Final

Request for Incidental Harassment Authorization for the Incidental Harassment of Marine Mammals Resulting from the Marine Structure Maintenance and Pile Replacement Program (Phase 1 Extension)

Navy Region Northwest
Silverdale, Washington
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Submitted to:
Office of Protected Resources,
National Marine Fisheries Service,
National Oceanographic and Atmospheric Administration

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EXECUTIVE SUMMARY

The United States (U.S.) Department of the Navy (Navy) is applying for an Incidental Harassment Authorization (IHA), with a one year renewal option, for the incidental take of marine mammals resulting from the repair, maintenance, and pile removal and replacement of existing marine structures at two installations at Naval Base (NAVBASE) NAVBASE Kitsap Bremerton and the NAVBASE Kitsap Manchester between July 2024 and July 2025. The Navy is applying for a second IHA, including a one year renewal option, for the incidental take of marine mammals resulting from the repair, maintenance, and pile removal and replacement of existing marine structures at three installations between July 2025 and July 2026 for NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, and Naval Station (NAVSTA) Everett. Any unfinished work will be accomplished during the renewal option follow-on IHA if needed. All of the installations are located within Puget Sound, Washington. Vibratory and impact pile driving associated with the proposed activities, pile removal and installation, have the potential to affect marine mammals in the waterways adjacent to and within these Navy installations that could result in harassment under the Marine Mammal Protection Act (MMPA) of 1972, as amended.

Ten marine mammal species (from 14 stocks) have a reasonable potential to occur within the waters surrounding the Navy's installations: humpback whale (*Megaptera novaeangliae*) including the Central America/Southern Mexico – California-Oregon-Washington, Mainland Mexico – California-Oregon-Washington, and Hawai'i stocks, minke whale (*Balaenoptera acutorostrata scammoni*), gray whale (*Eschrichtius robustus*), killer whale (*Orcinus orca*) including the West Coast transient and the Southern Resident stocks, harbor porpoise (*Phocoena phocoena vomerina*), Dall's porpoise (*Phocoenoides dalli dalli*), Steller sea lion (*Eumetopias jubatus*), California sea lion (*Zalophus californianus*), northern elephant seal (*Mirounga angustirostris*), and harbor seal (*Phoca vitulina richardii*) including the Hood Canal and Washington Northern Inland Waters stocks. The 10 species (from 15 stocks) are included in the analysis of this application based on the potential for exposure to Level B behavioral harassment from noise associated with vibratory and impact pile driving during repair projects at various marine structures located at the four installations. In addition, harbor seals have the potential for exposure to Level A harassment from the impact pile driving.

Maintaining existing wharves and piers is vital to sustaining the Navy's mission and ensuring readiness. The Navy has an ongoing waterfront inspection program to identify deficiencies in marine structures. Identified deficiencies are prioritized and then programmed for design and construction. Future waterfront inspections, as well as damage caused by severe weather events and/or incidents caused by vessels will result in emergent marine structure repairs.

The Navy is requesting two consecutive IHAs in order to complete the project. The IHA inclusive dates for the first year of the project will be between July 2024 and July 2025, with pile driving occurring between July 16, 2024 and January 15 or February 15, 2025 (depending on the installation work window). Under the first year of the project during the period of July 2024 to July 2025, up to 198 structurally unsound piles of various types would be replaced with 164 concrete or steel piles. If the work is not completed within the IHA inclusive dates, the Navy may request a renewal for the period of July 2025 to July 2026. It is anticipated that the only in-water construction work remaining at the end of the first in-water work window, January 15 - February 15, 2025, would be installation of fender and support piles using methods described in this IHA. Under the first year of the project during the period of July 2024 to July 2025, up to 198 structurally unsound piles of various types would be replaced with 164 concrete or steel piles.

The IHA inclusive dates for the second year of the project will be between July 2025 and July 2026, with pile driving occurring between July 16, 2025 and January 15 or February 15, 2026 (depending on the installation work window). During the second year from July 2025 to July 2026, up to 130 piles of various types would be replaced with 130 concrete or steel piles. If the work is not completed within the IHA inclusive dates, the Navy may request a renewal for the period of July 2026 to July 2027.

During both years, existing piles would be removed by various methods including vibratory extraction, cutting/chipping, clamshell removal, and direct pull, depending on pile and site conditions. Replacement concrete piles will be installed using an impact hammer. Water jetting may also be used to aid in pile installation for some concrete piles. To minimize underwater noise impacts on marine species, vibratory pile driving will be the primary method used to install new steel piles. An impact hammer may be used if substrate conditions prevent the advancement of piles to the required depth or to verify the load-bearing capacity. An air bubble curtain or other noise attenuating device will be used to reduce noise levels during impact driving of steel piles. In areas of bedrock (NAVBASE Kitsap Manchester), the “Down the Hole” (DTH) drilling method is used to “pre-drill” piles into place. DTH produces both continuous and impulsive sounds simultaneously. Marine mammal monitoring will be conducted during installation of all piles using impact driver, vibratory, or DTH drilling methods. During removal of old piles, only vibratory removal will be monitored (pulling or cutting of piles will not be analyzed or monitored). Work will shut down if marine mammals come within project-specific defined shut down zones. Pile driving duration will vary, depending on the scope of individual projects at each installation; all pile driving will be conducting during prescribed in-water work windows for each installation.

The Navy used the National Marine Fisheries Service (NMFS) promulgated thresholds for assessing pile driving impacts to marine mammals, and used the practical spreading loss equation and empirically measured source levels from other similar pile driving projects to estimate potential marine mammal exposures to pile driving noise. Predicted exposures are described in detail in Section 6 (Table 6-16-6-19) and summarized in Tables ES–1 and ES-2. Level A harassments associated with pile driving activities will be avoided for all species but may occur for harbor seals and California sea lions, by implementing mitigation measures described in Section 11. Conservative assumptions (including marine mammal densities, survey data, and other assumptions) used to estimate the exposures are likely to overestimate the potential number of exposures.

Pursuant to MMPA Section 101(a)(5)(D), the Navy submits this application to NMFS for the authorization of incidental, but not intentional, taking of individuals of 10 marine mammal species (from 13 stocks) during pile driving activities for the extension of Phase 1 of the Marine Structure Maintenance and Pile Replacement Program (MPR Program). The taking will be in the form of non-injurious, temporary harassment, and for harbor seals will also include non-serious injury. All taking is expected to have a negligible impact on populations of these species. In addition, the taking will not have an adverse impact on the availability of these species for subsistence use.

Regulations governing the issuance of incidental take under certain circumstances are codified at 50 Code of Federal Regulations Part 216, Subpart I (Sections 216.101–216.108). Section 216.104 sets forth 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.

Marine mammal monitoring will be conducted during pile installation and vibratory removal work, and shut down zones would be enforced as required under the conditions of the IHAs. The duration and frequency of such work, as well as other underwater noise-generating work during construction, are expected to vary depending on the scope of the individual project components. All pile removal and installation will be conducted during prescribed in-water work seasons.

Table ES-1. Total Underwater Level B Exposure Estimates by Species for July 2024-July 2025

Species and/or Stock	*Bremerton*	*Manchester*	*Total*[1]
Humpback whale[2] (Hawaii, Central America-Southern Mexico, and Mainland Mexico stocks)	Applies to all installations		**4**
Minke whale[2]	Applies to all installations		**4**
Gray whale[2]	Applies to all installations		**4**
Transient killer whale[2]	Applies to all installations		**12**
Southern Resident killer whale[2]	Applies to all installations		**20**
Harbor porpoise[3]	93	701	**794**
Dall's porpoise[2]	Applies to all installations		**10**
Steller sea lion	9	222	**231**
California sea lion	3,038	888	**3,926**
Northern elephant seal[2]	Applies to all installations		**2**
Harbor seal (Washington Northern Inland Water stocks)	62	370	**432**

[1]Calculations of exposures using species density or installation surveys, ZOI, and number of days are provided in appendix A.

[2]These species or stocks are unlikely to be exposed to pile driving sound due to their low numbers, distribution, or the use of mitigation measures such as using near real time locations and social media locations of whales to delay or shut down work.

[3]Group size of 1-3.

Table ES-2. Total Underwater Level A Exposure Estimates by Species For the Period of July 2024-July 2025

Species	*Bremerton*	*Manchester*	*Total*
Harbor seal	20	37	**57**

Table ES-3. Total Underwater Level B Exposure Estimates by Species for July 2025-July 2026

Species	*Bangor*	*Bremerton*	*Everett*	*Total*[1]
Humpback whale[2] (Hawaii, Central America-Southern Mexico, and Mainland Mexico stocks)	Applies to all installations			**4**
Minke whale[2]	Applies to all installations			**4**
Gray whale[2]	Applies to all installations			**4**
Transient killer whale[2]	Applies to all installations			**12**
Southern Resident killer whale[2]	Applies to all installations			**20**
Harbor porpoise[3]	905	204	48	**1,157**
Dall's porpoise[2]	Applies to all installations			**10**
Steller sea lion	261	18	8	**287**
California sea lion	900	2,352	384	**3,636**
Northern elephant seal[2]	Applies to all installations			**2**
Harbor seal (Hood Canal and Washington Northern Inland Water stocks)	576	48	2,128	**2,752**

[1]Calculations of exposures using species density or installation surveys, ZOI, and number of days are provided in appendix A.

[2]These species or stocks are unlikely to be exposed to pile driving sound due to their low numbers, distribution, or the use of mitigation measures such as using near real time locations and social media locations of whales to delay or shut down work.

[3]Group size of 1-3

Table ES-4. Total Underwater Level A Exposure Estimates by Species For the Period of July 2025-July 2026

Species	*Bangor*	*Bremerton*	*Everett*	*Total*
Harbor seal	20	0	0	**20**

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Abbreviations and Acronyms

Acronym	Definition
ACZA	ammoniacal copper zinc arsenate
BMP	Best Management Practices
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CSL	Cleanup Screening Levels
CV	coefficient of variation
CWA	Clean Water Act
dB	decibel
dB re 1 µPa	decibels referenced at 1 micropascal
dBA	A-weighted decibel
DIP	Demographically Independent Populations
DPS	Distinct Population Segment
DTH Drilling	Down the Hole Drilling
EHW-1	Explosive Handling Wharf #1
EHW-2	Explosive Handling Wharf #2
ENP	Eastern North Pacific
ESA	Endangered Species Act
ft	foot/feet
ft/sec	foot/feet per second
HDPE	high density polyethylene
Hz	hertz
IHA	Incidental Harassment Authorization
in	inch/inches
in/sec	inches per second
K/B	Keyport–Bangor
kHz	kilohertz
km	kilometer
L_{eq}	equivalent sound level
L_{max}	maximum sound level
LMR	Living Marine Resources
LOA	Letter of Authorization
mi	mile
MLLW	mean lower low water
MMPA	Marine Mammal Protection Act
MPR	Maintenance and Pile Replacement
NAVBASE	Naval Base
NAVSTA	Naval Station
Navy	U.S. Department of the Navy
NMFS	National Marine Fisheries Service
NMSDD	Navy Marine Species Density Database
NOAA	National Oceanic and Atmospheric Administration

Acronym	Definition
NTU	nephelometric turbidity unit
PSAMP	Puget Sound Ambient Monitoring Program
PSB	port security barrier
PSO	protected species observer
PTS	permanent threshold shift
PVC	polyvinyl chloride
RMS	root mean square
ROD	Record of Decision
sec	second
SEL	sound exposure level
SMS	Sediment Management Standards
SPL	sound pressure level
sq	square
SQS	Sediment Quality Standards
TL	transmission loss
TMDL	total maximum daily load
U.S.C.	United States Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WDOE	Washington Department of Ecology
WNP	Western North Pacific
WRA	Waterfront Restricted Area
ZOI	zone of influence

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1 INTRODUCTION AND DESCRIPTION OF ACTIVITIES

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

1.1 Introduction

The Navy is proposing to conduct maintenance and repair activities at marine waterfront structures at four installations within the Navy's Northwest Region within Puget Sound (Figure 1-1). Repairs will include replacing up to 198 structurally unsound piles over a one-year period (July 2024 through July 2025) at Naval Base (NAVBASE) Kitsap Bremerton and NAVBASE Kitsap Manchester. A second IHA is requested for replacement of 130 structurally unsound piles over a one-year period (July 2025 through July 2026). A total of 294 new piles will be installed over the two years, 164 during the period of July 2024-July 2025 and 130 piles during the period of July 2025 to July 2026 (Tables 1-1 and 1-2).

Under the Marine Mammal Protection Act (MMPA) of 1972, as amended (16 United States Code [U.S.C.] Section 1371(a)(5)(D)), Commander, Navy Region Northwest is requesting two sequential Incidental Harassment Authorizations (IHAs) for pile driving and removal activities that are expected to result in the unintentional taking of marine mammals. The 14 specific items required for this application, as set out by 50 Code of Federal Regulations (CFR) 216.104 Submission of Requests, are provided for in Chapters 1–14 of this application.

This regional level request for two IHAs is continuation of the Phase 1 Marine Structure Maintenance and Pile Replacement (MPR) programmatic Letter of Authorization (LOA).

Because this programmatic contains a number of projects each with one or more activities at several different locations, this application is organized to discuss both:

(1) General information common to activities covered under the MPR programmatic, such as a general description of activities that could occur at any in-water structure and analysis of general effects to species if exposed to specific activities within the MPR programmatic.

(2) Location-specific information describing site-specific baseline conditions, species occurrence information, and the site-specific potential for species exposure to effects from activities covered under the MPR programmatic.

The Navy was granted an extension of the MPR Program ESA Consultation with the NMFS and U.S. Fish and Wildlife Service (USFWS) under Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. Section 1531 et seq.), resulting in effective dates of April 2024 to March 2026.

1.2 Project Requirements for Programmatic Use

Marine structure maintenance and pile replacement projects at the four locations identified in this document will be able to utilize this programmatic consultation if the following conditions are met:

(1) Projects are reviewed prior to use of the MPR programmatic by a Navy biologist for their ability to meet the requirements of activities covered by this IHA.

(2) Projects included in this IHA adhere to the Best Management Practices (BMPs) and minimization measures as described in this IHA (Section 11.4) and any Terms and Conditions provided in the MPR Biological Opinion issued by NMFS (NMFS, 2019).

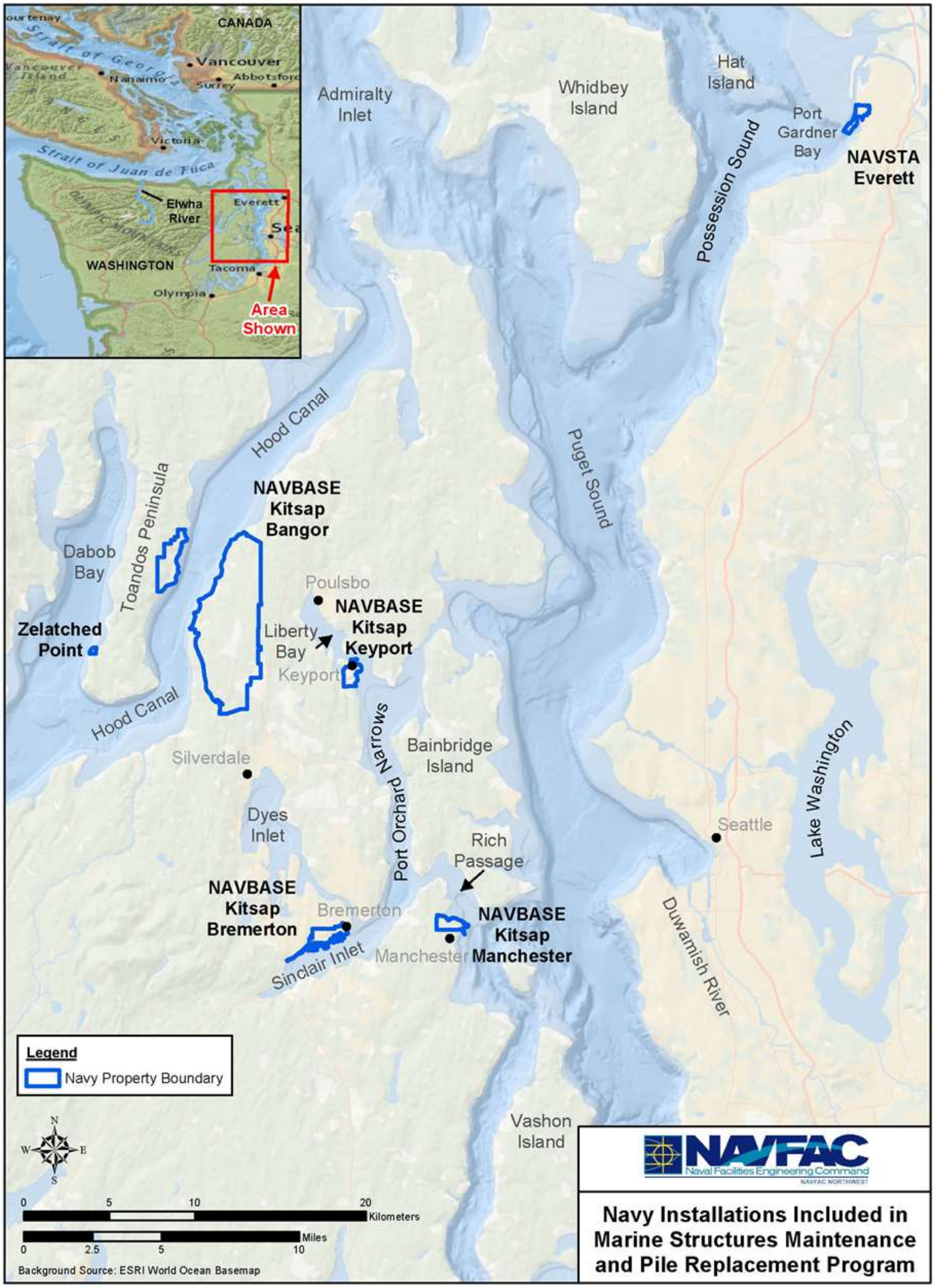

Figure 1-1. Navy Installations Included In The Marine Structures Maintenance and Pile Replacement Program

(3) Projects submit a post-project completion form including any monitoring reports required.

The Navy will also meet with NMFS prior to the start of the in-water work window to review upcoming monitoring plans. The intent is to utilize lessons learned to better inform potential effects of future MPR activities and in any follow-up programmatic consultations.

The following sections of this Chapter present an overview of the MPR Program, general information on typical pile repair and replacement construction techniques, other common repairs associated with marine pile-supported structures, a description of in-water structures, and pile replacement estimates by installation.

1.3 Overview of Pile MPR Program

The Navy's waterfront inspection program prioritizes deficiencies in marine structures and plans those maintenance and repairs for design and construction. The Proposed Action includes individual projects (where an existing need has been identified and funds have been requested) and estimates for emergent or emergency repairs. The latter are also referred to as contingency repairs. Potential impacts to marine mammals from actions in the MPR Program are only expected from noise produced from vibratory pile extraction, vibratory or impact pile installation, and "down the hole" (DTH) drilling.

Tables 1-1 and 1-2 provide a summary of pile types, sizes, and maximum numbers of piles at each installation to be replaced over the two one-year MPR Program periods from July 2024-July 2025 and July 2025-July 2026, respectively. This estimate assumes all piles are removed and replaced with new piles. However, existing piles may be repaired in place with no new piles installed and if replaced piles are larger than existing piles, typically fewer piles are needed. Therefore, estimates of replaced piles for each installation are a worst-case scenario. These estimates also include temporary (or "false work") piles that may be required during construction. Actual numbers will depend on the number actually replaced and the size and type of new piles installed. Section 1.5 provides a list of the in-water structures at the four installations, their functions, and anticipated pile repair requirements over the one-year program duration.

