Project area (NAVFAC SW 2015). Based on the observations presented in NAVFAC SW (2015), an average of 0.3 Pacific white-sided dolphins per day (rounded to 1 per day) were observed during the previous Fuel Pier Replacement Project. This expected daily individual count was used to calculate the Level B take for Pacific white-sided dolphin.

Potential takes could occur if Pacific white-sided dolphins move through the area on foraging trips when pile removal or installation is happening. Pacific white-sided dolphins that are taken could exhibit behavioral changes such as increased swimming speeds, increased surfacing time, or decreased foraging. Most likely, they may move away from the sound source and be temporarily displaced from the areas of pile removal or installation. There are no indications that Pacific white-sided dolphins use or regularly occur in San Diego Bay. Hence any exposure to Project-generated sound is likely to be transient and at relatively long distances from animals in the area. Therefore, potential takes by disturbance will have a negligible short-term effect on individual Pacific white-sided dolphins and would not result in population-level impacts.

6.8.6 Northern Elephant Seal

With increasing numbers (Carretta et al. 2021), the presence of northern elephant seals in the greater San Diego waters is considered as a reasonable possibility. In 2015, two juvenile northern elephant seals were observed in San Diego Bay, with one individual seen near the NBPL Harbor Drive Annex approximately 3.3 km (1.8 nmi) to the north of the Project area (T. McConchie, personal communication), and a second distressed juvenile observed on the beach to the west of Pier 99, which is 0.6 km (0.3 nmi) south of the Project area (NAVFAC SW 2015). With so few individuals observed inside of San Diego Bay, in place of an expected daily individual count, a total of two individuals for the duration of the Project was used to calculate the Level B take for northern elephant seals. However, with limited observations of this species in San Diego Bay, we are conservatively requesting to add five individuals to the requested Level B Take, in addition to the expected two individuals over the course of the Project's 32 days of in-water work.

Potential takes would likely involve single individuals that are on the shoreline or structures at the identified location, or swimming in the vicinity, most likely near the mouth of the bay. Northern elephant seals that are taken could exhibit behavioral changes such as entering the water in response to airborne noise, increased swimming speeds, increased surfacing time, or decreased foraging. Most likely, elephant seals may move away from the sound source. With the absence of any rookery or regularly used foraging or haul-out sites, potential takes by disturbance will have a negligible short-term effect on individual harbor seals and would not result in population-level impacts.

6.8.7 Species Not Included

Since Risso's dolphins have not been observed to enter San Diego Bay, and individual gray whales rarely occur in San Diego Bay, Level B harassment takes of these species are not expected. Furthermore, the proposed visual detection measures summarized in Sections 11 and 13, and in the Project-specific monitoring plan for non-IHA marine mammals would negate take of these species.

6.9 Description of Take Calculation and Exposure Estimates

Pile removal and installation activities may take place concurrently, where multiple piles are extracted or installed during a day. The following assumptions were used to calculate potential exposures to pile removal and installation activity noise for each species:

- Each animal can be "taken" via Level B harassment once every 24 hours.
- Differing methods of pile removal via vibratory extraction and pile installation (i.e., impact pile driving and vibratory hammer) will not occur coincidentally. Pile driving and high-pressure water jetting may occur coincidentally, but this was accounted for in the exposure analysis.
- Pile removal and installation are estimated to require 32 days of in-water work within the 183-day period outside CLT nesting season over the course of the one-year IHA period.
- The number of individual takes by species is the expected average individuals per day (based on previous observations) multiplied by the number of days of pile removal and installation activities (32 days) described in Section 2 (Table 2-1) and is summarized in Table 6-9.

Table 6-9. Summary of Expected Daily Species Presence in Project Area and Requested Level B Takes

Species	Expected Average Individuals Per Day	Requested Level B Take
California sea lion[1]	15	480
Harbor seal[1]	1	32
Bottlenose dolphin[1]	1	32
Common dolphin (Long- and Short-beaked)[2]	9	288
Pacific white-sided dolphin[2]	1	32
Northern elephant seal	-[3]	7
Total		**871**

[1] Average daily counts based on observations during Year 4 Fuel Pier Replacement Project Monitoring (NAVFAC SW 2017b).

[2] Average daily counts based on observations during Year 2 Fuel Pier Replacement Project Monitoring (NAVFAC SW 2015).

[3] Expected potential of two northern elephant seals over the duration of project activity with a +5 individuals "buffer" requested for Level B take.

7.0 IMPACTS TO MARINE MAMMAL SPECIES OR STOCKS

7.1 POTENTIAL EFFECTS OF IN-WATER PILE REMOVAL AND INSTALLATION ACTIVITIES ON MARINE MAMMALS

7.1.1 Potential Effects Resulting from Underwater Noise

The effects of in-water pile removal and installation activities 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 removal 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 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.