Table 1-1. Pile Types and Maximum Number to Be Replaced at Each Installation for One-Year Program Duration July 2024-July 2025

Installation	*Existing Pile Types and Sizes to Be Removed by Vibratory Method*	*Anticipated Piles Types and Sizes to Be Installed [1] (Type of Driving)*	*Maximum Number of Piles to Be Removed and Installed [2]*
NAVBASE Kitsap Bremerton	Pier C: 25 round timber 13-in (Vibratory or pull) Pier 5: 53 round timber 13-in (Vibratory or pull)	Pier C: 25 octagonal concrete up to 24-in (Impact) Pier 5: 65 concrete piles, 18 in x 18-in square (Impact)	168
NAVBASE Kitsap Manchester (Fuel Pier)	72 round steel 26-in (Pulled or cut; no vibratory)	74 octagonal concrete piles 24-in (Impact or Down the Hole drilling depending on substrate)	146
Region Total	**150**	**164**	**314**

Table 1-2. Pile Types and Maximum Number to Be Replaced at Each Installation for one-Year Program Duration July 2025-July 2026

Installation	*Existing Pile Types and Sizes to Be Removed by Vibratory Method*	*Anticipated Piles Types and Sizes to Be Installed* [1] *(Type of Driving)*	*Maximum Number of Piles to Be Removed and Installed* [2]
NAVBASE Kitsap Bangor (Marginal Wharf)	78 Round steel pile piles, 36-in (Vibratory, cut, or pull)	78 Round steel pile piles, 36-in (Vibratory/Impact proofing if needed)	156
NAVBASE Kitsap Bremerton (Pier F)	48 Round steel pile piles, 24-in fender piles (Vibratory or pull)	48 Round steel pile piles, 24-in fender piles (vibratory)	96
NAVSTA Everett (Pier A)	4 Square steel – 12-in (Vibratory or cut)	4 Square steel – 12-in jackets (Vibratory/Impact proofing if needed)	8
Region Total	**130**	**130**	**260**

Pile driving method is known for some projects based on the intended purpose and other information from installations, but in other cases pile it had not been determined if vibratory and/or impact would utilized. For purposes of analysis, the vibratory harassment zone was determined, since this would be a worst-case scenario in terms of size of the harassment zones for marine mammals. While all steel piles are assumed to have some extent of impact driving, to minimize acoustic noise effects on fish, piles will be initially driven with a vibratory hammer until they reach a point of refusal (where substrate conditions make use of a vibratory hammer ineffective) or engineering specifications require impact driving to verify load-bearing capacity (called "proofing" and involves impact driving the pile the final few feet into the subsurface after vibratory pile driving has been completed). Depending on subsurface conditions, the point of refusal could be reached immediately, requiring the entire pile to be fully impact driven, or later during vibratory driving, requiring the remainder of the pile to be only partially impact driven. If there is a rock substrate that cannot be penetrated with impact pile driving, such as NBK Manchester, then DTH drilling would utilized.

1.4 General Description of Pile Repair and Replacement Construction Methods

This section describes the methods of pile removal, repair, and installation and that may be used to accomplish the work included as part of the MPR Program. Additionally, other repairs of marine pile-supported structures that are commonly conducted as part of a pile repair and replacement projects are described below. The methods in this section are representative of typical Navy in-water construction methods that may be utilized. Although pile repair, extraction, and installation are part of the Proposed Action, only pile extraction and installation using vibratory pile driving, impact pile driving, or DTH drilling are likely to result in harassment of marine mammals. As described in Section 6, harassment is expected to occur due to elevated noise levels associated with vibratory pile driving (extraction and installation), impact pile driving, and DTH drilling. The Navy is not requesting marine mammal takes for other activities included in the MPR program including pile repair, clamshell pile extraction, or removal by chipping of piles because noise levels produced by these activities do not exceed baseline levels produced by other routine activities and operations at these locations. Any elevated noise levels resulting from non-pile driving activities will be intermittent, of short duration, and with low peak values.

1.4.1 Pile Repair

Several methods of pile repair may be used, including stubbing, wrapping, pile encapsulation, welding, or coating. Pile stubbing is a process in which an existing, damaged length of timber pile above the ground line is removed and replaced with a new length of timber pile. Wrapping may be utilized on existing timber piles to protect against marine borers. Typically, flexible polyvinyl chloride (PVC) is wrapped around the entire pile from the mudline to above the water line. There are different methods of pile encapsulation, but in general, encapsulation refers to the process of encasing piles in concrete. Encapsulation is used when a pile is damaged, but still retains some load-bearing capacity. Welding may be used if a steel pile is damaged above the water line. The damaged section of the steel pile may be cut out/off and a new pile section welded on. Coating repairs are occasionally required on steel piles to protect against corrosion. These processes do not involve pile driving.

1.4.2 Pile Replacement

Most in-water structures are pile-supported; therefore, repair of these structures typically involves removal of existing piles and installation of new piles or repair of existing piles in-place. In addition, fender piles (or guide piles) protect in-water structures from direct contact with vessels. In-water piles may be treated timber, steel, pre-stressed concrete, or high-density polyethylene (HDPE) plastic. Existing timber piles are generally treated with creosote or ammoniacal copper zinc arsenate (ACZA) to preserve the wood. ACZA does not contain creosote. New timber piles proposed for installation will not contain creosote. Steel piles may be hollow or filled with concrete following installation.

1.4.2.1 Pile Removal

Four methods of pile removal (vibratory extraction, cutting/chipping, clamshell removal, and direct pull) may be used depending on site conditions. In some cases, piles may be cut at or below the mudline, with the below-mudline portion of the pile left in place. The removal of broken piles is contingent on Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) agreements at each applicable installation.

All materials and waste would be disposed of in accordance with federal and state requirements. Creosote-treated piles may be cut into smaller segments in a manner that precludes further use and disposed of at an appropriate upland location. With the exception of creosote-treated piles, the Navy would evaluate if it would be possible to reclaim or recycle the materials. The four pile removal methods are described below.

1.4.2.1.1 Vibratory Extraction

Vibratory extraction is a common method for removing all pile types. A barge-mounted crane operates from the water adjacent to the pile during removal activities. A vibratory driver is a large mechanical device (5–16 tons) suspended from a crane by a cable and positioned on top of a pile. The pile is then loosened from the sediments by activating the driver and slowly lifting up on the driver with the aid of the crane. Once the pile is released from the sediments, the crane continues to raise the driver and pull the pile from the sediment. The driver is shut off once the end of the pile reaches the mudline and the pile is pulled from the water and placed on a barge. Vibratory extraction is expected to take approximately <1 to 30 minutes per pile depending on the pile size, type, and substrate conditions.

1.4.2.1.2 Cutting/Chipping

Concrete piles may be removed with a pneumatic chipping hammer or another similar tool capable of cutting through concrete. Pneumatic hammers are used for drilling and the chipping of brick, concrete, and other masonry. A pneumatic chipping hammer is similar to an electric power tool, but uses the energy of compressed air instead of electricity. The pneumatic chipping hammer consists of a steel piston that is reciprocated (moved backward and forward alternately) in a steel barrel by compressed air. On its forward stroke, the piston strikes the end of the chisel. The reciprocating motion of the piston occurs at such a rate that the chisel edge vibrates against the concrete with enough force to fragment or splinter the pile.

1.4.2.1.3 Clamshell

In some cases, removal with a vibratory driver is not possible because the pile may break apart from the force of the clamp and the vibration. If piles break or are damaged, a clamshell apparatus may be lowered from the crane to remove pile stubs. A clamshell is a hinged steel apparatus that operates similar to a set of steel jaws. The bucket is lowered from a crane and the jaws grasp the pile stub as the crane pulls upward. The use and size of the clamshell bucket would be minimized to reduce the potential for turbidity during pile removal.

1.4.2.1.4 Direct Pull

Based on site conditions, piles may be removed by wrapping the piles with a cable or chain and pulling them directly from the sediment with a crane. In some cases, depending on access and location, piles may be cut at or below the mudline.

1.4.2.2 Pile Installation

Three primary methods of pile installation may be used (jetting, vibratory, impact, and DTH drilling) depending on site conditions. These methods are described below.

Vibratory Driving: The vibratory pile driver method is a technique that may be used in pile installation where the substrate allows. Use of this technique may be limited in very hard or liquefiable substrates. This process begins by placing a choker cable around a pile and lifting it into vertical position with a crane. The pile is then lowered into position and set in place at the mudline. The pile is held steady while the vibratory driver installs the pile to the required tip elevation. In some substrates, a vibratory driver may be unable to advance a pile until it reaches the required depth. In these cases, an impact hammer may be used to entirely advance the pile to the required depth. For load-bearing structures, an impact hammer is typically required to strike a pile a number of times to ensure it has met the load-bearing specifications; this is referred to as "proofing."

Water Jetting: Water jetting is considered to be a continuous sound but is below the threshold for NMFS to regulate. Water jetting may be used to aid the penetration of a pile into a dense sand or sandy gravel stratum. Pile jetting utilizes a carefully directed and pressurized flow of water at the pile tip, which disturbs a ring of soils directly beneath it. The jetting technique liquefies the soils at the pile tip during pile placement, reducing the friction and interlocking between adjacent sub-grade soil particles around the water jet. Load-bearing piles installed with water jetting would still need to be proofed with an impact pile driver. Water jetting would not be used on projects where disturbance of contaminated sediments is a possibility.

Impact Driving: Impact driving is considered to be an impulse sound. Impact hammers may be used to install steel, concrete, plastic, or timber piles. Impact hammers have guides that hold the hammer in alignment with the pile while a heavy piston moves up and down striking the top of the pile and driving the pile into the substrate from the downward force of the hammer. To drive the pile, a pile is first moved into position and set into the proper location by placing a choker cable around a pile and lifting it into vertical position with the crane. A vibratory driver may be used to set the pile in place at the mudline. Once the pile is properly positioned, impact pile installation can typically take a minute or less to 60 minutes depending on pile type, pile size, and conditions (i.e., bedrock, loose soils, etc.) to reach the required tip elevation. Additional details of impact pile driving specific to the types of piles potentially used in the program are presented in Section 1.3.2.2.1 below.

Because impact driving of steel piles can produce underwater noise levels that have been known to be harmful to fish and wildlife, piles would be advanced to the extent practicable with a vibratory driver and only impact driven when required for proofing or when a pile cannot be advanced with a vibratory driver due to hard substrate conditions. When impact driving steel pipe piles, a bubble curtain or other noise attenuation device would be employed for all pile strikes with the possible exception of short periods when the device is turned off to test the effectiveness of the noise attenuation device.

A bubble curtain is usually a ring or series of stacked rings that are placed around a pile along the pile's entire length underwater. The rings are made of tubing which has small puncture holes through which compressed air is pumped. As the compressed air bubbles flow from the tubing, they create an air barrier that impedes the sound produced during pile driving. Based on the Navy (2015d) report on proxy pile type and driving method sound sources and bubble curtain attenuation results, the Navy will use 8 dB at the level of attenuation in calculations of pile driving monitoring and shutdown zones.

Down the Hole Drilling (DTH): DTH drilling is considered to have both impulsive and continuous sounds simultaneously (NMFS, 2022). Piles cannot be driven in to very dense/hard glacial soils and/or bedrock using either impact or vibratory pile driving methods described above. Where bedrock is encountered, piles would need to be placed at least 10 feet deep into existing bedrock to support the lateral load. The Navy would "pre-drill" the piles into place using down-the-hole (DTH) drilling.

DTH drilling is a common method used to drill holes through hard rock substrates. DTH drilling uses rotary cutting percussion action using a button bit. In DTH drilling, the percussion mechanism, or hammer, is located directly above the drill bit. The drill pipe transmits the necessary feed force and rotation to the hammer and bit, along with the compressed air used to actuate the hammer and flush the cuttings. The activity is analogous to jack hammering. The primary sound components are percussive drilling and release of compressed air. Compressed air is constantly fed to not only power the drill but also clear out loose material and cuttings.

1.4.2.2.1 Pile Driving Information by Pile Type

Concrete Piles

A maximum of 164 of the 294 total piles planned for installation have been identified as concrete piles. These piles would be installed at NAVBASE Kitsap Bremerton and NAVBASE Kitsap Manchester. At all locations, concrete piles will be a maximum of 24-in diameter (Table 1-1).

Concrete piles at NAVBASE Kitsap Bremerton will be installed using a vibratory or impact pile driving. At Manchester, the substrate is likely to require pre-drilling into the bedrock using the DTH drilling method; however, impact driving may be used if there are areas without bedrock. Because of the relatively low underwater noise levels associated with concrete piles when impact driven, bubble curtains are not proposed during impact installation of concrete piles.

Steel Piles

A maximum of 130 of the 294 total piles planned for installation have been identified as steel piles. These piles would be installed at NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton and Naval Station (NAVSTA) Everett. Steel piles will range in size from 12-in to a maximum of 36-in diameter (Table 1-2).

Impact driving of steel piles can produce underwater noise levels that have been known to be harmful to marine mammals; therefore piles would be advanced to the extent practicable with a vibratory driver and only impact driven when required for proofing or when a pile cannot be advanced with a vibratory driver due to hard substrate conditions. When impact driving steel pipe piles, a bubble curtain or other noise attenuation device would be employed for all pile strikes.

1.4.3 Associated Marine Structure Repairs and Maintenance

In addition to pile removal, installation, and repair, other marine structure repairs and maintenance will be included in most projects. These repairs include replacement of structural elements such as pile caps and cross bracing, replacement or repair of decking, and replacement of wave break panels. Fender system components such as camels may be replaced. Also, various metal components exposed to the marine environment are subject to corrosion and will require periodic maintenance, such as coating, or replacement. All of the associated repair activities either occur over water or involve only minor in-water work. All of the above activities will be conducted with the appropriate Spill Prevention Control and Countermeasures Plan and other BMPs identified in Section 11. Although these activities are a part of the Proposed Action, none of the associated marine structure repairs or maintenance activities described here is anticipated to result in impacts that will result in harassment of marine mammals.

1.4.4 Construction Access and Project Staging

Barges will be used as platforms for conducting work activities and to haul materials and equipment to and from work sites. Barges will be moored with spuds or anchors and not allowed to ground on the seafloor.

Other than barges as mentioned above, no staging sites for any of the projects in the program have been identified. If staging areas for equipment and materials are identified at a future date, they would occur in currently developed areas.

1.4.5 Future Maintenance

Maintenance of marine structures will not change as a result of project activities within the MPR Program. However, changes to the frequency of repairs are likely to occur when timber piles are replaced with steel or concrete piles because fewer repairs are typically needed for steel or concrete piles than timber piles.

1.5 Best Management Practices, Mitigation and Minimization Measures

General BMPs, mitigation and minimization measures that may be implemented for all in-water repair and replacement activities are described in Chapter 11 of this application. BMPs are routinely used by the Navy during pile repair, replacement, and maintenance activities to avoid and minimize potential environmental impacts. Additional minimization measures have been added to protect marine mammals, ESA-listed species, and designated critical habitats. These measures include vibratory installation of piles where possible, noise attenuation and performance measures for impact pile driving, and marine mammal monitoring as described in Chapter 11.

1.6 In-Water Structures and Pile Replacement Estimates by Installation

This section provides a description of in-water structures at the various installations and anticipated repair requirements over the program duration. Table 1-3 provides a list of marine pile-supported structures at each installation that are included in the MPR Program. Appendix A provides a list of planned projects and contingency pile estimates for each installation, as currently projected by year. Piles could be removed by any of the methods described in Section 1.3.2.1. Steel piles will be installed with a vibratory driver and proofed with an impact hammer to the appropriate tip elevation if possible. Past pile driving experience at NAVBASE Kitsap Bangor (Explosives Handling Wharf #2 [EHW-2] and Carderock Pier) and Bremerton (Pier 4 and Pier 5) demonstrated that piles typically could be solely vibratory driven, but occasionally hard glacial till or other difficult driving conditions were encountered, requiring installation to be completed with an impact driver. Timber, HDPE plastic, and concrete piles are typically installed with an impact hammer.

Table 1-3. Marine Pile-Supported Structures Included in the MPR Program

Structure Name	***Year Built***
NAVBASE Kitsap Bangor	
Carderock Pier	2008
Service Pier	*1980*
Keyport–Bangor (K/B) Dock	*1965*
Delta Pier	*1979*
Marginal Wharf	*1945*
Explosive Handling Wharf 1 (EHW-1)	*1975*
Magnetic Silencing Facility	*1978*
NAVBASE Kitsap Bremerton	
Pier 3	*1943*
Pier 4	*1932*
Pier 5	*1923*
Pier 6	*1926*
Pier 7	*1943*
Pier (Wharf) 9	*1962*
Pier B	*Rebuilt 2012*
Pier C	*1941*
Pier D	*Rebuilt 2004*
Mooring Pier A	*1949*
Mooring Pier E	*1949*
Mooring Pier F	*1949*
Mooring Pier G	*1949*
NAVBASE Kitsap Keyport	
Keyport Pier	*2002*
NAVBASE Kitsap Manchester	
Manchester Fuel Pier	*1993*
Manchester Finger Pier	*1978–1979, approach 2015*
Zelatched Point	
Zelatched Point Pier	*1965*
NAVSTA Everett	
Pier A	*1993*
Pier B	*1998*
Pier C	*1940s*
Pier D	*1940s*
Pier E	*1940s*
North Wharf	*1986*
South Wharf	*1992*
Small Boat Marina	*1995*
Small Boat Launch	*2011*

At locations with more than one structure (e.g., NAVBASE Kitsap Bremerton), two structures may be repaired simultaneously in the same in-water work window.

1.6.1 NAVBASE Kitsap Bangor

Pile-supported structures at the NAVBASE Kitsap Bangor waterfront include: Carderock Pier, Service Pier, Keyport–Bangor (K/B) Dock, Delta Pier, Marginal Wharf, Explosives Handling Wharf #1 (EHW-1), and the Magnetic Silencing Facility (Figure 1-2).

Over the one-year MPR Program duration from July 2025 to July 2026, up to 78 steel fender piles (36-in) are anticipated to be removed by vibratory or cutting and 78 steel fender piles (36-in) could be installed using vibratory with impact proofing at the Marginal Wharf.

1.6.2 NAVBASE Kitsap Bremerton

There are 13 pile-supported structures located at NAVBASE Kitsap Bremerton (Figure 1-3). Three pile repair and replacement projects are planned at NAVBASE Kitsap Bremerton at Piers C, 5, and F. During the period of July 2024 to July 2025, 25 timber fender piles (13-in) would be removed using vibratory or pulling, and replaced with 25 fender concrete piles (24-in) at Pier C using impact driving. Also during the period July 2024 to July 2025, 53 timber piles (13-in) would be removed and replaced with up to 65 concrete piles (18-in square) at Pier 5 using impact driving. During the period of July 2025 to July 2026, 48 steel fender piles (24-in) will be removed and replaced with 48 new steel fender piles (24-in) using vibratory driving at Pier F. Pile driving at Pier C would be impact driving and at Pier 5, piles would be installed using vibratory driving, therefore, there would no overlap between pile driving sources or synchronous pile driving (NMFS, 2023). In addition, Pier 5 is shielded from Pier C pile driving sound by Dry Dock 6 (solid structure extending out in to Sinclair Inlet; Figure 1-3).

1.6.3 NAVBASE Kitsap Manchester

The primary pile-supported structures at NAVBASE Kitsap Manchester are the 1,280-ft fuel pier and the finger pier with a barge mooring platform and a small boat float (Figure 1-4). During the period of July 2024 to July 2025, 72 steel fender piles (26-in) will be removed and replaced with 74 concrete piles (24-in) at the fuel Pier. All concrete piles will be installed with the DTH drilling method for areas with bedrock or an impact driver if there is no bedrock.

1.6.4 NAVSTA Everett

Pile-supported structures at NAVSTA Everett include Piers A, B, C, D, and E; North Wharf and South Wharf; the recreational marina; and the small boat launch (Figure 1-5). Additionally, there are fender piles along the waterfront areas. During the period of July 2025 to July 2026, four steel piles (12 in) may be removed by vibratory or cutting and replaced with four steel piles (12-in) with vibratory and impact driving or have support jackets installed by vibratory at Pier A.

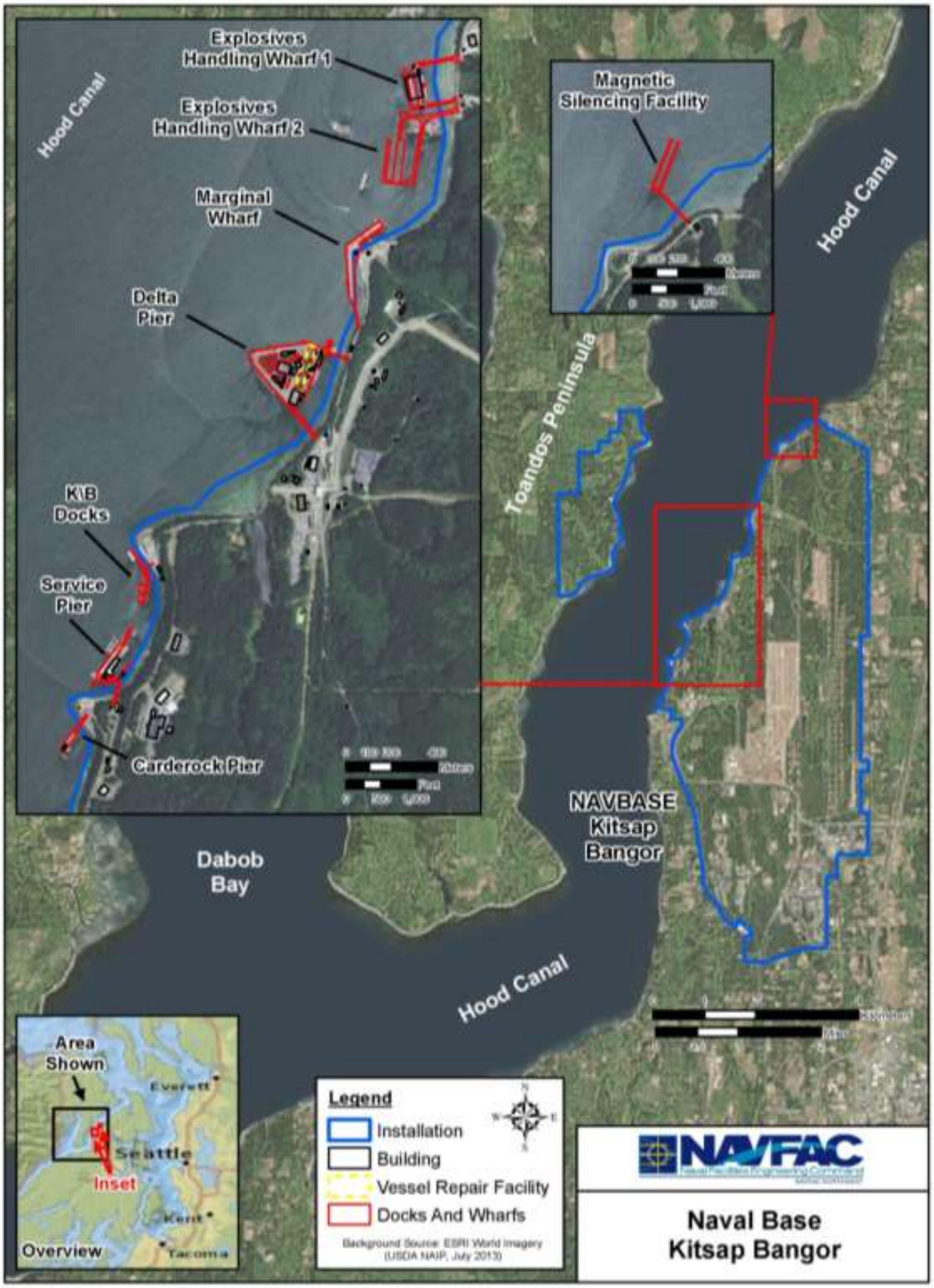

Figure 1-2. Naval Base Kitsap Bangor Showing the Different Facilities Including Marginal Wharf, With Pile Driving in 2025-2026.

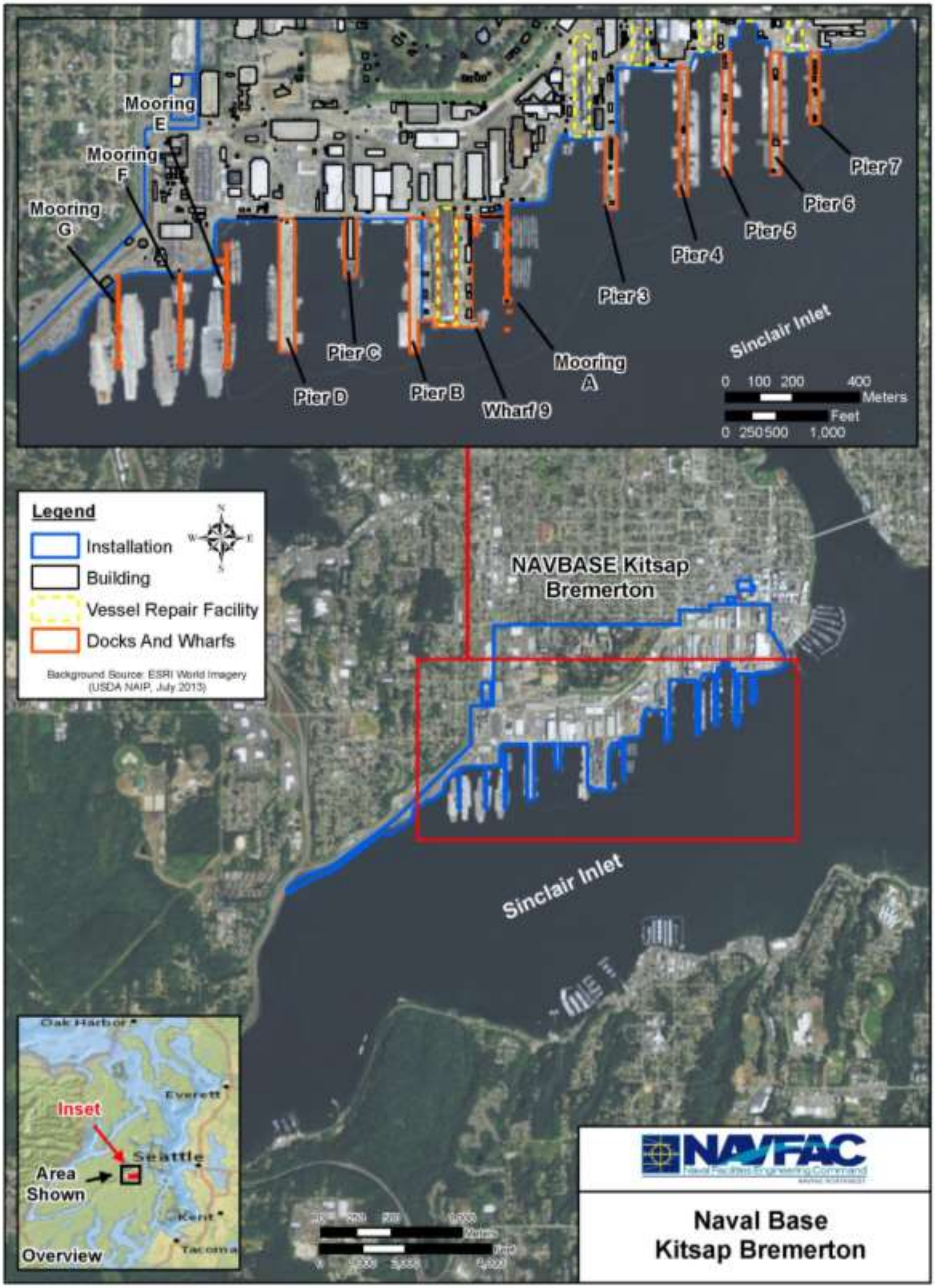

Figure 1-3. Naval Base Kitsap Bremerton Showing the Different Pier and Mooring Locations

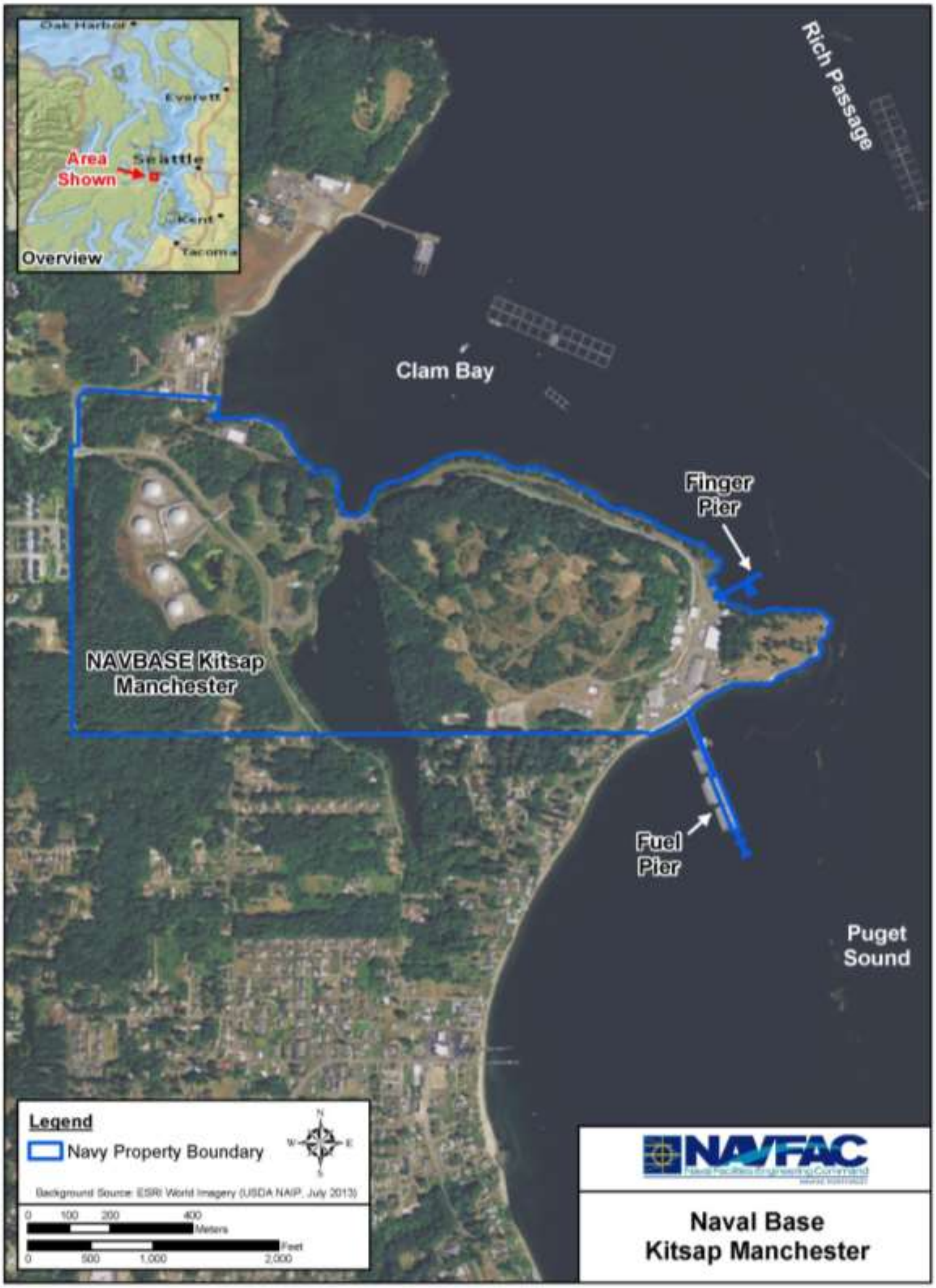

Figure 1-4. Naval Base Kitsap Manchester Showing the Location of the Fuel Pier

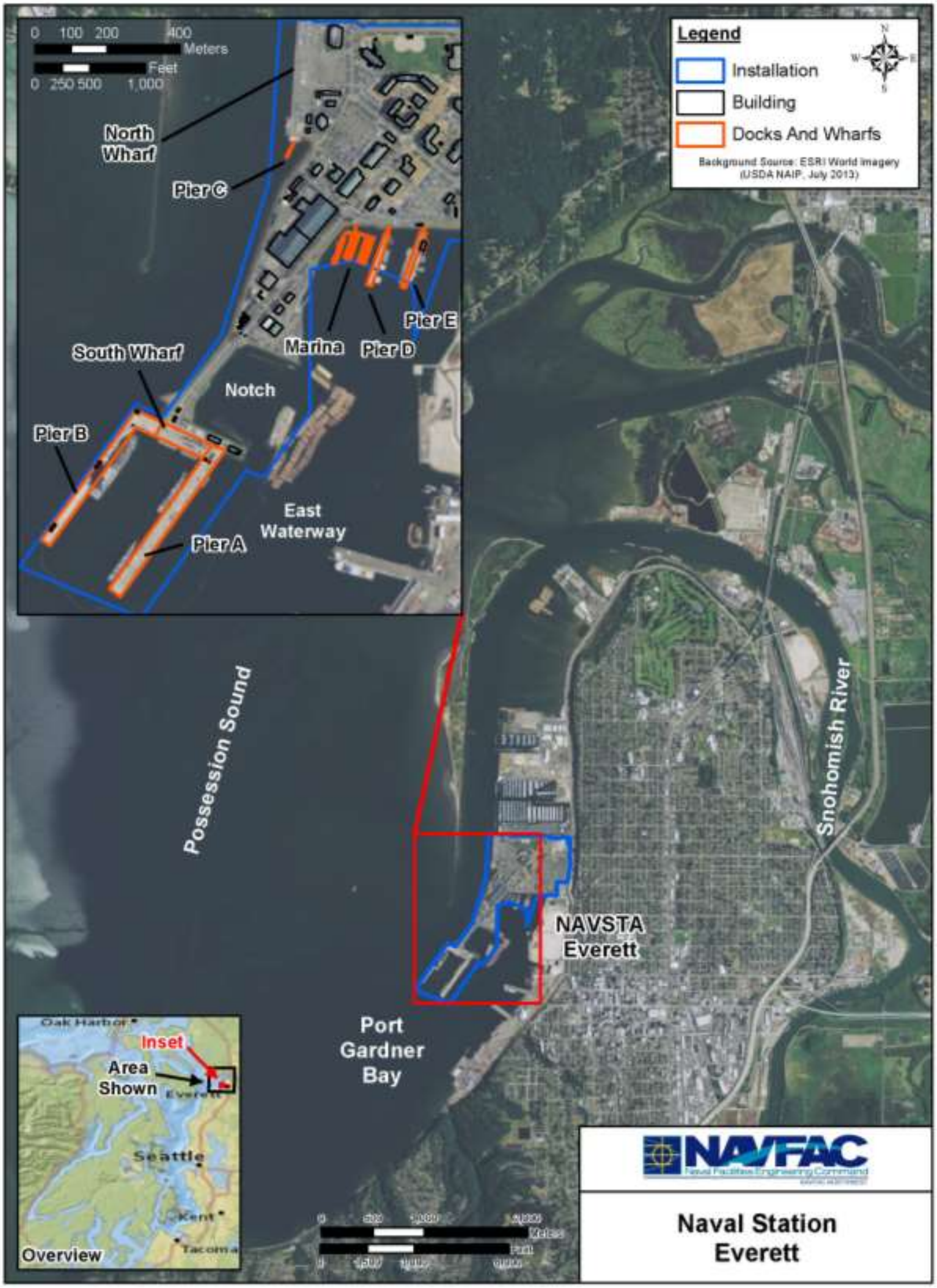

Figure 1-5. Naval Station Everett Showing the Locations of the Different Pier Locations

2 DATES, DURATION, AND LOCATION OF ACTIVITIES

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

2.1 Dates and Duration of Activities

No in-water work would begin at the installations until the Navy has received all required permits and approvals. Navy would like final text of IHA by March 2024 to support contracts solicitations, with the first IHA effective dates from July 1, 2024 to June 30, 2025 and the second IHA effective from July 1, 2025 to June 30, 2026.

Timing restrictions (or "in-water work windows") would be complied with to avoid conducting activities when juvenile salmonids are most likely to be present. The timing restrictions are typically imposed by the United States Army Corps of Engineers, USFWS, and NMFS to protect ESA-listed salmonid species:

- NAVBASE Kitsap Bangor (waterfront): July 16–January 15[1];
- NAVBASE Kitsap Bremerton, NAVBASE Kitsap Manchester, and NAVSTA Everett: July 16–February 15.

2.2 Geographic Region of Activities

The installations in the MPR Program are located in Puget Sound, Washington State (Figure 1-1). As defined in this document, Puget Sound includes the marine waters connecting to the Strait of Juan de Fuca through Admiralty Inlet and Deception Pass. Puget Sound is part of a larger series of glacially scoured channels that include the Strait of Juan de Fuca and Strait of Georgia in Canada. Puget Sound, along with the waters surrounding the San Juan Islands and those in the Strait of Juan de Fuca, comprise the marine inland waters of Washington State.

2.3 Project Location Descriptions by Installation

Existing environmental conditions are described for each installation in the following sections. Only one installation, NAVBASE Kitsap Bangor, has measurements for ambient sound level. Ambient sound at Navy installations is related to vessel activity; therefore, ambient sound levels at other installations with high vessel activity, such as NAVBASE Kitsap Bremerton, may be similar to those measured at NAVBASE Kitsap Bangor.

2.3.1 Naval Base Kitsap Bangor

NAVBASE Kitsap Bangor is located north of the community of Silverdale in Kitsap County on the Hood Canal. The proposed project areas along the Bangor waterfront are located within this region (Figure 1-2). NAVBASE Kitsap Bangor is the Pacific homeport for the Navy's TRIDENT submarine fleet with the mission to support and maintain a TRIDENT submarine squadron and other ships home-ported or moored at the installation and to maintain and operate administrative and personnel support facilities including security, berthing, messing, and recreational services. NAVBASE Kitsap Bangor is the only naval installation on the west coast with the specialized infrastructure able to support the TRIDENT program. The specialized infrastructure includes buildings, utilities, and systems used to support missile production shops, missile maintenance, missile component storage, and missile handling cranes, in

[1] The window required by the U.S. Army Corps of Engineers ends March 1, but the Navy observes an end date of January 15 to be protective of ESA-listed Hood Canal summer-run chum juvenile outmigrants.

addition to providing security and operational port facilities. There are eight pile-supported structures at NAVBASE Kitsap Bangor.

2.3.1.1 Marine and Bathymetric Setting

NAVBASE Kitsap Bangor is located on the Hood Canal, a long, narrow, fjord-like basin of western Puget Sound. Oriented northeast to southwest, the portion of the canal from Admiralty Inlet to a large bend, called the Great Bend, at Skokomish, Washington, is 52 miles (mi) long. East of the Great Bend, the canal extends an additional 15 mi to Belfair. Throughout its 67-mi length, the width of the canal varies from 1 to 2 mi and exhibits strong depth/elevation gradients.

Hood Canal is characterized by relatively steep sides and irregular seafloor topography. In northern Hood Canal, water depths in the center of the waterway near Admiralty Inlet vary between 300 and 420 ft. As the canal extends southwestward toward the Olympic Mountain Range and Thorndyke Bay, water depth decreases to approximately 160 ft over a moraine deposit. This deposit forms a sill across the canal in the vicinity of Thorndyke Bay, which limits seawater exchange with the rest of Puget Sound. The Bangor waterfront on NAVBASE Kitsap occupies approximately 5 mi of the shoreline within northern Hood Canal (1.7 percent of the entire Hood Canal coastline) and lies just south of the sill feature.

2.3.1.2 Tides, Circulation, and Currents

The tides in Hood Canal are mixed semidiurnal, with one flood and one ebb tidal event with a small to moderate range (1 to 6 ft) and a second flood and second ebb with a larger range (8 to 16 ft) during a 24-hour and 50-minute tidal day (URS and SAIC, 1994; Morris et al., 2008). Hood Canal is subject to one major flushing event per tide day when approximately 1.1326×10^9 cubic yards (or 3 percent of the total canal volume) is exchanged over a 6-hour period. Due to the wide range of tidal heights, the actual seawater exchange volume for Hood Canal ranges from 1 percent during a minor tide to 4 percent during a major tide. At NAVBASE Kitsap Bangor, the majority of the daily volume of seawater exchange flows directly across the waterfront area. As a result, the degree of flushing that occurs is relatively high and the characteristics of this seawater more closely track the physical, chemical, and biological conditions of Puget Sound than southern Hood Canal. Seawater that enters the canal from Admiralty Inlet during an incoming flood tide tends to be cooler, more saline, and well-oxygenated relative to the Hood Canal waters. As a result, the incoming water has a tendency to sink to the bottom of the canal as it flows over the sill and move south during each flood tide, while the lower density Hood Canal water tends to remain in the upper water column.

Current flow (speed and direction) along the Bangor waterfront is primarily a function of tidal action based on the phase and range of each tide, and current velocities in the shallower water areas (less than 50 ft) around the project area are variable and complex. The magnitude or instantaneous velocity of these fluctuating water column currents ranges from 0 to 0.88 foot per second (ft/sec) within the 30- to 65-ft water depth interval. However, current flow in any one direction is short-lived and inconsistent in magnitude, with relatively few periods of time when sufficient energy (0.7 ft/sec) exists to exceed the threshold for re-suspending deposits of unconsolidated material on the seafloor (Boggs, 1995). Statistical summaries show that time-averaged net flow is within the 0.07 to 0.10 ft/sec range in the upper water column and less than 0.03 ft/sec in proximity to the seafloor.