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 continuous 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 (O'Keefe and Young 1984; Ketten 1995; Finneran et al. 2015; Kastelein et al. 2018).

7.1.1.1 Physiological Responses

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 et al. 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 impacts are almost entirely acoustically mediated. Based on the mitigation measures outlined in Chapter 11 and the conservative modeling assumptions discussed in Chapter 6, marine mammals may be present. Therefore, marine mammals 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. Several 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 haul-out 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; 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 re 1µPa 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). Harbor seals were observed in the water at distances of approximately 400 to 500 m (1,312 to 1,640 ft) 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 haul-out site or feeding areas. One of these harbor seals was even seen to swim to within 150 m (492 ft) of the pile-driving barge during pile driving. Several California sea lions, however, were observed at distances of 500 to 1,000 m (1,640 to 3,280 ft) swimming rapidly and porpoising away from pile-driving activities. Both harbor seals and California sea lions continued feeding on dense schools of herring that occasionally occurred during pile driving (Caltrans 2001). Observations at other construction sites, including the previous NBPL Fuel Pier demolition and replacement project indicated that California sea lions typically did not respond behaviorally to pile driving (NAVFAC SW 2014, 2015, 2016, 2017a-b, 2018a-b; Navy 2016). 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 Naval Base 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.

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 if 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 in-water pile removal and installation operations over the 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 in-water pile removal noise are expected to vary. Some individuals may occupy the Project area during pile removal or installation without apparent discomfort, but others may be displaced with undetermined effects. Avoidance of the affected area during pile removal operations would reduce the likelihood of injury impacts but would also reduce access to foraging areas. Each of the ZOIs 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 removal activities will only occur during daylight hours, marine mammals swimming, foraging, or resting in the Project area at night will not be affected. Effects of pile removal and installation activities will be experienced by individual marine mammals 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 marine mammals may be exposed to SPLs during pile removal and installation operations at Pier 302 that may result in Level B Behavioral harassment. Any marine mammals which are taken (harassed), may change their normal behavior patterns (i.e., swimming speed, foraging habits, etc.) or be temporarily displaced from the area of construction. Any takes would likely have only a minor effect on individuals and no effect on the population. The sound generated from all planned pile removal and installation activities includes both impulsive (e.g., impact pile driving) and continuous (e.g., vibratory pile extraction or driving). While continuous sound is not known to cause injury to marine mammals, impulsive sound such as during impact pile driving can. Monitoring of Level A ZOIs during impact pile driving will ensure no such injuries will occur. Mitigation is likely to avoid most potential adverse underwater impacts to marine mammals from pile removal and installation activities. 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 any of the studied marine mammal populations recruitment, survival, or recovery.

8.0 IMPACT ON SUBSISTENCE USE

Potential impacts resulting from the Proposed Action will be limited to individuals of marine mammals located in the above identified Pier 302 ZOIs that have no subsistence requirements. Therefore, no impacts on the availability of species or stocks for subsistence use are considered.

9.0 IMPACTS TO THE MARINE MAMMAL HABITAT AND THE LIKELIHOOD OF RESTORATION

The proposed activities at Pier 302 are expected to have little, if any, effects on the distribution of marine mammals within the Project area. Only small numbers of marine mammals are expected to be present during pile removal and installation activities, and there are limited haul-out areas within the Project area available to seals or sea lions. Therefore, the main impact issue associated with the proposed activity will be temporarily elevated noise levels and the associated direct effects on marine mammals, as discussed in Sections 6 and 7. The most likely impact to habitat will occur from pile removal and installation effects on likely marine mammals' prey (i.e., fish) and minor impacts to the immediate substrate during the removal of piles.

9.1 Pile Removal and Installation Effects on Potential Prey (Fish)

The current IHA application addresses impulsive and continuous sounds associated with the machinery used to extract and install piles. Fish react to sounds which are especially strong and/or intermittent low-frequency sounds. Short duration and 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 µPa may cause subtle changes in fish behavior. SPLs of 180 dB may cause noticeable changes in behavior (Pearson et al. 1992). SPLs of sufficient strength have been known to cause injury to fish and fish mortality (Caltrans 2001; Longmuir and Lively 2001). Additionally, studies of fish response to pile driving for Pacific sardine and northern anchovy found that fish exhibited immediate startle response to individual strikes at 50 m (164 ft) but returned to "normal" pre-strike behavior following the conclusion of pile driving and no evidence of injury to fish as a result of pile driving (Appendix C in NAVFAC SW 2014).