The nearshore current observations at NAVBASE Kitsap Bangor piers and wharves in the summer of 2006 suggest that tidal currents were inconsistent with water level (tide) measurements. Rather than the typical relationship where maximum current corresponds to mid-flood or mid-ebb in the water level record, maximum flow velocities recorded along the waterfront aligned with water levels at the high and low tide. Furthermore, the direction of nearshore flow often ran counter to expectations in a normal system, with flood tide coinciding with northeastward currents and ebb tide resulting in southwesterly currents (Morris et al., 2008).

The typically light winds afforded by the surrounding highlands (Olympic and Cascade Mountain Ranges) coupled with the fetch-limited environment of Hood Canal result in relatively calm wind conditions throughout most of the year. However, the northern and middle sections of Hood Canal are oriented in the southwest to northeast direction. Therefore, organized coastal storm events that reach land in the late autumn and winter months, as well as fair weather systems in the spring and summer exhibiting wind speeds in excess of 20 knots, have the capability to generate substantial wind waves due to increased fetch and/or alter normal tidal flow within the basin. However, much of the Bangor waterfront area is afforded some protection by the coastline of both Kitsap and Toandos Peninsulas.

2.3.1.3 Water Quality

The federal Clean Water Act (CWA) requires that all states restore their waters to be “fishable and swimmable.” Section 303(d) of the CWA established a process to identify and clean up polluted waters. Every 2 years, all states are required to perform a water quality assessment of the quality of surface waters in the state, including all the rivers, lakes, and marine waters where data available. The Washington Department of Ecology (WDOE) compiles its own water quality data, and invites other groups to submit water quality data they have collected.

Waters whose beneficial uses—such as for drinking, recreation, aquatic habitat, and industrial use—are impaired by pollutants are placed in the “polluted water” category (Category 5) on the water quality assessment. Categories range from Category 1, waters that meet tested standards for clean waters, to Category 5, waters that fall short of state surface water quality standards and are not expected to improve within the next 2 years. The 303(d) list is comprised of those waters that have been designated as Category 5, impaired. Waters placed on the 303(d) list require the preparation of a water cleanup plan, like a total maximum daily load (TMDL). The TMDL identifies how much pollution needs to be reduced or eliminated to achieve clean water. It identifies the maximum amount of a pollutant to be allowed to be released into a water body so that the beneficial uses of the water are not impaired.

The CWA contains the requirements to set water quality standards for all contaminants in surface waters. The U.S. Environmental Protection Agency (USEPA) is the designated regulatory authority to implement pollution control programs and other requirements of the CWA. However, USEPA has delegated regulatory authority for the CWA to WDOE for the implementation of pollution control programs in Washington State, as well as other CWA requirements.

Washington surface water quality standards contained in Washington Administrative Code (WAC) 173-210A provide the basis for protecting and regulating the quality of surface waters in Washington State. The standards implement portions of the federal CWA by specifying the designated and potential uses of waterbodies in the state. They set water quality criteria to protect those uses and acknowledge limitations. The standards also contain policies to protect high-quality waters (antidegradation) and specify how criteria are to be implemented.

NAVBASE Kitsap Bangor is located within Hood Canal. WAC 173-201A-612 has established designated uses for Hood Canal as follows: extraordinary (aquatic life uses); primary contact (recreation); shellfish harvesting; and wildlife habitat, commerce/navigation, boating, and aesthetics (miscellaneous uses). The current 303(d) list includes two grid segments along the Bangor waterfront impaired by low dissolved oxygen levels. One is adjacent to Marginal Wharf and Delta Pier; the other is to the south of Service Pier

(WDOE, 2017). Waters of Hood Canal immediately south of the proposed project sites and approximately 0.5 mi north of the base boundary are on the current 303(d) list for low dissolved oxygen. No TMDL has been developed by WDOE for this area. Areas of Hood Canal near the base have also been listed as Category 2, waters of concern, for isolated exceedances of bacteria (fecal coliform) and pH.

The Navy has sampled the waters off NAVBASE Kitsap Bangor numerous times for water quality parameters (temperature, salinity, dissolved oxygen, and turbidity) (Hafner and Dolan, 2009; Phillips et al., 2009). This sampling has shown that these waters are consistently within the Washington State standards for extraordinary water quality (i.e., the best possible rating) for each of these parameters (Hafner and Dolan, 2009; Phillips et al., 2009). An exception to these findings was temperature, which typically met extraordinary water quality levels in the winter months and excellent water quality standards in the summer months. Waters south of EHW-1 and further offshore showed similar results with the exception of dissolved oxygen, which typically ranged from excellent to extraordinary.

2.3.1.4 Sediments

The Washington State Sediment Management Standards (SMS) (WAC 173-204) provide the framework for the long-term management of marine sediment quality. The SMS establishes standards for the quality of sediments as the basis for management and reduction of pollutant discharges by providing a management and decision-making process for contaminated sediments.

The marine Sediment Quality Standards (SQS) established by the SMS define the lower limit of sediment quality expected to cause no adverse impacts to biological resources. The SMS Cleanup Screening Levels (CSL) represents cleanup thresholds. Concentrations between the SQS and CSL values require further investigation to determine whether actual adverse impacts exist at the site due to contaminated sediments.

Washington State’s Water Quality Assessment and 303(d) list includes an assessment of sediments in the state’s waterbodies. The USEPA approved the current assessment and 303(d) list in July 2016 (WDOE, 2016). Assessed sediments are classified into seven categories:

- Category 5 – Polluted sediments / 303(d) list
- Category 4C – Sediments impaired by a non-pollutant
- Category 4B – Sediments that have a pollution control plan
- Category 4A – Sediments that have a TMDL
- Category 3 – Insufficient data
- Category 2 – Sediments of concern
- Category 1 – Sediments that meet tested standards

Sediment found along the eastern shore of Hood Canal is primarily from natural erosion of bluffs (by wind or wave action). No rivers or large watersheds feed into Hood Canal along the east shore; however, numerous small drainages along the waterfront do feed Hood Canal, contributing to a secondary source of sedimentation. Existing marine sediments at the proposed project sites are composed of gravelly sands with some cobbles in the intertidal zone, transitioning to silty sands in the subtidal zone (Hammermeister and Hafner, 2009). The presence of glacial till approximately 6 ft below mud line in the intertidal zone, increasing to over 10 ft in the subtidal zone was found in subsurface coring studies performed in 1994 (URS, 1994).

NAVBASE Kitsap Bangor sediment composition varies by location along the waterfront. Sediments at the EHW-2 site consist of fine sands and silt/clay with little hydrogen sulfide odor. Sediments north of EHW-1 and at K/B Dock contain medium sand and organic matter with a slight hydrogen sulfide odor. The sediments at the Cattail Lake delta and at Floral Point are a mix of cobble, sand, and silt/clay. Other sites sampled along the waterfront (at the Magnetic Silencing Facility, Delta Pier, Devil's Hole Delta, and Service Pier) are a mix of fine and medium sands and silt/clay.

NAVBASE Kitsap Bangor has been listed twice on the CERCLA National Priorities List for investigation and, if necessary, cleanup of past waste disposal sites. In January 1990, the Navy and the USEPA entered into a Federal Facilities Agreement to ensure that environmental impacts associated with past practices at the base are investigated and remedial actions are completed as needed to protect human health and the environment. As of 2005, all required actions have been completed. WDOE concurred that there was no increasing trend of contaminants of concern and additional sampling was not needed (Madakor, 2005). Results from a 2007 base-wide sediment investigation confirm that, with a few exceptions, sediment quality at NAVBASE Kitsap Bangor is within SQS standards (Hammermeister and Hafner, 2009). None of the subsurface samples collected exceeded the numeric criteria. No marine sediments at or near the Bangor waterfront are currently assessed by WDOE or included on the 303(d) list (WDOE, 2017).

2.3.1.5 Ambient Sound

2.3.1.5.1 <u>Underwater Sound, Including Other Installations</u>

Underwater ambient sound in Puget Sound is comprised of sounds produced by a number of natural and anthropogenic sources and varies both geographically and temporally. Natural sound sources include wind, waves, precipitation, and biological sources such as shrimp, fish, and cetaceans. These sources produce sound in a wide variety of frequency ranges (Urick, 1983; Richardson et al., 1995) and can vary over both long (days to years) and short (seconds to hours) time scales. In shallow waters, precipitation may contribute up to 35 decibels (dB) to the existing sound level, and increases in wind speed of 5 to 10 knots can cause a 5 dB increase in ambient ocean sound between 20 hertz (Hz) and 100 kilohertz (kHz) (Urick, 1983).

Human-generated sound is a significant contributor to the ambient acoustic environment at the MPR Program installations (Table 2-1). Normal port activities include vessel traffic from large ships, support vessels and security boats, and loading and maintenance operations, which all generate underwater sound (Urick 1983). Other sources of human-generated underwater sound not specific to the naval installations include sounds from echo sounders on commercial and recreational vessels, industrial ship noise, and noise from recreational boat engines. Ship and small boat noise comes from propellers and other on-board rotating equipment.

Table 2-1. Activity Levels in and near Installations and Noise Sources

Installation	*Relative Vessel Activity Level*	*Noise Sources*
NAVBASE Kitsap Bangor	High	Naval ships, Coast Guard vessels, small boats
NAVBASE Kitsap Bremerton	Very high	Shipyard, high traffic and homeport for large ships, small boats, ferry lane nearby
NAVBASE Kitsap Manchester	Medium	Fuel barges, tugboats, small boats, ferry lanes nearby
NAVSTA Everett	Very high	Homeport for naval ships, Coast Guard vessels, commercial shipping traffic to and from Port of Everett, small boats

The underwater acoustic environment at each installation will vary depending on the amount of anthropogenic activity, weather conditions, and tidal currents. In high-use installations, such as NAVBASE Kitsap Bremerton, anthropogenic noise may dominate the ambient soundscape. In areas with less anthropogenic activity, ambient sound is likely to be dominated by sound from natural sources.

Underwater ambient sound has been recorded and measured at NAVBASE Kitsap Bangor near Marginal Wharf. The major contributors to the average background noise between 100 Hz and 20 kHz were wind-driven wave action and manmade noise sources from small boat traffic and industrial noise emanating from the waterfront work areas (Slater, 2009). The average broadband (100 Hz–20 kHz) sound level was 114 dB referenced at 1 micropascal (re 1 µPa) root mean square (RMS). Peak spectral noise from industrial activity was noted below 300 Hz, with a maximum level of 110 dB RMS in the 125 Hz band. From 300 Hz to 5 kHz, average received levels ranged between 83 and 99 dB RMS, although small powerboats generated peak narrowband source levels of 150 to 165 dB in the 350 to 1,200 Hz region. Wind-driven wave sound dominated the background sound at 5 kHz and above. In general, ambient noise one-third octave levels flattened above 10 kHz. Precipitation was not noted during this study, but would be expected to increase average broadband noise levels as much as 20 dB above average levels noted in deeper water.

Similar sound levels were recorded near the EHW-1 during the Test Pile Program at NAVBASE Kitsap Bangor in 2011. Average sound levels ranged from 112.4 dB RMS at mid-depth to 114.3 dB RMS at deep depth (Illingworth & Rodkin, 2012). These measurements were made during normal port activities, but did not include noise from construction and pile driving projects. Small-scale geographic variations in ambient sound are to be expected based on land shadowing and other environmental factors, but for analysis purposes, the average sound level at this installation was assumed to be 114 dB RMS.

Ambient sound measurements from NAVBASE Kitsap Bangor are well within the range of levels reported for a number of sites within the greater Puget Sound region (95–135 dB RMS) (Carlson et al., 2005; Veirs & Veirs, 2005). Nearshore broadband measurements near ferry terminals in Puget Sound resulted in median sound levels (50 percent cumulative distribution function) between 107 and 133 dB RMS (Laughlin, 2015). While ambient sound levels at other MPR Program installations are likely to differ from the NAVBASE Kitsap Bangor measurements due to differences in anthropogenic activities and environmental factors, it is reasonable to assume that average ambient sound at quiet locations, such as Zelatched Point, will be below the 114 dB RMS levels measured at NAVBASE Kitsap Bangor, and that at louder locations ambient sound levels will be similar to the Navy's measurements during the Test Pile Program near EHW-1 at NAVBASE Kitsap Bangor (~114 dB RMS). Under normal weather and traffic conditions, ambient sound at all installations is assumed to be below 120 dB RMS.

2.3.1.5.2 Airborne Sound

Airborne sound at the installations is produced by common industrial equipment, including trucks, cranes, compressors, generators, pumps, and other equipment that might typically be employed along industrial waterfronts; and airborne sound is produced by other sounds such as sea lions present at some of the installations. Sound levels are highly variable based on the types and operational states of equipment at the recording location, and sound levels may even vary within a single installation, with some piers/wharfs very loud and others relatively quiet. Data from airborne ambient sound measurements are currently only available for a short period of time at NAVBASE Kitsap Bangor. Since these are the only available data for the MPR Program's project locations, the Navy has used these data to estimate ambient sound levels at a broad scale for all of the project areas.

Airborne sound measurements were taken at Delta Pier within the waterfront industrial area at NAVBASE Kitsap Bangor during a 2-day period in October 2010. During this period, daytime sound levels ranged from 60 A-weighted decibel (dBA)[2] to 104 dBA, with average values of approximately 64 dBA. Evening and nighttime levels ranged from 64 to 96 dBA, with an average level of approximately 64 dBA. Thus, daytime maximum levels were higher than nighttime maximum levels, but average nighttime and daytime levels were similar (Navy, 2010). More recent measurements, taken during the Navy's Test Pile Program located near EHW-1 at NAVBASE Kitsap Bangor, indicated an average airborne ambient sound level of 55 dBA (Illingworth & Rodkin, 2012). Maximum sound levels from the 2010 recordings were produced by a combination of sources including heavy trucks, forklifts, cranes, marine vessels, mechanized tools and equipment, and other sound-generating industrial/military activities. Maximum sound levels were intermittent in nature and not present at all times. Based on the sound levels measured at the highly industrial location at Delta Pier, the Navy estimated that maximum airborne sound levels at pier locations with a high level of industrial activity may reach as high as 104 dBA due to trucks, forklifts, cranes, and other industrial activities. Sound levels will vary by time and location, but average background sound levels are expected to range from approximately 55 dBA (average from Test Pile Program at NAVBASE Kitsap Bangor) to 64 dBA (average levels measured at Delta Pier at NAVBASE Kitsap Bangor) (Navy, 2010; Illingworth & Rodkin, 2012).

2.3.2 Naval Base Kitsap Bremerton

NAVBASE Kitsap Bremerton is located within the city of Bremerton in Kitsap County on the north side of Sinclair Inlet (Figure 1-3). The eastern portion of the base is a fenced, high-security area known as the Controlled Industrial Area. Puget Sound Naval Shipyard and Intermediate Maintenance Facility is the major tenant command of NAVBASE Kitsap Bremerton. NAVBASE Kitsap Bremerton contains multiple dry docks, piers, and wharfs and is capable of overhauling and repairing, constructing, deactivating, and dry-docking all types and sizes of ships. It also serves as the homeport for a nuclear aircraft carrier and other Navy vessels. There are 13 pile-supported structures located at NAVBASE Kitsap Bremerton.

2.3.2.1 Marine and Bathymetric Setting

NAVBASE Kitsap Bremerton is located on the north side of Sinclair Inlet. Sinclair Inlet is located off the main basin of Puget Sound and is about 4.3 mi long and 1.2 mi wide (Noble et al., 2013). The inlet is

[2] A-weighted sound (dBA) is measured using a filter that de-emphasizes the low and high frequency components of the sound in a manner similar to the frequency response of the human ear. A-weighted sound measurements correlate well with subjective human reactions to noise.

connected to the main basin through Port Orchard Narrows and Rich Passage. Another relatively narrow waterway, Port Washington Narrows, connects Sinclair Inlet to Dyes Inlet. NAVBASE Kitsap Bremerton contains multiple dry docks, piers, and wharfs. In-water structures, shoreline fill, and erosion protection at NAVBASE Kitsap Bremerton have resulted in a shoreline geometry and character that is quite different from undisturbed shorelines in Puget Sound. Bathymetry near existing piers and in turning basins immediately offshore has been altered by significant dredging to accommodate aircraft carriers and other Navy vessels. Water depths range from 40 to 45 ft, increasing to 45 to 50 ft in dredged berthing areas. West of the project sites, further into the inlet, depths gradually decrease to less than 30 ft.

2.3.2.2 Tides, Circulation, and Currents

Though the bathymetry and relative isolation of Sinclair Inlet affect tidal flows in the inlet, the semidiurnal tidal regime in Sinclair Inlet is similar to the pattern discussed for NAVBASE Kitsap Bangor. Tidal currents and winds are the primary sources of water circulation and transport in Sinclair Inlet. Weak tide currents move water in and out of the inlet with a maximum velocity of 0.2 to 0.3 knots (URS & SAIC, 1999). Analysis of tidal currents in 1994 indicated residual current speeds of less than 4 inches per second (in/sec) for more than 90 percent of the time, regardless of site location, water depth, or season. Residual current speeds higher than 4 in/sec were rare, and speeds higher than 8 in/sec occurred less than 0.5 percent of the time.

Tide dynamics in the inlet result in a predominantly clockwise gyre in the inlet, which has the effect of redepositing suspended sediments back in the inlet. This effect and the generally weak nature of these currents make the inlet more depositional than erosional for both mud (silt and clay) and sand-sized particles (Gartner et al., 1998; URS and SAIC, 1999).

2.3.2.3 Water Quality

The project sites are located within Sinclair Inlet, a poorly flushing estuary with freshwater input from Gorst, Blackjack, Ross, Anderson, Sacco, and Karcher Creeks. WAC 173-201A-612 has established designated uses for Sinclair Inlet as follows: excellent (aquatic life uses); primary contact (recreation); and wildlife habitat, harvesting, commerce/navigation, boating, and aesthetics (miscellaneous uses). Sinclair Inlet is closed to shellfish harvest due to pollutant levels.

Waters in the western portions of the waterfront area (covering Moorings E, F, and G) are classified as Category 2 for fecal coliform. One grid covering the area between Mooring A and Pier 5 is classified as Category 4B (waters that have a pollution control plan) for polychlorinated biphenyls (PCBs) in tissue (Lizon, 2015 personal communication). There are also Category 5 listings within Sinclair Inlet outside of the immediate Bremerton waterfront area for PCBs and mercury in tissues. Waters between Mooring E and Mooring A, and from Pier 6 eastward are located in grids that are not classified in any category for water quality. Several areas within Sinclair Inlet outside of the immediate Bremerton waterfront area are classified as Category 5 for fecal coliform and dissolved oxygen and Category 2 for temperature. Multiple creeks emptying into the southern and western reaches of Sinclair Inlet are classified at Category 5 and Category 2 for multiple contaminants. Turbidity within Sinclair Inlet generally meets the state of Washington standards for marine waters (Gartner et al., 1998).

Sinclair Inlet experiences isolated events of low dissolved oxygen associated with elevated nutrient concentrations and phytoplankton blooms (URS and SAIC, 1999). For at least one nearby grid, WDOE concluded that "these excursions could be attributed to natural conditions (i.e., this location is subject to intrusions of upwelled, low DO water), but may also be exacerbated by human activity" (WDOE, 2017). Water quality has been detrimentally affected by runoff and sediment contamination from the surrounding watersheds, including such land uses as forest land, highways, urban development, commercial development, and industrial development.

2.3.2.4 Sediments

The waterfront area at Bremerton has been significantly altered by artificial fill deposits and facility development. These fill deposits overlie beach and estuarine soils at varying depths. Sinclair Inlet exhibits a weak estuarine flushing, clockwise current pattern, and sediment deposition along the northern shoreline (URS and SAIC, 1999). Weak tide currents move water in and out of the inlet with a maximum velocity of 0.2 to 0.3 knots (URS and SAIC, 1999). This effect and the generally weak nature of these currents make the inlet more depositional than erosional for both mud (silt and clay) and sand-sized particles. Currents are generally not capable of re-suspending bottom sediments. Existing sedimentation rates are 0.2 to 0.8 in (0.5 to 2 cm) per year (URS and SAIC, 1999).

Sediment contamination within Sinclair Inlet, including the project areas, has been well documented and includes a variety of metals and organic chemicals originating from human sources (USEPA, 2000). The marine sediments have been affected by past shipyard operations, leaching from creosote-treated piles, and other activities in Sinclair Inlet. A 2000 CERCLA Record of Decision (ROD) for Operable Unit B Marine documents the Navy's decision to cleanup sediment contamination by a combination of sediment removal and disposal in a Confined Aquatic Disposal site located on Navy property, sediment capping, and natural attenuation. The ROD was developed in cooperation with the USEPA and WDOE. The active cleanup actions are complete and monitoring of the site is ongoing (USEPA, 2000). Sediments at the project sites and adjacent to the piers at Bremerton are classified by WDOE as Category 4B (sediments that have a pollution control plan) for various metals, polycyclic aromatic hydrocarbons, PCBs, and other semivolatile organic compounds (SVOCs) (WDOE, 2017).

2.3.2.5 Ambient Sound

NAVBASE Kitsap Bremerton is located in an urban setting with marine industrial uses characterized by noise from truck and automobile traffic; marine vessel traffic; ship-loading cranes; diesel-powered equipment; railroad traffic; continuously operating transmission lines for steam, water, and fuel; and compressors. The primary concentration of these types of noise sources is along the shore. Noise is also generated by commercial vehicles (e.g., tugs, barges, and fishing vessels), ferry traffic, and recreational vessels operating on Sinclair Inlet. Other sources of noise include air traffic, wind, and surf. Depending on the noise-generating activities and distance from those activities, industrial shipyard noise is typically between 60 and 90 dBA. The piers are located on the industrial shore of the base and generate noise during maintenance periods. At these times, noise is generated by the use of skiffs and small vessels, occasional use of tugs, transfer of equipment to and from the pier, and motor vehicle traffic to and from the piers.

2.3.3 Naval Base Kitsap Manchester

NAVBASE Kitsap Manchester is located on Orchard Point, in the village of Manchester, in southern Kitsap County, approximately 4 mi due east of Bremerton (Figure 1-5). The installation is bounded by rural-residential lands to the west, Clam Bay to the northwest, Rich Passage to the northeast, Puget Sound to the east, and residential property and the village of Manchester to the south. NAVBASE Kitsap Manchester provides bulk fuel and lubricant support to area Navy afloat and shore activities. There are two piers located at the installation: the Fuel Pier, which provides for offload of bulk fuel from tanker ship, and the Finger Pier, which is utilized for mooring of barges and small boats.

2.3.3.1 Marine and Bathymetric Setting

NAVBASE Kitsap Manchester is located on the west shore of the main basin of Puget Sound. The Finger Pier is located on the north side of Orchard Point and the Fuel Pier is located in a small embayment open on the south side of Orchard Point. In Clam Bay, the bathymetry is gently sloping with depths in the outer portions of the bay of approximately 18 ft below mean lower low water (MLLW). Depths off Orchard Point drop off dramatically to 60 ft below MLLW approximately 500 ft from shore and 300 ft below MLLW 1 mi offshore. Rich Passage is a shallow sill, less than 70 ft deep. Its waters are biologically productive due to this shallow depth and the tidal constriction provided by the narrow passage between Bainbridge Island and Orchard Point/Point Glover. The obstruction to tidal flows caused by the sill causes localized upwelling and enhanced vertical flux of nutrients, which results in elevated primary production (Kruckeberg, 1991). The marine waters along the shorelines of the East Kitsap basin also provide a physical transition zone between the warmer, less saline waters of the shallow shelves, bays, and channels of the peninsula to the cool, dense saline ocean waters of Puget Sound’s main basin (Williams et al., 1975). The shoreline near the fuel pier consists of sand and cobble beach with stable sediments and riprap structures. The water depth at the waterward end of the fuel pier is approximately 60 ft.

2.3.3.2 Tides, Circulation, and Current

Tides in the area are characterized as mixed semidiurnal with two high and low tides per lunar day. Statistics for a 12-year-long tidal elevation records from the National Oceanic and Atmospheric Administration (NOAA) long-term monitoring station indicates that the average high tide in the area is about 12 ft above MLLW. The highest daily high tide may reach 15 ft above MLLW, while the lowest daily low tide may reach 4 ft below MLLW. The highest tides and greatest tidal ranges in the annual cycle usually occur in winter months (Osborne and MacDonald, 2005).

Rich Passage is characterized by swift, strong tidal currents. Flood currents are directed to the north-northwest, and ebb currents are directed to the south-southeast. In Clam Bay, currents are oriented parallel to shore but undergo as many as four reversals of direction during a single tidal cycle. Net current drift in the vicinity of Orchard Point is oriented to the east-southeast, with an estimated velocity of 0.1 ft/sec. In the deeper waters of Rich Passage, net drift is flood dominant (i.e., toward the northwest). The maximum retention time for waters in the furthest interior regions of Clam Bay is approximately 6 hours.

2.3.3.3 Water Quality

Beaver Creek runs along the northern boundary of NAVBASE Kitsap Manchester. Little Clam Bay (a tidal lagoon) covers 17 acres in the west central portion of the installation. Little Clam Bay is connected to Clam Bay, thence Rich Passage, through a culvert. WAC 173-201A-612 has established designated uses for Clam Bay and adjoining waters of Puget Sound as follows: extraordinary (aquatic life uses); primary contact (recreation); shellfish harvesting; and wildlife habitat, commerce and navigation, boating, and aesthetics (miscellaneous uses). Areas to the east and northeast of Manchester are classified as Category 2 for pH, dissolved oxygen, and fecal coliform (WDOE, 2017). Areas south of Manchester are classified as Category 5 for dissolved oxygen. Duncan Creek, which empties into Puget Sound south of Manchester, is classified as Category 5 for fecal coliform and dissolved oxygen.

Before, during, and after the replacement of the large fuel pier in 1992–1993, NMFS monitored water quality. Water quality parameters near the construction site were unexceptional and fell within the expected norms for this part of Puget Sound (Navy, 2015a).

2.3.3.4 Sediments

The shoreline at Manchester varies from rocky points to gravelly sand and mud. The two grids encompassing the fuel pier site are listed as Category 1 (sediments that meet tested standards) for sediments. In the late-1950s to early-1960s, the on-base landfill was covered to minimize potential contact with landfill waste. Further investigation into site contamination was formally conducted in 1987. Based on the findings, the Manchester site was listed on the CERCLA National Priorities List in 1994 and the ROD was signed in 1997. The southeastern edge of the landfill was exposed along the Clam Bay shoreline (north of the project site), and landfill waste materials had eroded into the adjacent intertidal area. The selected cleanup remedy included a landfill cap and shoreline protection system, a sediment cap in the intertidal area, and removal of contaminated soil and structures in the former fire training area (U.S. Army Corps of Engineers, 2014).

2.3.3.5 Ambient Sound

Although Manchester is somewhat isolated and does not have the level of industrial activity of Bremerton or Bangor, it is visited by fuel barges and tugboats and there are associated fueling operations. The installation also experiences vehicular and small boat traffic. It is also close to the Seattle to Bremerton ferry lanes. As a result, the main sound sources are periodic. Average sound levels are expected to be in the 55–65 dBA range.

2.3.4 Naval Station Everett

NAVSTA Everett is located in the city of Everett in Snohomish County (Figure 1-7). The station provides homeport ship berthing, industrial support, and a Navy administrative center. The station is bordered to the north by the Port of Everett Marina and to the south by the Port of Everett shipping terminals and former Kimberly-Clark Paper Mill. The NAVSTA Everett installation contains five piers (A, B, C, D, and E), two wharfs (North and South), a recreational marina, and a small boat launch.

2.3.4.1 Marine and Bathymetric Setting

NAVSTA Everett is located in Port Gardner Bay in Puget Sound’s Whidbey Basin. Within Port Gardiner Bay, the East Waterway lies between the NAVSTA Everett and industrial properties to the east and south. To the west of the installation is the channelized mouth of the Snohomish River bounded by Jetty Island. The island, composed of sediment from maintenance dredging, acts as a breakwater for the northwest area along the installation’s waterfront because it separates Port Gardner Bay and Possession Sound from the Snohomish River channel. The mouth of the Snohomish River channel is a historically industrialized area of highly modified shorelines and dredged waterways that forms a protected harbor within Port Gardner Bay. The Snohomish River system empties into Port Gardner Bay. East of Jetty Island lies the Snohomish River estuary, consisting of a series of interconnected sloughs that flow through the lowlands east and north of the river’s main channel. These waterways can experience tidal influence as far as 20 mi upstream (SAIC, 2009). Water depths in Possession Sound range from about 30 ft near the industrialized shoreline in Port Gardner to 600 ft in mid-channel. The entire shoreline of the station is riprap.

2.3.4.2 Tides, Circulation, and Currents

Significant flow from the Snohomish River adjacent to the installation creates strong surface currents and acts as a persistent counter to tidal currents and flows within Port Gardner Bay (Navy, 2016a).

2.3.4.3 Water Quality

WDOE has established designated uses for Everett Harbor as follows: good (aquatic life uses); secondary contact (recreation); shellfish harvesting; and wildlife habitat, commerce/navigation, boating, and aesthetics (miscellaneous uses) (WAC 173-201A-612). WDOE classifies the waters surrounding NAVSTA Everett as Category 2 for fecal coliform and dissolved oxygen (WDOE, 2017). Water quality and sediments of East Waterway have historically been of concern primarily due to industrial discharges. Stormwater runoff from NAVSTA Everett enters into the base-wide drainage system that collects into four oil-water separators before discharging into the Snohomish River.

2.3.4.4 Sediments

Marine sediments in the nearshore areas surrounding NAVSTA Everett are characterized as unconsolidated silt and clay, with hard sandy bottom. There is also a substantial accumulation of woody debris in the East Waterway from historic operations of an old Kimberly-Clark facility and other historical industrial activities. The sediments in the waterways surrounding NAVSTA Everett have been polluted from historical industrial discharge; the nearshore environment is made up of shallow waters which were classified as polluted waters by WDOE. Areas in the inner Everett Harbor are classified as Category 5 (polluted sediments) and Category 2 (sediments of concern) for sediment bioassay (WDOE, 2017). Sediments south of Pier C and at the marina are classified as Category 2 for benzoic acid.

Sediments from north Possession Sound near Everett have historically had high contamination levels. Many chemical contaminants (such as arsenic, copper, mercury, cadmium, lead, benzoic acid, 2-methylphenol, and others), which are known to be biologically harmful, are present in this region. Sediments in Port Gardner and the East Waterway are also contaminated. Results from bioassays and other toxicity tests indicated the sediments of the Everett Harbor area contain levels of organic and inorganic chemicals that are toxic to test organisms.

In 2009, a comprehensive sedimentation characterization study was conducted for Port Gardner Bay under the Puget Sound Initiative for Harbors (WDOE, 2009). The study conducted subsurface video probes and surface and subsurface sediment chemistry analyses. The samples were analyzed for ammonia, total sulfides, total organic carbon, total volatile solids, and Washington State SMS chemicals of concern. Following is a summary of the results:

- Substantial woody debris on the surface and subsurface sediments from historical logging operations in the area. This has resulted in oxygen depletion, leading to releases of hydrogen sulfide and methane gas.
- Detection of sedimentary methane bubbles in two sampling locations within the East Waterway.
- Toxicity testing for surface chemistry samples indicated that there were medium to high concentrations of mercury and 4-methylphenol near the alternative projects; however, no samples that exceeded the CSL criteria were directly adjacent to either of the alternative project sites.
- Exceedance of SMS criteria for 4-methylphenol detected in the surface sediments (1–3 ft) in one location.
- The bioassay analysis indicated that the A1-03 sampling (in the East Waterway near the logjam) had a CSL failure and should be considered for cleanup (WDOE, 2009).

The conclusion of the study was:

"…the East Waterway sediments have the highest degree of impact from biological toxicity and chemicals in general…. East Waterway is impacted by concentrations of mercury, zinc, and 4-methylphenol above the Sediment Management Standards. Biological toxicity also exists in specific areas potentially due to organic enrichment from the accumulation of wood waste" (WDOE, 2009). Results from a range of studies complement and support WDOE's decision to focus cleanup and restoration efforts in Port Gardner Bay, specifically the East Waterway. It is expected that WDOE's cleanup efforts in this area would greatly contribute to an overall reduction in the risk of impacts from these contaminants.

2.3.4.5 Ambient Sound

A baseline noise assessment study was conducted in 2010 to support the proposed docking of a sea-based X-band radar vessel at NAVSTA Everett. Time-weighted community noise metrics were collected at 17 locations in Everett. The city has a day-night level of 65 dBA established as the land use recommendation for residential areas. Noise levels measured at NAVSTA Everett indicate that day-to-day activities at the installation are not significant contributors to the surrounding noise environment. The loudest continuous noise source (an exhaust fan on a ship) measured 72 dBA at 125 ft from the source (ManTech, 2010). Residential noise in Everett, east of the base, was recorded between 47 and 51 dBA. Aside from NAVSTA Everett, other contributors to the noise environment surrounding the project area include the Port of Everett, and a major vehicle and railroad transportation corridor along Marine View Drive. The transportation corridor contributes the highest day-night level at 72.7 dBA. The use of heavy equipment commonly occurs sporadically throughout daytime hours given the industrial location of NAVSTA Everett.

3 MARINE MAMMAL SPECIES AND NUMBERS

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

Fourteen marine mammal species and/or stocks managed by NMFS have a reasonable potential to occur within Puget Sound (Table 3-1). A reasonable potential was defined as species with any regular occurrence in Puget Sound since 1995. The likelihood of encountering each of these species is presented qualitatively by installation in Table 3-2. Two of these species have Distinct Population Segments (DPSs) listed under the ESA: the humpback whale and the killer whale. Stock abundance and ESA status of these species is listed in Table 3–1. Section 3.1 provides a description of each of the species and their population abundance. Section 4 contains life history information for each species.

Several dolphin species, including Pacific white-sided dolphins (*Lagenorhynchus obliquidens*), bottlenose dolphin (*Tursiops truncatus*), long-beaked common dolphin (*Delphinus capensis*), and Risso's dolphin (*Grampus griseus*) have been detected in Puget Sound on occasion but are not carried forward in this application. These species are very rare in Puget Sound and are not expected to occur near any of the MPR installations. None of these species is listed under the ESA although they are protected under the MMPA. The Navy is not requesting any incidental take of these dolphin species.

Table 3-1. Marine Mammals Potentially Present in Puget Sound

Species and Stock or DPS	*Stock*	*ESA Status*	*Occurrence in the Project Areas*	*Stock Abundance*[1]	*Potential Biological Removal*	*Annual Mortality or Serious Injury*	*MMPA Stock Status Factors*	*Critical Habitat Within the Project Area*
Humpback whale (*Megaptera novaeangliae*)	Central America/Southern Mexico – California-Oregon-Washington	Endangered	Rare	1,494[2] (CV = 0.167)	2.6	18.4	Strategic / Depleted	No
Humpback whale (*Megaptera novaeangliae*)	Mainland Mexico – California-Oregon-Washington	Threatened	Rare	3,479[2] (CV = 0.099)	32.5	30.7	Strategic / Depleted	No
Humpback whale (*Megaptera novaeangliae*)	Hawai'i Stock	None	Rare	11,278[3] (CV = 0.56)	127	19.6	None	No
Killer whale (*Orcinus orca*)	Eastern North Pacific Southern Resident	Endangered	Rare	74[2] (two calves in June 2023)	0.13	≥0.4	Strategic / Depleted	Yes
Killer whale (*Orcinus orca*)	Eastern North Pacific Transient	None	Rare	349[3]	3.5	0.4	None	No
Minke whale (*Balaenoptera acutorostrata scammoni)*	California, Oregon, Washington	None	Rare	915[2] (CV = 0.792)	4.1	≥0.59	None	No
Gray whale (*Eschrichtius robustus*)	Eastern North Pacific	None	Rare	26,690[2] (CV = 0.05)	801	131	None	No
Harbor porpoise (*Phocoena phocoena vomerina*)	Washington Inland Waters	None	Likely	11,233[2] (CV = 0.37)	66	≥7.2	None	No

Species and Stock or DPS	*Stock*	*ESA Status*	*Occurrence in the Project Areas*	*Stock Abundance[1]*	*Potential Biological Removal*	*Annual Mortality or Serious Injury*	*MMPA Stock Status Factors*	*Critical Habitat Within the Project Area*
Dall's porpoise (*Phocoenoides dalli dalli)*	California, Oregon, Washington	None	Rare	16,498[2] (CV = 0.608)	99	≥0.66	None	No
Steller sea lion (Eumetopias jubatus)	Eastern United States	None	Likely (Rare at NBK Bremerton)	43,201[3]	2,592	112	None	No
California sea lion *(Zalophus californianus)*	United States	None	Likely	257,606[2]	14,011	≥321	None	No
Northern elephant seal *(Mirounga angustirostris)*	California Breeding	None	Rare	187,386[2]	5,122	13.7	None	No
Harbor seal *(Phoca vitulina richardii)*	Washington Northern Inland Waters	None	Likely	11,036[4]	Undetermined	9.8	None	No
	Hood Canal			1,088[4]		3.4		

Notes: CV = coefficient of variation; DPS = Distinct Population Segment
Sources:
1. NMFS marine mammal stock assessment reports at: https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports
2. Carretta et al., 2023
3. Young et al., 2023
4. The most recent abundance estimates for harbor seals in Washington inland waters are based on surveys conducted in 1999. There are no current estimates of abundance for these stocks but the populations are thought to be stable (Carretta et al., 2014).

3.1 Estimates of On-Site Abundance

Estimating potential marine mammal occurrence over time and space can be challenging. Prior Navy marine mammal Incidental Harassment Authorization (IHA) applications in Puget Sound relied on density estimates for some or all species exposure estimates. Analyses based on species density assume that marine mammals are uniformly distributed within a given area at any given point in time. This assumption is rarely true for marine mammal species in Puget Sound because many of the species are not resident, but occasionally or seasonally transient through portions of Puget Sound (Table 3-2). Additionally, most species are not distributed evenly but occur clumped in groups. Distribution of individuals or groups does not occur uniformly in space but is biased by areas of greater importance, such as areas of high prey abundance, haulout sites, or areas with lower predation risk, etc. For example, density estimates near haulouts or foraging location would be expected to be a function of distance from the attracting haulout and number of animals utilizing the haulout or foraging location.

To characterize potential species occurrence, this application utilized density information available for Puget Sound and recent research and survey information conducted on-site or in Puget Sound. The Navy also discussed species occurrence with local species experts and reviewed incidental sighting reports from the Orca Network for verified or reasonably verified species presence, as well as information on seasonal, intermittent, or unusual species occurrences. Based on a review of this information, the Navy separated species into three groups to predict numbers present at potential project sites during the in-water work period:

- Species with rare or infrequent occurrence in all or part of Puget Sound
- Species with routine occurrence, but no site-specific survey information
- Species with site-specific survey information

Table 3-2. Relative Occurrence of Marine Mammals at MPR Program Installations

Species	***NAVBASE Kitsap Bangor (Hood Canal)***	***NAVBASE Kitsap Bremerton (Sinclair Inlet)***	***NAVBASE Kitsap Manchester (Rich Passage/ Main Basin Puget Sound)***	***NAVSTA Everett (Port Gardner Bay/Possession Sound)***
Humpback whale	Rare	Rare	Rare	Rare
Minke whale	Rare	Rare	Rare	Rare
Gray whale	Rare	Rare	Rare	Seasonal
Transient killer Whale	Likely	Rare	Likely	Likely
Southern Resident killer whale	Unlikely	Unlikely	Likely -Seasonal September–April	Likely - Seasonal September–April
Harbor porpoise	Likely	Rare	Rare	Likely
Dall's porpoise	Unlikely	Unlikely	Unlikely	Unlikely
Steller sea lion	Likely -Seasonal Small numbers - haulout on site Sep–May	Rare	Likely- Seasonal Small numbers - haulout nearby Sep– May	Likely –Seasonal Small numbers - haulout nearby Sep–May
California sea lion	Likely - Seasonal Haulout on site August–early June	Likely -Seasonal Haulout on site August–early June	Likely -Seasonal Haulout nearby August–early June	Likely -Seasonal Haulout on site August–early June
Northern elephant seal	Rare	Rare	Rare	Rare
Harbor seal	Likely haulout on site	Likely haulout nearby	Likely haulout nearby	Likely haulout on site

In the case of species with rare or infrequent occurrence in all or part of Puget Sound, the Navy reviewed historical temporal and spatial distribution to predict potential numbers of animals during the in-water work period. For example, in Hood Canal, the presence of humpback whales, gray whales, or Dall's porpoises is considered rare. Therefore, a methodology that assumes at any point in time animals are present or uniformly distributed, either in time or space, would have little chance of predicting actual occurrence. Therefore, for these types of species, a historical temporal and spatial distribution was used to estimate potential occurrence during the in-water work window.