The most likely impact to fish from pile removal and installation 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 or removal stops is unknown, but a rapid return to normal recruitment, distribution and behavior is anticipated. In general, impacts to marine mammal prey species are expected to be minor and temporary. Further, it is anticipated that preparation activities for pile driving or removal (i.e., positioning of the hammer, clipper or wire saw) and upon initial startup of a device would cause fish to move away from the affected area outside areas where injuries may occur. Therefore, relatively small portions of the Project area would be affected for relatively short periods of time, and the potential for effects on fish to occur would be temporary and limited to the duration of sound-generating activities.

9.2 Pile Removal and Installation Effects on Potential Foraging Habitat

The area likely impacted by the Pier 302 Replacement Project is relatively small compared to the total available habitat in San Diego Bay. As a result, the removal and installation of pilings, substrate disturbance, and high levels of activity at the Project site would be inconsequential in terms of long-term effects on marine mammal foraging.

Turbidity is expected to increase in the short-term during pile removal. The size and shape of the turbidity plume from pile removal are difficult to quantify because of variability in naturally occurring conditions, such as wind and currents. Consequently, it is difficult to predict the specific areas that may be influenced by the plume. Pile removal and installation activities are likely to increase turbidity in the immediate vicinity, for example when high-pressure water jetting is used. Turbidity monitoring during jetting to remove caissons for the fourth IHA of the Fuel Pier Replacement Project revealed relatively minor, if any, changes, with only localized decreases in water clarity that dissipated within three to five minutes (but up to 10) from the start of jetting (NAVFAC SW 2018a). Therefore, if water jetting is utilized during pile installation at the Project site, it would likely have similar effects to water jetting during previous pile removal activities with the resulting effects being relatively minor, local to the pile being worked on, and having only temporary negative effects on water quality lasting until sediment resettles.

Eelgrass beds have been reported to the north and south of the base of Pier 302 within the Project area as seen in figure 2-1 (Merkel & Associates, Inc. 2021). Based on proximity to the Project site, pre-construction eelgrass surveys will be conducted closer to the start of construction, in accordance with the California Eelgrass Mitigation Policy, to determine actual extent of beds within the Project area.

9.3 Summary of Impacts to Marine Mammal Habitats

Given that the affected area has limited use as foraging habitat for marine mammals, the removal and 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. Therefore, pile removal and installation are not likely to have a permanent, adverse effect on marine mammal foraging habitat in the Project area.

Some degree of impact could occur to eelgrass beds and will be addressed through the Essential Fish Habitat (EFH) consultation process with the NMFS office. Once pre-construction eelgrass surveys are completed, potential impacts to eelgrass, if any, will be determined.

10.0 IMPACTS TO MARINE MAMMALS FROM LOSS OR MODIFICATION OF HABITAT

The proposed activities at Pier 302 are not expected to have any habitat-related effects that could cause significant or long-term consequences for individual marine mammals or their larger populations. Based on the discussions in Section 9, there will be no impacts to marine mammals resulting from loss or modification of marine mammal habitat.

11.0 MEANS OF EFFECTING THE LEAST PRACTICABLE ADVERSE IMPACTS – MITIGATION MEASURES

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 several mitigation measures, discussed below, in an effort to minimize the number of marine mammals potentially affected.

11.1 Mitigation for Pile-Removal and Installation Activities

11.1.1 Proposed Measures

1. Level A and Level B Harassment ZOIs During Pile Removal and Installation
   a) During all in-water activities, regardless of predicted SPLs, a buffered shutdown zone of 20 m (66 ft) will be monitored. Since most marine mammals are fast-swimming, this is appropriate to reduce the likelihood of injury to marine mammal species due to physical interaction with construction equipment during in-water activities. If an animal enters the buffered shutdown zone, in-water activities would be stopped until the individual(s) has left the zone of its own volition, or not been sighted for 15 minutes.
   b) Prior to the start of impact pile driving each day, the contractor will implement soft start procedures for impact pile driving. Soft start requires contractors to provide an initial set of strikes at reduced energy, followed by a thirty-second waiting period, then two subsequent reduced energy strike sets followed by thirty seconds between each set. A soft start must be implemented at the start of each day's impact pile driving and at any time following cessation of impact pile driving for a period of thirty minutes or longer.
   c) A buffered Level A shutdown zone has been established for PW species during impact pile driving of 24-inch concrete piles at 70 m (230 ft). Adherence to this shutdown zone will avoid and minimize the potential for Level A acoustic injury to PW species during impact pile driving. If any PW is seen within 70 m (230 ft) during impact pile driving of 24-inch concrete piles, this activity would be stopped until the individual(s) has left the zone of its own volition, or not been sighted for 15 minutes.
   d) The Level B harassment ZOIs will be monitored throughout the time required to remove or install each pile type as stated in Section 6 above. 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 20 m (66 ft) or Level A ZOI, at which point removal or installation activities shall be halted.