At installations where species have routine occurrence, but no site-specific species surveys, the Navy assumed that individuals are relatively uniformly distributed within the affected area and used densities within the in-water work period from the Navy Marine Species Density Database (NMSDD) (Navy, 2019) to estimate number of individuals potentially present. This database contains density values used in Navy MMPA permit applications for at sea training and testing. Because Navy training and testing takes place in Puget Sound, density values were available for Puget Sound.

Finally, in locations where a reasonable assessment of marine mammal abundance could be determined from on-site surveys, survey numbers and trends were the best predictor of abundance. For example, survey information is available for California sea lions and harbor seals hauled out at or near NAVBASE Kitsap Bangor, Bremerton, Manchester, and NAVSTA Everett. At these locations, estimated abundance of California sea lions and harbor seals used the survey data. Navy survey efforts and density determinations are described in Appendix C for the four installations where they have occurred.

3.2 Species Abundance

3.2.1 Humpback Whale

A large-scale photo-identification sampling study of humpback whales was conducted from 2004 to 2006 throughout the North Pacific (Calambokidis et al., 2008; Barlow et al., 2011). Known as the SPLASH (Structure of Populations, Levels of Abundance, and Status of Humpbacks) Project, the study was designed to sample all known North Pacific feeding and breeding populations. Overall humpback whale abundance in the North Pacific, based on the SPLASH Project, was estimated at 21,808 individuals (coefficient of variation [CV] = 0.04) confirming that this population of humpback whales has continued to increase and is now greater than some pre-whaling abundance estimates (Barlow et al., 2011). Data indicate that the North Pacific population has been increasing at a rate of between 5.5 and 6.0 percent per year, approximately doubling every ten years (Calambokidis et al., 2008).

In 2016, NMFS designated 14 DPSs for humpback whales based on breeding areas (81 FR 62259, September 8, 2016; see Section 4.1.1). Three DPSs occur along the U.S. West Coast: the Central America DPS (listed as endangered under the ESA), the Mexico DPS (listed as threatened under the ESA), and the Hawai'i DPS (unlisted under the ESA). The abundance estimate for the Mexico DPS is 3,479 individuals (CV = 0.099) and the abundance estimate for the Central America DPS is 1,494 individuals (CV = 0.167; Carretta et al., 2023). The abundance estimate for the Hawaii DPS is 11,278 individuals (CV = 0.56; Young et al., 2023).

3.2.2 Minke Whale

The abundance estimate for the California, Oregon, and Washington stock of minke whales is 915 individuals (CV = 0.792) (Carretta et al., 2023). Based on ship surveys conducted in the summer and fall from 1991 to 2008, 147 minke whales (CV = 0.68) are estimated to occur in waters off Washington and Oregon (Barlow, 2010). Two minke whales were seen during 1996 aerial surveys in Washington and British Columbia inland waters (Calambokidis et al., 1997), but no abundance estimates were made.

3.2.3 Gray Whale

The most recent estimate of abundance for the Eastern North Pacific population is from 2010/2011 surveys and is 26,690 (CV = 0.05) whales (Carretta et al., 2023). The eastern population is increasing, despite an unusually large number of gray whales that stranded along the coast from Mexico to Alaska in 1999 and 2000 (Gulland et al., 2005) and from 2019 to 2023 (NMFS, 2023).

The current abundance estimate for the Pacific Coast Feeding Group, described in greater detail in Section 4.3.1, is 209 (standard error = 15.4) (Carretta et al., 2016).

3.2.4 Killer Whale, West Coast Transient Stock

A minimum abundance estimate for the West Coast Transient stock is 349 animals based on photographic data (Young et al., 2023). This estimate is considered conservative because it is derived from a catalogue of West Coast Transient killer whales from the inland waters of British Columbia (Towers et al., 2019), which focuses on whales found in Canadian waters. Estimates of transient killer whale abundance in California has not been updated since the publication of the most recent catalogue in 1997. Therefore, the population estimate of 349 animals is considered a minimum count for this stock (Muto et al., 2021).

3.2.5 Killer Whale, Eastern North Pacific Southern Resident Stock

In 1993, the three pods (J, K, and L pods) comprising this stock totaled 96 killer whales (Ford et al., 1994). The population increased to 99 whales in 1995 and then declined to 79 whales in 2001. The stock abundance is listed as 74 whales (Carretta et al., 2023) and there were two births within L pod in June 2023 that are not included in the abundance estimate (Center for Whale Research, 2023).

3.2.6 Harbor Porpoise

Aerial surveys of the inland marine waters of Washington were conducted throughout the year from 2013 to 2015, and in the Strait of Juan de Fuca and the San Juan Islands (and some adjacent Canadian waters) in April 2015 (Smultea et al., 2015; Jefferson et al., 2016). These surveys encompassed waters inhabited by the Washington Inland Waters stock of harbor porpoise, as well as, harbor porpoises from British Columbia. Estimated abundance for Puget Sound was 2,269 (CV = 0.378) (Smultea et al., 2017). The highest densities were detected in North Puget Sound (Admiralty Inlet, East Whidbey, and South Whidbey sub-regions) and the lowest in the Vashon and Bainbridge sub-regions, and Hood Canal.

3.2.7 Dall's Porpoise

The abundance estimate for the California, Oregon, and Washington stock is 16,498 individuals (CV = 0.61) (Barlow, 2016 as presented in Carretta et al., 2023).

Additional numbers of Dall's porpoise occur in the inland waters of Washington State, but the most recent estimate obtained in 1996 (900 animals; CV = 0.40) (Calambokidis et al., 1997) is not included in the overall estimate of abundance for this stock due to the need for more current information.

3.2.8 Steller Sea Lion

The Eastern stock was estimated by NMFS in the Recovery Plan for the Steller Sea Lion to number between 45,000 to 51,000 animals (NMFS, 2008b). This stock has been increasing approximately 3 percent per year over the entire range since the late 1970s (NMFS, 2012a). The most recent population estimate for the Eastern stock based on more recent data is 43,201 (Young et al., 2023).

3.2.9 California Sea Lion

A complete population count of California sea lions is not possible because all age and sex classes are not ashore at the same time during field surveys. In lieu of counting all sea lions, pups are counted during the breeding season (because this is the only age class that is ashore in its entirety), and the number of births is estimated from the pup count. The size of the population is then estimated from the number of births and the proportion of pups in the population. The current population estimate for the U.S. stock of California sea lions is 257,606 (Carretta et al., 2023).

3.2.10 Northern Elephant Seal

A complete population count of elephant seals is not possible because all age classes are not ashore at the same time. Instead, pups are counted during the breeding season (because this is the only age class that is ashore in its entirety), and the number of births is estimated from the pup count. The size of the population is then estimated from the number of births and the proportion of pups in the population. Based on the estimated 40,684 pups born in California in 2010, the California stock is approximately 187,386 (Carretta et al., 2023). Based on trends in pup counts, northern elephant seal colonies were continuing to grow in California through 2005, but are currently stable or slowly decreasing in Mexico (Stewart et al., 1994 as cited in Carretta et al., 2013).

3.2.11 Harbor Seal

Aerial surveys of harbor seals in Washington inland waters were conducted during the pupping season in 1999; during which time the total numbers of hauled-out seals (including pups) were counted. In 1999, the mean count of harbor seals occurring in Washington's inland waters was 9,550 (CV = 0.14) animals. Using a correction factor to account for animals in the water, which are missed during aerial surveys, Jeffries et al. (2003) reported population estimates of 11,036 (7,213 x 1.53; CV = 0.15) for the Washington Northern Inland Waters stock and 1,088 (711 x 1.53; CV = 0.15) for the Hood Canal stock; of harbor seals (Jeffries et al., 2003). However, because the most recent abundance estimate is greater than 10 years old, there is no current estimate of abundance.

4 AFFECTED SPECIES STATUS AND DISTRIBUTION

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

4.1 Humpback Whale

4.1.1 Status and Management

Prior to 2016, humpback whales were listed under the ESA as an endangered species worldwide. Following a 2015 global status review (Bettridge et al., 2015), NMFS established 14 DPSs with different listing statuses (81 FR 62259, September 8, 2016) pursuant to the ESA. At the time of the DPS designations and listings, the stocks of humpback whales in the Pacific did not align with the newly described DPSs that contained individuals from those stocks. Because MMPA stocks cannot be portioned, i.e., parts managed as ESA-listed while other parts managed as not ESA-listed, NMFS considered the existing humpback whale stocks under the MMPA to be endangered and depleted for MMPA management purposes. The 2022 Stock Assessment Reports (SARs) included revised stock structures for humpback whales in the North Pacific that better align with the ESA-designated DPSs (Carretta et al., 2023; Young et al., 2023). In the 2022 SARs, four stocks of humpback whales are currently recognized along the U.S. West Coast: the Central America/Southern Mexico – California-Oregon-Washington stock, the Mainland Mexico – California-Oregon-Washington stock, the Mexico – North Pacific stock, and the Hawai'i stock (Carretta et al., 2023; Young et al., 2023).

Individuals from the Central America/Southern Mexico – California-Oregon-Washington stock are considered part of the Central America DPS, which is listed as endangered under the ESA. Because the Central America DPS is listed under the ESA, the Central America/Southern Mexico – California-Oregon-Washington stock is considered strategic and depleted under the MMPA. This stock winters between Costa Rica and southern coastal Mexico and spends the summer feeding along the U.S. west coast from California to Washington, including the inland waters of the Salish Sea (Carretta et al., 2023).

The Mexico DPS is listed as threatened under the ESA, and includes individuals from two stocks: the Mainland Mexico – California-Oregon-Washington stock and the Mexico – North Pacific stock. Because the Mexico DPS is listed under the ESA, the Mainland Mexico – California-Oregon-Washington stock and the Mexico – North Pacific stock are considered strategic and depleted under the MMPA. Humpback whales from the Mainland Mexico – California-Oregon-Washington stock winter off the mainland of Mexico and spend the summer along the west coast of the U.S. and Canada, from California to the Bering Sea off Alaska, including the inland waters of the Salish Sea (Carretta et al., 2023). Humpback whales from the Mexico – North Pacific stock winter off mainland Mexico, including the Baja California Peninsula and the Revillagigedo Archipelago, located approximately 285 mi south/southwest of Cabo San Lucas on the southern tip of the Baja California Peninsula, and summer primarily in Alaskan waters. The Mexico – North Pacific stock specifically excludes any humpback whales that migrate from Mexico to California or Oregon. The 2022 SARs note that the Mexico – North Pacific stock likely includes multiple demographically independent populations (DIPs) based on movement data collected and/or analyzed by Martien et al. (2021), Wade (2021), and Wade et al. (2021), but was designated as a single stock due to insufficient data available to delineate DIPs within the stock (Young et al., 2023).

Under the revised stock structure described in the 2022 SARs, the Hawai'i DPS, which is not listed under the ESA, is aligned with the newly described Hawai'i stock (Young et al., 2023). The Hawai'i stock consists of one demographically independent population (DIP) (the Hawai'i - Southeast Alaska /

Northern British Columbia DIP) and one unit (the Hawai'i – North Pacific unit), which may or may not comprise multiple DIPs. Lacking available data to assess them separately, NMFS manage the DIP and unit as a single stock. Individuals from the Hawai'i - Southeast Alaska / Northern British Columbia DIP generally winter off Hawai'i and summer in Southeast Alaska and Northern British Columbia, including a small number of humpbacks that summer in Southern British Columbia and Washington State. Individuals from the Hawai'i – North Pacific unit also winter in Hawai'i, but summer in Russia and Western/Central Alaska from the Bering Sea and Aleutian Islands to the Gulf of Alaska, excluding Southeast Alaska. The Hawai'i stock is not considered strategic or depleted (Young et al., 2023).

Critical habitat for the Central America and Mexico DPSs has been established along the U.S. West Coast and in Alaska (86 FR 21082; April 21, 2021). No critical habitat for humpback whales occurs within the Salish Sea.

Individuals from the Central America/Southern Mexico – California-Oregon-Washington stock, Mainland Mexico – California-Oregon-Washington stock, and Hawai'i stock could occur in the vicinity of Puget Sound Navy installations. Wade et al. (2021) estimated that 6 percent of humpback whales occurring in Washington belong to the Central America DPS, 25 percent belong to the Mexico DPS, and 69 percent belong to the Hawai'i DPS.

4.1.2 Distribution

Humpback whales are distributed worldwide in all major oceans and most seas. They are typically found during the summer on high-latitude feeding grounds and during the winter in the tropics and subtropics around islands, over shallow banks, and along continental coasts where calving occurs (Calambokidis et al., 2008; Barlow et al., 2011). Photo-identification studies suggest that whales feeding in the northwest are part of a small sub-population that primarily feeds from central Washington to southern Vancouver Island (Calambokidis et al., 2004, 2008).

Although humpback whales were common in inland Washington waters prior to the whaling period, few sightings had been reported in this area before 2002 (Scheffer and Slipp, 1948; Calambokidis and Steiger, 1990; Pinnell and Sandilands, 2004). Most sightings occur in the Strait of Juan de Fuca and in the San Juan Island area. In Puget Sound, Calambokidis et al. (2002) recorded only six individuals between 1996 and 2001. However, from January 2003 through July 2012 there were over 60 sightings reported to Orca Network, some of which could be the same individuals. In 2022, the Pacific Whale Watch Association (PWWA) reported observing humpback whales on 274 days, with a total of 396 individual humpback whales identified in the Salish Sea. PWWA also documented 34 mothers with calves in the Salish Sea in 2022, breaking the previous record of 21 mother/calf pairs set in 2021 (PWWA 2023). Puget Sound opportunistic sightings primarily occur April through July, but sightings are reported in every month of the year. A review of reported sightings in Puget Sound indicates humpback whales usually occur as individuals or in pairs (Orca Network, 2015a).

4.1.3 Site-Specific Occurrence

Orca Network received reports of humpback whales in Puget Sound during every month in 2022. Most of the sightings reported to Orca Network since 2003 were in the main basin of Puget Sound with numerous sightings in the waters between Point No Point and Whidbey Island, Possession Sound (Figure 1-1), and southern Puget Sound in the vicinity of Point Defiance. Some of the reported sightings were in the vicinity of NAVSTA Everett and NAVBASE Kitsap Manchester. A few sightings of possible humpback whales were reported by Orca Network in the waters near NAVBASE Kitsap Bremerton and between January 2003 and December 2015 (Orca Network, 2015a). Humpback whales were sighted in the vicinity of Manette Bridge in Bremerton in March and May 2016, and May 2017 (Orca Network, 2017), and a carcass was found under a dock at NAVBASE Kitsap Bremerton in June 2016 (Cascadia Research, 2016), which was reported to the National Marine Fisheries Service and the Marine Mammal Stranding Network.

In Hood Canal where NAVBASE Kitsap Bangor is located, single humpback whales were observed for several weeks in January and February 2012 (Orca Network, 2022) and in 2015 (Orca Network, 2022). Multiple sightings in Hood Canal were reported in June 2019, February through May 2020, and August 2021(Orca Network, 2022). Prior to the 2012 sightings, there were no confirmed reports of humpback whales entering Hood Canal (Orca Network, 2022).

The number of humpback whales potentially present near any of the four naval installations over the time period of the requested authorization is expected to be very low in any month.

4.2 Minke Whale

4.2.1 Status and Management

Minke whales are protected under the MMPA, but they are not designated as depleted or strategic, nor are they listed under the ESA. The Northern minke whale is separated into two distinct subspecies: the Northern Pacific (*B. a. scammoni*) and the Northern Atlantic (*B. a. acutorostrata*). Within U.S. waters, the Northern Pacific subspecies is broken into three management stocks: the Alaskan stock; the California, Oregon, Washington stock; and the Hawaiian stock. Because minke whales from California to Washington appear behaviorally distinct from migratory whales further north and are considered "resident," minke whales in coastal waters of California, Oregon, and Washington (including Washington inland waters) are considered a separate stock (Carretta et al., 2013).

4.2.2 Distribution

As noted above, minke whales appear to establish home ranges in the inland waters of Washington (Dorsey, 1983; Dorsey et al., 1990). Minke whales are reported in the inland waters year-round, although the majority of the records are from March through November (Calambokidis & Baird, 1994). Minke whales are sighted primarily in the San Juan Islands and Strait of Juan de Fuca but are relatively rare in Puget Sound south of Admiralty Inlet (Stern, 2005; Orca Network, 2015a). In the Strait of Juan de Fuca, individuals move within and between specific feeding areas around submarine banks (Stern, 2005). Dorsey et al. (1990) noted minke whales feeding in locations of strong tidal currents. Hoelzel et al. (1989) reported that 80 percent of feeding observations in the San Juan Islands were over submarine slopes of moderate incline at a depth of about 66 ft (20 m) to 328 ft (100 m). Three feeding grounds have been identified in the Strait of Juan de Fuca and San Juan Islands area (Osborne et al., 1988; Hoelzel et al., 1989; Dorsey et al., 1990; Stern, 2005). There is year-to-year variation in the use of these feeding areas, and other feeding areas probably exist (Osborne et al., 1988; Dorsey et al., 1990). A review of Washington inland water sighting data from January 2005 through August 2012 indicates that Minke whales typically occur as lone individuals or in small groups of two or three (Orca Network, 2022).

4.2.3 Site-Specific Occurrence

Sightings of minke whales in Puget Sound, south of Admiralty Inlet (Figure 1-1) are infrequent. Approximately 55 minke whale sightings were recorded with Orca Network between January 2005 and August 2012. The majority of those sightings (41) were in Admiralty Inlet. The 14 records that were in

Puget Sound, but not in the Admiralty Inlet portion, occurred from March through October. The PWWA recorded observations of minke whales in the Salish Sea on 158 days in 2022 (PWWA 2023). No sightings were reported in the vicinity of NAVBASE Kitsap Bremerton or NAVBASE Kitsap Bangor (The Whale Museum, 2023).

Based on the information presented, the number of minke whales potentially present near any of the four naval installations is expected to be very low in any month and even lower in winter months.

4.3 Gray Whale

4.3.1 Status and Management

Two North Pacific populations of gray whales are formally recognized: the Western Pacific subpopulation (also known as the Western North Pacific or the Korean-Okhotsk population) that is critically endangered and shows no apparent signs of recovery, and the Eastern Pacific population (also known as the Eastern North Pacific or the California-Chukchi population) that appears to have recovered from exploitation and was removed from listing under the ESA in 1994 (Carretta et al., 2016). All populations of the gray whale are protected under the MMPA; the Western Pacific subpopulation is listed as endangered under the ESA and the stock is designated as depleted and strategic under the MMPA, but there is no designated critical habitat for this species. The Eastern North Pacific stock is not considered depleted or strategic under the MMPA (Carretta et al., 2023).

Weller et al. (2013) and the NMFS stock assessment (Carretta et al., 2016) report observations of a small number of gray whales feeding in the western Pacific waters and wintering in eastern North Pacific waters. It is uncertain which stock these individuals belong to, and none of them have been observed in Puget Sound; therefore, it is unlikely that any members of the endangered western Pacific stock occur in the vicinity of MPR locations.

A group of a few hundred gray whales known as the Pacific Coast Feeding Group feeds along the Pacific coast between southeastern Alaska and southern California throughout the summer and fall (Calambokidis et al., 2002). This group of whales has generated uncertainty regarding the stock structure of the Eastern North Pacific population (Carretta et al., 2013). Photo-identification, telemetry, and genetic studies suggest that the Pacific Coast Feeding Group may be demographically distinct (Calambokidis et al., 2010; Mate et al., 2010; Frasier et al., 2011). However, the NMFS Task Force on gray whale stock structure (Weller et al., 2013) was not able to provide definitive advice as to whether the Pacific Coast Feeding Group is a separate population stock under MMPA guidelines, and the group has no formal status under the MMPA, International Union for Conservation (of Nature and Natural Resources), or ESA. Currently, the Pacific Coast Feeding Group is not treated as a distinct stock in the NMFS stock assessment reports, but this may change in the future based on new information (Carretta et al., 2013; Weller et al., 2013).

Gray whales began to receive protection from commercial whaling in the 1930s. However, hunting of the western population continued for many more years. The International Whaling Commission (IWC) sets a quota allowing catch of gray whales annually from the eastern population for aboriginal subsistence. In 2012 the IWC approved a 6-year quota (2013–2018) of 744 gray whales, with an annual maximum of 140 whales for native people of Chukotka, Russia and Washington State (Makah Indian Tribe) (IWC, 2015).

Gray whales along the west coast of North America are experiencing an ongoing Unusual Mortality Event (UME), with a total of 682 gray whales reported stranded between Mexico and Alaska since

January 1, 2019. While no definitive cause has been identified, preliminary findings from NMFS' analysis of several stranded gray whales indicate emaciation and malnutrition. Vessel strikes and killer whale predation have also been documented in stranded gray whales analyzed as part of the UME (NMFS 2023).

4.3.2 Distribution

Eastern gray whales are known to migrate along the U.S. west coast on both their northward and southward migrations. This species makes the longest annual migration of any mammal—between 9,321 and 12,427 mi roundtrip (Jefferson et al., 2008; Jones & Swartz, 2009). The migration connects summer arctic feeding grounds with winter mating and calving regions in temperate and subtropical coastal waters. Winter grounds extend from central California south along Baja California, the Gulf of California, and the mainland coast of Mexico. The northward migration to the feeding grounds occurs in two phases. The first phase, in late January through March, consists of newly pregnant females, who go first to maximize feeding time, followed by adult females and males, then juveniles. The second phase, in April through May, consists primarily of mothers and calves that have remained in the breeding area longer allowing calves to strengthen and rapidly increase in size before the northward migration (Herzing & Mate, 1984; Jones & Swartz, 2009). Beginning in the fall, whales start the southward migration from the summer feeding to winter calving areas mainly following the coast to Mexico. The trip averages 2 months. During the southbound migration, peak sightings occur between early December and mid-February off the Oregon coast and in January off the Washington coast (Herzing & Mate, 1984, Rugh et al., 2001). Along the U.S. West Coast, from the border with Mexico to the Aleutian Islands, all waters within 47 km of the coast, including the inland waters of Washington State, have been identified as a Biologically Important Area (BIA) for migrating gray whales (Van Parijs et al., 2015). In addition, the waters of northern Puget Sound, around the south end of Whidbey Island and Camano Island, have been identified as a BIA for feeding gray whales (Calambokidis et al., 2015).

Most of the Eastern North Pacific stock summers in the shallow waters of the northern Bering Sea, Chukchi Sea, and western Beaufort Sea (Rice and Wolman, 1971), but a small proportion (approximately 200 individuals) spend the summer and fall feeding along the Pacific coast from southeastern Alaska to central California (Sumich, 1984; Calambokidis et al., 2002, 2010; Gosho et al., 2011; Carretta et al., 2012). These whales are collectively known as the "Pacific Coast Feeding Group" (Carretta et al., 2016).

The migration routes of the Western North Pacific (WNP) subpopulation of gray whales are poorly known (Weller et al., 2002). Previous sighting data suggested that the remaining population of western gray whales had a limited range extent between the Okhotsk Sea off the coast of Sakhalin Island and the South China Sea (Weller et al., 2002). However, recent long-term studies of radio-tracked whales indicate that the coastal waters of eastern Russia, the Korean Peninsula, and Japan are part of the migratory route (Weller et al., 2012). There is also photographic evidence of a match between a whale found off Sakhalin and the Pacific coast of Japan, more than 932 mi south of the Sakhalin feeding area (Weller et al., 2008). Tagging, photo-identification, and genetic studies show that some whales identified in the WNP off Russia have been observed in the Eastern North Pacific (ENP), including the west coast of Vancouver Island, British Columbia, and Baja California, Mexico (Lang, 2010; Mate et al., 2011; Weller et al., 2012; Urbán et al., 2013; Mate et al., 2015). These studies have recorded a total of 27 gray whales observed in both the WNP and ENP (Carretta et al., 2016). Some whales that feed off Sakhalin Island in summer migrate east across the Pacific to the west coast of North America in winter, while others migrate south to waters off Japan and China (Carretta et al., 2016). Some presumed WNP whales may be ENP whales foraging in areas historically attributed to the WNP subpopulation (Mate et al., 2015). No photo-matches of "Sakhalin" whales have been reported in Puget Sound or other Washington inland waters. Given the small number of whales that have been detected in both the WNP and ENP, and the uncertainty over their assignment to a stock, it is unlikely that an individual of the endangered WNP subpopulation would occur in the vicinity of naval installations in Puget Sound.

4.3.3 Site-Specific Occurrence

As the majority of gray whales migrate past the Strait of Juan de Fuca (Figure 1-1) in route to or from their feeding or breeding grounds, a few of them enter Washington inland waters to feed (Stout et al., 2001). Gray whales are observed in Washington inland waters, including Puget Sound in all months of the year (Calambokidis et al., 2010; Orca Network, 2015a) with peak numbers from March through June (Calambokidis et al., 2010). The PWWA recorded observations of gray whales in the Salish Sea on 200 days in 2022 (PWWA 2023). Fewer than 20 gray whales are documented in the inland waters of Washington and British Columbia each year beginning in January (Orca Network, 2022). Most whales sighted are part of a small regularly occurring group of 6 to 10 gray whales, known as "Sounders" that use mudflats in the Whidbey Island and the Camano Island area as a springtime feeding area (Calambokidis et al., 2010). Observed feeding areas are located in Saratoga Passage between Whidbey and Camano Islands including Crescent Harbor, and in Port Susan Bay located between Camano Island and the mainland north of Everett (Orca Network, 2022). Gray whales feed on benthic invertebrates, including dense aggregations of ghost shrimp and tubeworms (Weitkamp et al., 1992, Richardson, 1997).

Gray whales that are not identified with the regularly occurring group in the Whidbey Island and Camano Island area are occasionally sighted in Puget Sound. These whales are not associated with feeding areas and are often emaciated (Orca Network, 2023). There are typically from 2 to 10 stranded gray whales per year in Washington (NMFS, 2023). In the waterways near NAVBASE Kitsap Bremerton, 11 opportunistic sightings of gray whales were reported to Orca Network between January 2003 and July 2012. One stranding occurred at NAVBASE Kitsap Bremerton in January 2013 and a second stranding at NAVBASE Kitsap Bremerton occurred in 2021. A gray whale spent several weeks in Dyes Inlet near NAVBASE Kitsap Bremerton in April and May 2023 and subsequently stranded near Olympia, Washington in June 2023. The latter 2021 and 2023 strandings are included in the 2019-2023 NMFS declared UME. Gray whales have been sighted in Hood Canal south of the Hood Canal Bridge since 1999, including a stranded whale at Belfair State Park (Orca Network, 2022).

Gray whales are expected to occur in the waters surrounding all of the naval installations in this document with the exception of NAVBASE Kitsap Bangor because they are rare in the Hood Canal. Gray whales are expected to occur primarily from March through June when in-water construction work will not occur. Therefore, some exposure to individual gray whales could occur over the duration of the Proposed Action; however, project timing will help to minimize potential exposures.

4.4 Killer Whale, West Coast Transient Stock

4.4.1 Status and Management

Among the genetically distinct assemblages of killer whales in the northeastern Pacific, the West Coast Transient stock, which occurs from California to southeastern Alaska, is one of two stocks that may occur in the MPR Program area. The other is the Southern Resident killer whale stock, which has not been detected in Hood Canal since 1995. Killer whales belonging to the West Coast Transient stock are protected under the MMPA, but not listed under the ESA. The West Coast Transient stock is not considered depleted or strategic under the MMPA (Young et al., 2023).

4.4.2 Distribution

The geographical range of the West Coast Transient stock of killer whales includes waters from California through southeastern Alaska with a preference for coastal waters of southern Alaska and British Columbia (Krahn et al., 2002). Transient killer whales in the Pacific Northwest spend most of their time along the outer coast of British Columbia and Washington, but visit inland waters in search of harbor seals, sea lions, and other prey. Transients may occur in inland waters in any month (Orca Network, 2015a), but several studies have shown peaks in occurrences: Morton (1990) found bimodal peaks in spring (March) and fall (September to November) for transients on the northeastern coast of British Columbia, and Baird and Dill (1995) found some transient groups frequenting the vicinity of harbor seal haulouts around southern Vancouver Island during August and September, which is the peak period for pupping through post-weaning of harbor seal pups. However, not all transient groups were seasonal in these studies and their movements appeared to be unpredictable. During the period 2004–2010, transient killer whales occurred in Washington inland waters most frequently in August–September with a strong second peak in April–May (Houghton et al., 2015)

The number of West Coast Transient killer whales in Washington inland waters at any one time was considered likely to be fewer than 20 individuals (Wiles, 2004). Recent research suggests that the transient killer whales use of inland waters from 2004 through 2010 has increased and the trend is likely due to increasing prey abundance (Houghton et al., 2015). Many of the West Coast Transients in Washington inland waters have been catalogued by photo identification. PWWA recorded observations of West Coast Transient killer whales in the Salish Sea on 278 days in 2022, with a total of 1,221 unique sightings (defined as an observation of a specific group of killer whales on a single day and does not include repeat reports of the same whales on the same day; PWWA 2023). On April 1, 2022, 72 individual West Coast Transient killer whales from ten different groups were documented in the Salish Sea (PWWA 2022).

West Coast Transient killer whales most often travel in small pods of up to four individuals (Baird & Dill, 1996). Houghton et al. (2015) reported that the group size most often observed in the Salish Sea was four whales for 2004–2010, is larger than the size most often observed from 1987-1993, and that group size appeared to be increasing from 2004–2010. According to unpublished data (Houghton, 2012 personal communication), the most commonly observed group size in Puget Sound (Puget Sound is defined in Section 2 as waters east of Admiralty Inlet [including Hood Canal] through South Puget Sound and north to Skagit Bay) from 2004 to 2010 was 6 whales (mode = 6, mean = 6.88) (Houghton, 2012 personal communication). During the April 1, 2022 single-day record of 72 West Coast Transient killer whales observed throughout the Salish Sea, the largest group documented was 19 (PWWA 2022).

4.4.3 Site-Specific Occurrence

Transient killer whales were observed for lengthy periods in Hood Canal (Figure 1-1) in 2003 (59 days) and 2005 (172 days) between the months of January and July (London, 2006), but were not observed again until March 2016 (Orca Network, 2017). Transient killer whales were observed in Hood Canal on two days in March, one day in April, and 8 days in May 2016. On at least one of the days in May 2016 these whales were seen in Dabob Bay (Orca Network, 2017). West Coast Transient killer whales spent several days to weeks in Hood Canal in 2022 and 2023 (Orca Network, 2023). Transient killer whales have been sighted infrequently near NAVBASE Kitsap-Bremerton (e.g., in May 2010, April and June 2013, June 2015, August 2022, and June 2023 in Dyes Inlet; June 2015, August 2022, March 2023, May 2023 and June 2023 in Sinclair Inlet; and April 2021, March 2023, May 2023, and June 2023 near the Manette Bridge (Orca Network 2022). Transient killer whales have occasionally been observed transiting through Rich Passage near NAVBASE Kitsap Manchester shortly before or after they were observed in Sinclair Inlet near NAVBASE Kitsap Bremerton, most recently in June 2023 (Orca Network 2023). Transient killer whales have been observed in Possession Sound near NAVSTA Everett as well as within the NAVSTA Everett waters in 2022.

4.5 Killer Whale, Eastern North Pacific Southern Resident Stock

4.5.1 Status and Management

The Southern Resident stock contains three pods (J, K, and L pods), considered one stock under the MMPA and as a "distinct population segment" (therefore, "species") under the ESA. The Southern Resident stock is protected and designated as depleted and strategic under the MMPA and listed as endangered under the ESA (Carretta et al., 2023).

In 2006, NMFS designated approximately 2,560 square miles (sq mi) of critical habitat in three specific marine areas (71 FR 69054; November 29, 2006):

- Summer Core Area in Haro Strait and waters around the San Juan Islands
- Puget Sound
- Strait of Juan de Fuca

Eighteen sites owned or controlled by the Department of Defense are excluded from this critical habitat designation, including Navy installations within Puget Sound.

In 2021, NMFS expanded the designated critical habitat for Southern Resident killer whales to include nearly 16,000 sq mi along the U.S. West Coast from the U.S. border with Canada to Point Sur, California. The U.S. Navy’s Quinault Range Site is excluded from the expanded critical habitat designation (86 FR 41668; August 2, 2021).

The primary constituent elements essential for conservation of the Southern Resident killer whale critical habitat are:

- Water quality to support growth and development
- Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth
- Passage conditions to allow for migration, resting, and foraging (71 FR 69054)

4.5.2 Distribution

The Eastern North Pacific Southern Resident stock is a transboundary stock that occurs in inland waters of Washington and British Columbia. They regularly visit coastal sites off Washington state and Vancouver Island (Ford et al., 1994) and are known to travel as far south as central California (Black, 2011), but less is known of these offshore movements. Photo-identification of individual whales in the stock through the years has resulted in a substantial understanding of this stock’s structure, behaviors, and movements in inland waters. Southern Resident killer whales are most frequently observed in the inland waters of Washington State and British Columbia during the late spring, summer, and fall (Hanson & Emmons, 2011). In Washington inland waters Southern Residents are most often observed in Haro Strait, along the west side of San Juan Island, and in the Strait of Juan de Fuca (see review in Kriete, 2007; NMFS 2008a; Hanson & Emmons, 2011). Southern Residents occasionally occur in Puget Sound typically in the fall or winter months (NMFS, 2006) when in-water construction will occur.

Pod sizes of Southern Resident killer whales range from approximately 16 (in K pod) to 34 (in L pod) individuals. Group sizes encountered can be smaller or larger if pods temporarily separate or join together. Therefore, some exposure to groups of up to 20 individuals or more could occur over the duration of the MPR Program.

4.5.3 Site-Specific Occurrence

Southern Resident killer whales are expected to occur occasionally in the waters surrounding all of the naval installations with the exception of NAVBASE Kitsap Bangor (Figure 1-1) because they have not been reported in Hood Canal, including Dabob Bay, since 1995 (NMFS, 2006). Southern Resident killer whales were historically documented in Hood Canal by sound recordings in 1958 (Ford, 1991), a photograph from 1973, sound recordings in 1995 (Unger, 1997), and also anecdotal accounts of historical use, but these latter sightings may be West Coast transient killer whales (NMFS, 2006). Southern Resident killer whales are rare near NAVBASE Kitsap Bremerton with only two sighting in Dyes Inlet since 1997. There was a more recent confirmed Southern Resident occurrence along the Washington State Ferries route between Bremerton and Seattle in December 2007, but the exact location of the sighting is not known (Orca Network, 2015a). Southern Residents have been observed in Saratoga Passage and Possession Sound near NAVSTA Everett (Orca Network, 2015a).

4.6 Harbor Porpoise

4.6.1 Status and Management

Harbor porpoises are protected under the MMPA, but not listed under the ESA. NMFS conservatively recognizes two stocks in Washington waters: the Oregon/Washington Coast stock and the Washington Inland Waters stock (Carretta et al., 2013). The Washington Inland Waters stock is not considered strategic or depleted under the MMPA. Individuals from the Washington Inland Waters stock are expected to occur in Puget Sound.

4.6.2 Distribution

In Washington inland waters, harbor porpoise are known to occur in the Strait of Juan de Fuca and the San Juan Island area year-round (Calambokidis and Baird, 1994; Osmek et al., 1996; Carretta et al., 2012). Harbor porpoises were historically one of the most commonly observed marine mammals in Puget Sound (Scheffer and Slipp, 1948); however, there was a significant decline in sightings beginning in the 1940s (Everitt et al., 1979; Calambokidis et al., 1992). Only a few sightings were reported between the 1970s and 1980s (Calambokidis et al., 1992; Osmek et al., 1996; Suryan and Harvey, 1998), and no harbor porpoise sightings were recorded during multiple ship and aerial surveys conducted in Puget Sound (including Hood Canal) in 1991 and 1994 (Calambokidis et al., 1992; Osmek et al., 1996). Incidental sightings of marine mammals during aerial bird surveys conducted as part of the Puget Sound Ambient Monitoring Program (PSAMP) detected few harbor porpoises in Puget Sound between 1992 and 1999 (Nysewander et al., 2005). However, these sightings may have been negatively biased due to the low elevation of the plane which may have caused an avoidance behavior. Since 1999, PSAMP data, stranding data, and aerial surveys conducted from 2013 to 2016 documented increasing numbers of harbor porpoise in Puget Sound, indicating that the species is increasing in the area (Nysewander, 2008; WDFW, 2008; Jeffries, 2013; Smultea et al., 2017).

4.6.3 Site-Specific Occurrence

Sightings in Hood Canal (Figure 1-1) north of the Hood Canal Bridge have increased in recent years (Evenson et al., 2016; Elliser et al., 2021). During line transect vessel surveys conducted in the Hood Canal in 2011 for the Test Pile Program near NAVBASE Kitsap Bangor and Dabob Bay (HDR, 2012), an average of six harbor porpoises were sighted per day in the deeper waters. Group sizes ranged from 1 to 10 individuals (HDR, 2012). Raum-Suryan and Harvey (1998) reported a mean group size of 1.9 (range 1–8 individuals) in the San Juan Islands. Mean group size of harbor porpoises for each survey season in the 2013–2016 aerial surveys was 1.7 (Smultea et al., 2017). Rone et al. (2024) reported that porpoise density in spring was 2.444, summer 2.152, fall 3.524, and winter 0.812 porpoises/km^2. Information is available on harbor porpoise occurrence in Puget Sound (Navy, 2019; Smultea et al., 2022; Rone et al., 2024), however, little site-specific information, within 500 meters, is available for the Navy installations. Harbor porpoises have been seen infrequently at NAVSTA Everett (L. Wagoner, 2016 personal communication).

4.7 Dall's Porpoise

4.7.1 Status and Management

Dall's porpoises are protected under the MMPA and are not listed under the ESA. Dall's porpoise is managed by NMFS within U.S. Pacific economic exclusion zone waters as two stocks: (1) an Alaska stock; and (2) a California, Oregon, and Washington stock (Allen & Angliss, 2012; Carretta et al., 2012). The California, Oregon, and Washington stock occurs in Washington inland waters (Carretta et al., 2011 as presented in Carretta et al., 2013). This stock is not considered strategic or depleted under the MMPA.

4.7.2 Distribution

Dall's porpoise is one of the most common odontocete species in North Pacific waters (Jefferson, 1991; Ferrero & Walker, 1999; Calambokidis & Barlow, 2004; Williams & Thomas 2007). Dall's porpoise is found from northern Baja California, Mexico, north to the northern Bering Sea and south to southern Japan (Jefferson et al., 1993). However, the species is only common between 32 degrees N and 62 degrees N in the eastern North Pacific (Morejohn, 1979; Houck & Jefferson, 1999). Dall's porpoise are found in outer continental shelf, slope, and oceanic waters, typically in temperatures less than 63 degrees F (17 degrees C) (Houck & Jefferson, 1999; Reeves et al., 2002; Jefferson et l., 2008).

Dall's porpoises may occur in Washington inland waters year-round, but appears to be very rare (Evenson et al., 2016). Extensive aerial surveys conducted in Puget Sound and Hood Canal in all seasons from 2013–2015 logged only one sighting of one individual (Jefferson et al., 2016). Only four Dall's porpoise were detected in aerial surveys of the northern inland waters of Washington (Strait of Juan de Fuca, San Juan Islands, Strait of Georgia) during spring 2015 (Smultea et al., 2015). Additional sightings have been reported in the Strait of Juan de Fuca and Haro Strait between San Juan Island and Vancouver Island (Nysewander et al., 2005; Orca Network 2015a). Tagging studies suggest Dall's porpoises seasonally move between the Haro Straight area and the Strait of Juan de Fuca or farther west (Hanson et al., 1998).