2. Visual Monitoring
   a) Pile Removal and Installation: Monitoring will be conducted for all buffered Level A shutdown zones and Level B ZOIs before, during, and after pile removal activities. The Level B ZOI may be adjusted, subject to NMFS concurrence. Monitoring will take place from 30 minutes prior to initiation through 30 minutes post-completion of removal and installation activities.
   b) Monitoring will be conducted by qualified protected species observers (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., Pier 160 C and A, or any other suitable location) to monitor for marine mammals and implement shutdown/delay procedures, when applicable, by notifying

the equipment operator of a need for a shutdown of pile removal. The PSOs will be positioned with a clear view of the buffered Level A shutdown zones and all Level B ZOIs based on the visibility of the monitoring zone specific to each activity and visibility of that zone on a given day as needed.

c) PSOs will provide monitoring data for all animals observed within the visual range of the Project area, regardless of the in-water activity.
d) Pile removal and installation will only commence once observers have declared the buffered Level A 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 approaches/enters any buffered Level A shutdown zone during pile removal and installation operations, operations 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 a re-detection of the animal(s) from the last observation time.
f) If a marine mammal species not covered in this IHA enters the Level B harassment ZOI, all pile removal 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 or extraction will be allowed to proceed if the above measures are fulfilled for non-IHA species.
g) In the unlikely event that environmental conditions, such as heavy fog or low-light, prevent the visual detection of marine mammals within the buffered shutdown zone, in-water pile removal and installation activities will either be delayed or stopped until the environmental conditions allow PSOs to fully observe the applicable shutdown zones.
h) Based on the proposed PSO locations, most of each ZOI will be observable. There is a small amount of area that will be hard to view based on the location of other piers in the area; however, due to the fact that most marine mammals travel through the bay in a north-to-south or south-to-north direction, any mammal that may be temporarily unobservable must travel through the observable areas to get into or out of the Project area, and therefore would be accounted for in daily take numbers.
i) 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.

3. Daylight Pile Removal/Installation
   a) In-water pile removal and installation work will occur only during daylight hours that allow for sighting of marine protected species within all Project area and defined monitoring zones.
   b) Ambient lighting conditions will dictate the ability to see marine mammals. In the Project area, daylight hours will generally be considered as from 45 minutes after sunrise to 45 minutes before sunset. However, the on-site PSO will make a final determination on ambient lighting conditions based on their ability to see animals in the water.

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) fines that do remain suspended would be rapidly dispersed by tidal currents; and 3) tidal currents would tend to collapse the silt curtains and make them ineffective.

11.1.3 Mitigation Effectiveness

All PSOs utilized for mitigation activities will be experienced biologists with training in marine mammal detection and behavior. Due to their specialized training the Navy expects that visual mitigation will be highly effective. 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 Bay Harbor Safety Committee 2009). Fog is anticipated on 10-20% of the days, typically in late night and early morning hours (San Diego Bay Harbor Safety Committee 2009) and could occasionally limit visibility for marine mammal monitoring. However, observers will be positioned in locations which provide the best vantage point(s) for monitoring, such as on nearby piers, and the shutdown zone covers relatively small and accessible areas of the bay. As such, proposed mitigation measures are likely to be very effective.

12.0 MINIMIZATION OF ADVERSE EFFECTS ON SUBSISTENCE

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

13.0 MONITORING AND REPORTING MEASURES

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.

13.1.1 Visual Marine Mammal Observations

The Navy will collect sightings data and behavioral responses to pile removal and installation activities for marine mammal species observed in the Project area. All observers will be trained in marine mammal identification and behaviors.

13.1.2 Methods of Monitoring

The Navy will monitor all buffered Level A shutdown zones and Level B ZOIs before, during, and after pile removal activities. Based on NMFS requirements, the Marine Mammal Monitoring Plan would include the following procedures:

1. Trained PSOs will be placed at the best vantage point(s) practicable (e.g., Pier 160 C and A) to monitor for marine mammals and implement shutdown/delay procedures.
2. Any PSO can notify the equipment operator of a need for a shutdown of pile removal or installation, but shutdowns will generally be called by the PSO closest to the in-water activities. (referred to as "Command"). The "Command" PSO will coordinate monitoring efforts and construction starts/stops and provide updates to the other PSO.
3. Two PSOs will be deployed at locations with a clear view of the buffered shutdown zones and ZOIs during pile removal and installation activities. The actual monitoring location(s) will be based on providing the greatest visibility of the monitoring zone specific to each activity.
4. During all observation periods, observers will use binoculars and the naked eye to search continuously for marine mammals within the visual range of the PSOs.
5. Monitoring distances will be measured with range finders.
6. 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.
7. Bearing to animals will be determined using a compass.
8. In-water activities will be curtailed under conditions of fog or poor visibility that might obscure the presence of a marine mammal within the shutdown zones.
9. The number, species, and locations of all marine mammals observed will be documented using an electronic tablet or hardcopy datasheets in compliance with NMFS reporting requirements.
10. When a PSO is not present, but in-water activities are scheduled, a 20 m (66 ft) buffered shutdown zone will be implemented around any in-water equipment.
11. Pre-Activity Monitoring:
    a) Visual surveys will occur for at least 30 minutes prior to the start of in-water activities.
    b) If a marine mammal is present within any buffered Level A shutdown zone, in-water activities will be delayed until either the animal has voluntarily left and been visually confirmed beyond the shutdown zone, or 15 minutes as elapsed since the last observation time without a re-detection of the animal.

c) The shutdown zones may only be declared clear, and pile removal or installation started, when the entire shutdown zone is visible (i.e., when not obscured by poor light, rain, fog, etc.). If any shutdown zone is obscured by fog or poor lighting conditions, activity at the location will not be initiated until the shutdown zone is visible.
d) If marine mammals are present within the Level B Behavioral Harassment Monitoring ZOI, in-water activities will not need to be delayed.

12. During Activity Monitoring:
a) If a marine protected species approaches, or appears to be approaching and buffered Level A shutdown zone, the PSO who first observed the animal will alert the “Command” PSO, who will notify the work crew of the animal’s current status; in-water activities will be allowed to continue while the animal remains outside the buffered shutdown zone. If the "Command" PSO does not respond, then any PSO can initiate a shutdown.
b) If the marine protected species enters the buffered shutdown zone, a shutdown will be called by the “Command” PSO. As the animal enters the shutdown zone, all pile removal or installation operations will be stopped, and the animal(s) will be continually tracked. Once a shutdown has been initiated, all in-water activities that generate potentially impactful noise will be delayed until the animal has voluntarily left the shutdown zone and has been visually confirmed beyond the shutdown zone, or 15 minutes have passed without re-detection of the animal (i.e., the zone is deemed clear of marine protected species). The “Command” PSO will inform the construction contractor that activities can re-commence.
c) If shutdown and/or clearance procedures would result in an imminent concern for human safety, then the activity will be allowed to continue until the safety concern is addressed. During that timeframe the animal will be continuously monitored, and the Navy point of contact will be notified and consulted prior to re-initiation of Project-related activities.
d) Shutdown shall occur if a species for which authorization has not been granted, or for which the authorized numbers of takes have been met, approaches or is observed within the Level B ZOI. The contractor shall notify the Navy point of contact, who will then contact NMFS immediately. For non-IHA species, pile removal using vibratory extraction will be allowed to proceed if the animal(s) is observed to leave the Level B ZOI, or if one hour has lapsed since the last observation.
e) If a marine mammal is observed entering the Level B ZOIs, the pile segment being worked on will be completed without cessation, unless the animal enters or approaches the shutdown zone. Regardless of location within the Level B ZOI, an initial behavior and the location of the animal(s) will be logged. Behaviors will be continually logged until the animal is either passed off to another PSO, the animal is no longer visible, or it has left the Level B ZOI.

13. Post-Activity Monitoring:
a) Monitoring of all zones will continue for 30 minutes following completion of pile removal and installation. These surveys will record all marine mammal observations following the same procedures as identified for the pre-construction monitoring time period and will focus on observing and reporting unusual or abnormal behaviors.

13.1.3 Data Collection

NMFS requires that the PSOs use monitoring forms that collect, at a minimum, the following information:

- Date and time that pile removal begins or ends;
- Construction activities occurring during each observation period;

- Weather parameters (e.g., wind, humidity, temperature);
- Tidal 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 in-water 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" because of Project activities over the course of a day.

13.2 Reporting

A draft report will be submitted to NMFS within 90 calendar days of the completion of acoustic measurements and marine mammal monitoring. The results will be summarized in textual, graphical, and tabular form and include summary metrics, as applicable. A final report will be prepared and submitted to the NMFS within 30 days following receipt of comments on the draft report from the NMFS.

The marine mammal report shall contain informational elements including:

- Beginning and end dates and times of all marine mammal monitoring.
- Construction activities occurring during each daily observation period, including how many and what type of piles were driven or removed and by what method (i.e., impact or vibratory).
- Weather parameters and water conditions during each monitoring period (e.g., wind speed, percent cover, visibility, sea state).
- The number of marine mammals observed, by species, relative to the pile location and if pile driving or removal was occurring at time of sighting.
- Age and sex class, if possible, of all marine mammals observed.
- PSO locations during marine mammal monitoring.
- Distances and bearings of each marine mammal observed to the pile being driven or removed for each sighting (if pile driving or removal is occurring at time of sighting).
- Description of any marine mammal behavior patterns during observation, including direction of travel and estimated speed time spent within the Level B harassment ZOIs while the source was active.
- Number of individuals of each species by month detected within the monitoring zone, and estimates of number of marine mammals taken, by species.
- Detailed information about implementation of any mitigation triggered (e.g., shutdowns and delays), a description of specific actions that ensued, and resulting behavior of the animal, if any.
- Description of attempts to distinguish between the number of individual animals taken and the number of incidences of take, such as ability to track groups or individuals.
- Submit all PSO datasheets and/or raw sighting data in a separate file from the Final Report referenced above.

14.0 RESEARCH

The U.S. Navy is one of the world's leading organizations in assessing the effects of human activities on 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, OPNAV N45 developed in 2011 a new Living Marine Resources (LMR) Research and Development Program (http://www.lmr.navy.mil/). The goal of the LMR Research and Development 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 (SERDP) and Environmental Security Technology Certification Program (ESTCP) 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. SERDP and ESTCP 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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APPENDIX A. ZOI Spreadsheets by Pile Type and Removal Installation Method

Level A ZOI 18-inch Octagonal Concrete Piles VE

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Pier 302 Replacement Project-18-inch octagonal concrete pile vibratory extraction
PROJECT/SOURCE INFORMATION	Vibratory extraction of 25, 18-inch octagonal concrete piles assumed to happen for 15 minutes at a time, 5 extractions a day, for a total of 1.25 hours a day for 5 days

STEP 2: WEIGHTING FACTOR ADJUSTMENT

Weighting Factor Adjustment (kHz)[¥]	2.5	default

STEP 3: SOURCE-SPECIFIC INFORMATION

Sound Pressure Level (L_{rms}), specified at "x" meters (Cell B30)	162
Number of piles within 24-h period	5
Duration to drive a single pile (minutes)	15
Duration of Sound Production within 24-h period (seconds)	4500
10 Log (duration of sound production)	36.53
Transmission loss coefficient	15
Distance of sound pressure level (L_{rms}) measurement (meters)	10

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	199	198	173	201	219
PTS Isopleth to threshold (meters)	**9.2**	**0.8**	**13.7**	**5.6**	**0.4**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (-dB)†	**-0.05**	**-16.83**	**-23.50**	**-1.29**	**-0.60**

Level A ZOI for 18-inch Steel Pile Pile VE

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Pier 302 Replacement Project- 18-inch steel pile vibratory extraction
PROJECT/SOURCE INFORMATION	Vibratory extraction of 3, 18-inch steel piles assumed to happen for 15 minutes at a time, 1 extraction a day, for a total of 15 minutes a day for 3 days

STEP 2: WEIGHTING FACTOR ADJUSTMENT

Weighting Factor Adjustment (kHz)[¥]	2.5	default

STEP 3: SOURCE-SPECIFIC INFORMATION

Sound Pressure Level (L_{rms}), specified at "x" meters (Cell B30)	156
Number of piles within 24-h period	1
Duration to drive a single pile (minutes)	15
Duration of Sound Production within 24-h period (seconds)	900
10 Log (duration of sound production)	29.54
Transmission loss coefficient	15
Distance of sound pressure level (L_{rms}) measurement (meters)	10

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	199	198	173	201	219
PTS Isopleth to threshold (meters)	**1.3**	**0.1**	**1.9**	**0.8**	**0.1**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (-dB)†	**-0.05**	**-16.83**	**-23.50**	**-1.29**	**-0.60**

Level A ZOI for 24-inch Octagonal Concrete Pile Impact Pile Driving

VERSION 2.2: 2020

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Pier 302- Impact pile driving of 24-inch octagonal concrete piles
PROJECT/SOURCE INFORMATION	Impact pile driving of 24-inch octagonal concrete piles assumed to occur for 20 minutes at a time for up to 4 piles a day for 8 days

STEP 2: WEIGHTING FACTOR ADJUSTMENT

Weighting Factor Adjustment (kHz)[¥]	2	

STEP 3: SOURCE-SPECIFIC INFORMATION

E.1 1: METHOD TO CALCULATE PK AND SEL_{cum} (SINGLE STRIKE EQUIVALENT) PREFERRED METHOD (pulse duration not needed)

Unweighted SEL_{cum} (at measured distance) = SEL_{ss} + 10 Log (# strikes)	**199.0**

SEL_{cum}

Single Strike SEL_{ss} ($L_{E,p,\text{ single strike}}$) specified at "x" meters (Cell B32)	166
Number of strikes per pile	500
Number of piles per day	4
Transmission loss coefficient	15
Distance of single strike SEL_{ss} ($L_{E,p,\text{ single strike}}$) measurement (meters)	10

PK

$L_{p,0\text{-pk}}$ specified at "x" meters (Cell G29)	188
Distance of $L_{p,0\text{-pk}}$ measurement	10
$L_{p,0\text{-pk}}$ Source level	203.0

RESULTANT ISOPLETHS*

*Impulsive sounds have dual metric thresholds (SELcum & PK). Metric producing largest isopleth should be used.

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS Isopleth to threshold (meters)	**116.6**	**4.1**	**138.9**	**62.4**	**4.5**
PK Threshold	219	230	202	218	232
PTS PK Isopleth to threshold (meters)	**NA**	**NA**	**1.2**	**NA**	**NA**

"NA": PK source level is ≤ to the threshold for that marine mammal hearing group.

E.1 2: METHOD TO CALCULATE PK AND SEL_{cum} (USING RMS SPL SOURCE LEVEL)

SEL_{cum}

Sound Pressure Level (L_{rms}), specified at "x" meters (Cell B53)	176
Number of piles per day	4
Strike (pulse) Duration[∆] (seconds)	0.1
Number of strikes per pile	500
Duration of Sound Production (seconds)	200
10 Log (duration of sound production)	23.01
Transmission loss coefficient	15
Distance of sound pressure level (L_{rms}) measurement (meters)	10

PK

$L_{p,0\text{-pk}}$ specified at "x" meters (Cell G47)	188
Distance of $L_{p,0\text{-pk}}$ measurement	10
$L_{p,0\text{-pk}}$ Source level	203.0

RESULTANT ISOPLETHS*

*Impulsive sounds have dual metric thresholds (SELcum & PK). Metric producing largest isopleth should be used.

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS Isopleth to threshold (meters)	**116.6**	**4.1**	**138.9**	**62.4**	**4.5**
PK Threshold	219	230	202	218	232
PTS PK Isopleth to threshold (meters)	**NA**	**NA**	**1.2**	**NA**	**NA**

"NA": PK source level is ≤ to the threshold for that marine mammal hearing group.

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (-dB)†	**-0.01**	**-19.74**	**-26.87**	**-2.08**	**-1.15**

Level A ZOI for 14 inch Square Concrete Pile Impact Pile Driving

VERSION 2.2: 2020

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Pier 302- 14-inch square concrete impact pile driving
PROJECT/SOURCE INFORMATION	Impact pile driving of 14-inch square concrete piles assumed to occur for 15 minutes at a time for up to 1 piles a day for 2 days

STEP 2: WEIGHTING FACTOR ADJUSTMENT

Weighting Factor Adjustment (kHz)¥	2	

STEP 3: SOURCE-SPECIFIC INFORMATION

E.1 1: METHOD TO CALCULATE PK AND SEL_{cum} (SINGLE STRIKE EQUIVALENT) **PREFERRED METHOD (pulse duration not needed)**

Unweighted SEL_{cum} (at measured distance) = SEL_{ss} + 10 Log (# strikes)	**178.0**

SEL_{cum}

Single Strike SEL_{ss} ($L_{E,p,\text{single strike}}$) specified at "x" meters (Cell B32)	154
Number of strikes per pile	250
Number of piles per day	1
Transmission loss coefficient	15
Distance of single strike SEL_{ss} ($L_{E,p,\text{single strike}}$) measurement (meters)	10

PK

$L_{p,0\text{-}pk}$ specified at "x" meters (Cell G29)	183
Distance of $L_{p,0\text{-}pk}$ measurement	10
$L_{p,0\text{-}pk}$ Source level	198.0

RESULTANT ISOPLETHS*

*Impulsive sounds have dual metric thresholds (SELcum & PK). Metric producing largest isopleth should be used.

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS Isopleth to threshold (meters)	**4.6**	**0.2**	**5.5**	**2.5**	**0.2**
PK Threshold	219	230	202	218	232
PTS PK Isopleth to threshold (meters)	**NA**	**NA**	**NA**	**NA**	**NA**

"NA": PK source level is ≤ to the threshold for that marine mammal hearing group.

E.1 2: METHOD TO CALCULATE PK AND SEL_{cum} (USING RMS SPL SOURCE LEVEL)

SEL_{cum}

Sound Pressure Level (L_{rms}), specified at "x" meters (Cell B53)	166
Number of piles per day	1
Strike (pulse) Duration^Δ (seconds)	0.1
Number of strikes per pile	250
Duration of Sound Production (seconds)	25
10 Log (duration of sound production)	13.98
Transmission loss coefficient	15
Distance of sound pressure level (L_{rms}) measurement (meters)	10

PK

$L_{p,0\text{-}pk}$ specified at "x" meters (Cell G47)	183
Distance of $L_{p,0\text{-}pk}$ measurement (meters)+	10
$L_{p,0\text{-}pk}$ Source level	198.0

RESULTANT ISOPLETHS*

*Impulsive sounds have dual metric thresholds (SELcum & PK). Metric producing largest isopleth should be used.

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS Isopleth to threshold (meters)	**6.3**	**0.2**	**7.5**	**3.4**	**0.2**
PK Threshold	219	230	202	218	232
PTS PK Isopleth to threshold (meters)	**NA**	**NA**	**NA**	**NA**	**NA**

"NA": PK source level is ≤ to the threshold for that marine mammal hearing group.

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (-dB)†	**-0.01**	**-19.74**	**-26.87**	**-2.08**	**-1.15**

Level A ZOI for 6-inch Steel Pipe Pile VI

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Pier 302 Replacement Project- 6-inch round steel pile vibratory pile driving
PROJECT/SOURCE INFORMATION	Vibratory pile driving of 17, 6-inch round steel piles assumed to happen for 1 minute at a time, 5 installs a day at 5 minutes a day for a total of 4 days

STEP 2: WEIGHTING FACTOR ADJUSTMENT

Weighting Factor Adjustment (kHz)[¥]	2.5	default

STEP 3: SOURCE-SPECIFIC INFORMATION

Sound Pressure Level (L_{rms}), specified at "x" meters (Cell B30)	155
Number of piles within 24-h period	5
Duration to drive a single pile (minutes)	1
Duration of Sound Production within 24-h period (seconds)	300
10 Log (duration of sound production)	24.77
Transmission loss coefficient	15
Distance of sound pressure level (L_{rms}) measurement (meters)	10

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	199	198	173	201	219
PTS Isopleth to threshold (meters)	**0.5**	**0.0**	**0.8**	**0.3**	**0.0**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (-dB)†	**-0.05**	**-16.83**	**-23.50**	**-1.29**	**-0.60**

Level B Harassment Zone Calculations

Installation/Removal Method:	Removal (Vibratory Extractor)	
Pile Size/Type/Material:	18-inch Octagonal Concrete Piles	
Metric	**Input**	**Notes**
Source Level (dB RMS):	162	*NAVFAC SW (2022)*
Measurement Distance (m):	10	
Transmission Loss:	15	*Practical Transmission Loss*
Acoustic Threshold (dB RMS):	129.6	*Dahl and Dall'Osto (2019)*
Distance to Threshold (m):	**1,445**	

Installation/Removal Method:	Removal (Vibratory Extractor)	
Pile Size/Type/Material:	18-inch Round Steel Pipe Piles	
Metric	**Input**	**Notes**
Source Level (dB RMS):	156	*Denes et al (2016)*
Measurement Distance (m):	10	
Transmission Loss:	15	*Practical Transmission Loss*
Acoustic Threshold (dB RMS):	129.6	*Dahl and Dall'Osto (2019)*
Distance to Threshold (m):	**575**	

Installation/Removal Method:	Installation (Vibratory Hammer)	
Pile Size/Type/Material:	6-inch Round Steel Piles	
Metric	**Input**	**Notes**
Source Level (dB RMS):	155	*Illingworth & Rodkin (2007)*
Measurement Distance (m):	10	
Transmission Loss:	15	*Practical Transmission Loss*
Acoustic Threshold (dB RMS):	129.6	*Dahl and Dall'Osto (2019)*
Distance to Threshold (m):	**494**	

Installation/Removal Method:	Installation (Impact Hammer)	
Pile Size/Type/Material:	24-inch Octagonal Concrete Piles	
Metric	**Input**	**Notes**
Source Level (dB RMS):	176	*CALTRANS (2020)*
Measurement Distance (m):	10	
Transmission Loss:	15	*Practical Transmission Loss*
Acoustic Threshold (dB RMS):	160	*NMFS (2018)*
Distance to Threshold (m):	**117**	

Installation/Removal Method:	Installation (Impact Hammer)	
Pile Size/Type/Material:	14-inch Octagonal Concrete Piles	
Metric	**Input**	**Notes**
Source Level (dB RMS):	166	*CALTRANS (2020)*
Measurement Distance (m):	10	
Transmission Loss:	15	*Practical Transmission Loss*
Acoustic Threshold (dB RMS):	160	*NMFS (2018)*
Distance to Threshold (m):	**25**	