4.7.3 Site-Specific Occurrence

Dall's porpoise were detected in Puget Sound during aerial surveys in winter (1993–2008) and summer (1992–1999) as part of the PSAMP (Nysewander et al., 2005; WDFW, 2008), with additional observations reported to Orca Network (2015a). During the surveys, Dall's porpoise were sighted in Puget Sound as far south as Carr Inlet in southern Puget Sound and as far north as Saratoga Passage, north of NAVSTA Everett (Nysewander et al., 2005; WDFW, 2008). Dall's porpoise could also occasionally occur in Hood Canal (Jeffries, 2006 personal communication); the last one was observed in deeper water near NAVBASE Kitsap Bangor in summer 2008 (Tannenbaum et al., 2009).

Several vessel line-transect surveys and other monitoring efforts were completed in Hood Canal (including Dabob Bay), and Dall's porpoise were not seen (HDR, 2012). Dall's porpoises have not been documented in the Rich Passage to Agate Passage area in the vicinity of NAVBASE Kitsap Bremerton in either the summer or winter surveys (Nysewander et al., 2005; WDFW, 2008). Dall's porpoises have been documented in Possession Sound near Naval Station Everett, with all but one sighting occurring in the winter (Nysewander et al., 2005; WDFW, 2008). Recent extensive aerial surveys of Puget Sound and Hood Canal during 2013–2015 detected only one individual (Jefferson et al., 2016), but did not specify its location. Dall's porpoises had been regularly occurring within Puget Sound but with the return of harbor porpoises in early 2000s, their numbers have significantly declined (Evenson et al., 2016).

4.8 Steller Sea Lion

4.8.1 Status and Management

In the North Pacific, NMFS has designated two Steller sea lion stocks: (1) the Western U.S. stock consisting of populations at and west of Cape Suckling, Alaska (144 degrees W longitude); and (2) the Eastern U.S. stock, consisting of populations east of Cape Suckling, Alaska. The Western U.S. stock is listed as depleted under the MMPA and endangered under the ESA. Although there is evidence of mixing between the two stocks (Jemison et al., 2013), animals from the Western U.S. stock are not present in Puget Sound. Individuals that occur in Puget Sound are from the Eastern DPS (Allen & Angliss, 2013). The Eastern DPS (stock) was removed from listing under the ESA in 2013 because it was stable or increasing throughout the northern portion of its range (Southeast Alaska and British Columbia) and stable or increasing slowly in the central portion of its range (Oregon through northern California) (NMFS 2012; 78 FR 66140). The Eastern U.S. stock is not considered depleted or strategic under the MMPA. Critical habitat has been designated for the Steller sea lion (58 FR 45269); however, there is no designated critical habitat for the species in Washington State.

4.8.2 Distribution

The Eastern stock of Steller sea lions is found along the coasts of southeast Alaska to northern California where they occur at rookeries and numerous haulout locations along the coastline (Jeffries et al., 2000; Scordino, 2006; NMFS, 2012b). A new rookery has recently been established at the Carroll Island and Sea Lion Rock Complex on the outer Washington coast, with over 100 pups born at the rookery in 2015 (Muto et al., 2020). Male Steller sea lions often disperse widely outside of the breeding season from breeding rookeries in northern California (St. George Reef) and southern Oregon (Rogue Reef) (Scordino, 2006; Wright et al., 2010). Based on mark recapture sighting studies, males migrate back into these Oregon and California locations from winter feeding areas in Washington, British Columbia, and Alaska (Scordino, 2006).

In Washington, Steller sea lions use haulout sites primarily along the outer coast from the Columbia River to Cape Flattery, as well as along the Vancouver Island side of the Strait of Juan de Fuca (Jeffries et al., 2000). A major winter haulout is located in the Strait of Juan de Fuca at Race Rocks, British Columbia, Canada (Canadian side of the Strait of Juan de Fuca) (Edgell & Demarchi, 2012). Numbers vary seasonally in Washington with peak numbers present during the fall and winter months and a decline in the summer months that corresponds to the breeding season at coastal rookeries (approximately late May to early June) (Jeffries et al., 2000). In Puget Sound, Jeffries (2012 personal communication) identified five winter haulout sites used by adult and subadult (immature or pre-breeding animals) Steller sea lions, ranging from immediately south of Port Townsend (near Admiralty Inlet) to Olympia in southern Puget Sound (see Figure 4-1). Numbers of animals observed at these sites ranged from a few to less than 100 (Jeffries, 2012 personal communication). In addition, Steller sea lions opportunistically haul out on various navigational buoys in Admiralty Inlet south through southern Puget Sound near Olympia (Jeffries, 2012 personal communication). One or two animals occur on these buoys.

4.8.3 Site-Specific Occurrence

The Navy conducts surveys at its installations in Puget Sound that have sea lion haulouts. Haulouts are located at NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, NAVBASE Kitsap Manchester, and NAVSTA Everett (Figure 4-1). Survey methods and frequency are described in detail Appendix C.

Steller sea lions have been seasonally documented in shore-based surveys at NAVBASE Kitsap Bangor in Hood Canal since 2008 with up to 13 individuals observed hauled out on submarines at Delta Pier (Figure 4-2) (Navy, 2023). Surveys at NAVBASE Kitsap Bangor indicate Steller sea lions begin arriving in September and depart by the end of May (Navy, 2023).

Shore-based surveys at NAVBASE Kitsap Bremerton have not detected Steller sea lions since the surveys were initiated in 2010 (Navy, 2023). A Steller sea lion was sighted on a float on the floating security barrier during a vessel survey in November 2012 (Lance, 2012 personal communication) and others were detected during aerial surveys conducted by WDFW in spring 2013 (Jeffries, 2013).

Steller sea lions haul out on floating platforms in Clam Bay approximately 0.5 mi offshore from the NAVBASE Kitsap Manchester finger pier, approximately 8 mi from NAVBASE Kitsap Bremerton (Figure 4-3). The platforms appear associated with a fish farming net pen in Clam Bay. The number of Steller sea lions in the vicinity of NAVBASE Kitsap Manchester is limited by the variable size and availability of floating platforms in Clam Bay. The Navy has conducted regular surveys of sea lions on the floats since November 2012; however, no surveys were conducted September 2013 through November 2013 and July 2017 through June 2018 (Navy, 2023). Steller sea lions were seen in all surveyed months except for June, July, and August with as many as 43 individuals present in September 2021.

Shore-based surveys conducted since July 2012 at NAVSTA Everett have rarely detected Steller sea lions. However, NOAA staff have reported that they occasionally see Steller sea lions, one or two at a time, hauled-out on the port security barrier (PSB) and at the Notch Basin (L. Wagoner, 2016 personal communication). In recent years, several Steller sea lions have been observed on the PSB, generally one at a time (Navy, 2023). Other than these detections on the installation's PSBs, the nearest known Steller sea lion haulout is 14 mi away; therefore, Steller sea lions are expected to be a rare occurrence in waters off this installation during pile driving activities.

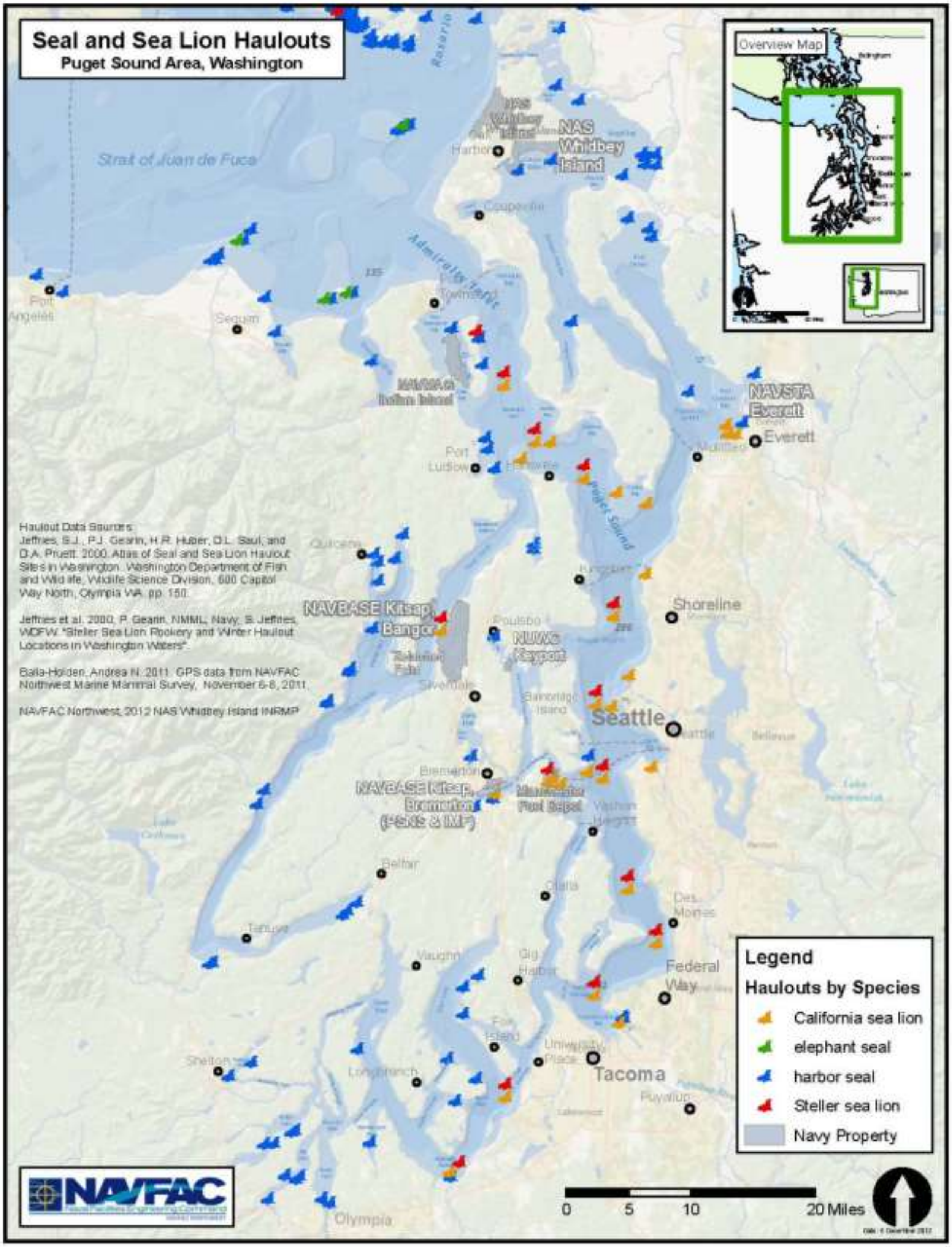

Figure 4-1. Pinniped Haulouts in the Vicinity of the MPR Project Areas

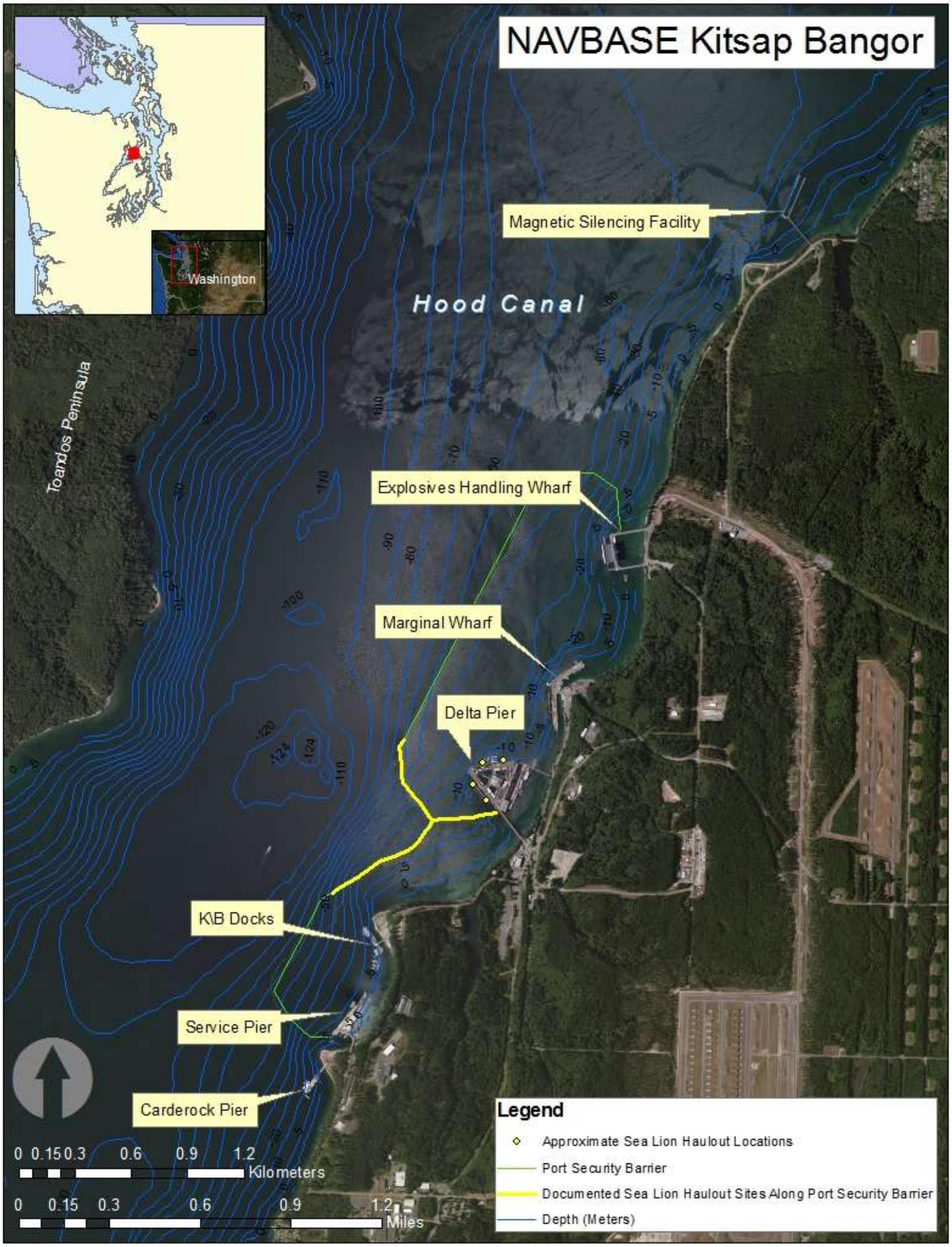

Figure 4-2. Pinniped Haulouts at NAVBASE Kitsap Bangor

Figure 4-3. Pinniped Haulouts at NAVBASE Kitsap Bremerton

4.9 California Sea Lion

4.9.1 Status and Management

California sea lions are protected under the MMPA and are not listed under the ESA. NMFS has defined one stock for California sea lions (U.S. Stock), with five genetically distinct geographic populations: (1) Pacific Temperate, (2) Pacific Subtropical, (3) Southern Gulf of California, (4) Central Gulf of California, and (5) Northern Gulf of California. The Pacific Temperate population includes rookeries within U.S. waters and the Coronados 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 (Carretta et al., 2013). The U.S. stock of California sea lions is not considered depleted or strategic under the MMPA.

4.9.2 Distribution

During the summer, California sea lions breed on islands from the Gulf of California to the Channel Islands to islands off of Central California. During the breeding season, sea lions seldom travel more than about 31 mi from the islands. The primary rookeries are located on the California Channel Islands of San Miguel, San Nicolas, Santa Barbara, and San Clemente. During the non-breeding season (August to May), adult and subadult males migrate northward along the coast to central and northern California, Oregon, Washington, and Vancouver Island, and return south in the spring. They are occasionally sighted hundreds of miles offshore as well as within the Strait of Juan de Fuca and Puget Sound. Adult females with pups remain in waters near their breeding rookeries off the coasts of California and Mexico to alternately forage and then return to suckle their pups. California sea lions also enter bays, harbors, and river mouths and often haul out on man-made structures such as piers, jetties, offshore buoys, and oil platforms.

4.9.3 Site-Specific Occurrence

Jeffries et al. (2000) and Jeffries (2012 personal communication) identified dedicated, regular haulouts used by adult and subadult California sea lions in Washington inland waters (Figure 4-1). Main haulouts occur on the PSBs at NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, and NAVSTA Everett, and floats, docks, or barges in Rich Passage near NAVBASE Kitsap Manchester, Seattle (Shilshole Bay), south Puget Sound (Commencement Bay, Budd Inlet), and numerous navigation buoys south of Whidbey Island to Olympia in south Puget Sound (Jeffries et al., 2000; Jeffries, 2012 personal communication) (Figure 4-1). Outside the MPR Program area, Race Rocks, British Columbia, Canada (Canadian side of the Strait of Juan de Fuca) has been identified as a major winter haulout for California sea lions (Edgell & Demarchi, 2012).

California sea lions are typically present most of the year except for mid-June through August in Washington inland waters, with peak abundance numbers between October and April (NMFS, 1997; Jeffries et al., 2000; Navy, 2023). California sea lions would be expected to opportunistically forage within the area, following local prey availability; however, they tend to forage in the Strait de Juan de Fuca and the Pacific Coast (DeLong et al., 2017). During the late spring and summer months and associated breeding periods, the inland waters would not be considered a high-use area by California sea lions, as they would be returning to rookeries in California waters (DeLong et al., 2017). However, as described below, surveys at Bangor indicate that a few individuals are present through mid-June and have arrived as early as August (Navy, 2023). Surveys at NAVSTA Everett from 2012 to 2022 indicate a few individuals may remain year-round (Navy, 2023). Haulouts are located at NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, NAVBASE Kitsap Manchester, and NAVSTA Everett. Survey methods and frequency are described in detail in Appendix C.

California sea lions have been documented during shore-based surveys at NAVBASE Kitsap Bangor in Hood Canal since 2008 in all survey months, with as many as 320 individuals observed at one time (October 2018) hauled out on submarines at Delta Pier and on PSB floats (Figure 4-2) (Navy, 2023; Appendix C).

California sea lions have been documented during shore- and boat-based surveys at NAVBASE Kitsap Bremerton since 2010, with as many as 412 individuals hauled out at one time (October 2019) on PSB floats (Figure 4-3) (Navy, 2023).

California sea lions haul out on floating platforms in Clam Bay approximately 0.5 mi offshore from the NAVBASE Kitsap Manchester finger pier, approximately 8 mi from NAVBASE Kitsap Bremerton (Figure 4-4). As with Steller sea lions, the number of California sea lions in the vicinity of NAVBASE Kitsap Manchester is limited by the variable size and availability of floating platforms from the fish farming facility. California sea lions were seen in every survey month except July and August, with as many as 130 individuals present in one survey in October 2014. Aerial surveys were conducted by WDFW from March–April 2013, July–August 2013, November 2013, and February 2014. The number of sea lions have significantly decreased since 2018 as some of the floats used by the California sea lions were removed. New floats were reintroduced in 2021 with a subsequent increase in sea lions in the area. These surveys detected California sea lions on the floating platforms during all survey months except July, with up to 212 individuals present on one survey in February 2022.

California sea lions have been documented during shore-based surveys at NAVSTA Everett from July 2012 to June 2016 in all survey months, with as many as 267 individuals hauled out at one time (April 2020) on PSB floats (Figure 4-5) (Navy, 2023).

California sea lions are expected to be exposed to noise from project activities at NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, NAVBASE Kitsap Manchester, and NAVSTA Everett because haulouts are located at these installations or nearby. Exposure is estimated to occur primarily from August through the end of the in-water work window in mid-January or mid-February.

Figure 4-4. Pinniped Haulouts near NAVBASE Kitsap Manchester

Figure 4-5. Pinniped Haulouts at and near NAVSTA Everett

4.10 Northern Elephant Seal

4.10.1 Status and Management

Northern elephant seals are protected under the MMPA and are not listed under the ESA. NMFS has defined one stock for the northern elephant seal, the California Breeding stock, which is geographically distinct from a population in Baja California. Individuals that may occur in Puget Sound belong to the California Breeding stock. This stock is not considered depleted or strategic under the MMPA.

4.10.2 Distribution

The northern elephant seal occurs almost exclusively in the eastern and central North Pacific. Rookeries are located from central Baja California, Mexico, to northern California (Stewart & Huber, 1993). Adult elephant seals engage in two long migrations per year, one following the breeding season, and another following the annual molt (Stewart and DeLong, 1995; Robinson et al., 2012). Between the two foraging periods they return to land to molt with females returning earlier than males (March through April versus July through August). After the molt, adults then return to their northern feeding areas until the next winter breeding season. Breeding occurs from December to March (Stewart & Huber, 1993). Juvenile elephant seals typically leave the rookeries in April or May and head north, traveling an average of 559 to 621 mi. Most elephant seals return to their natal rookeries when they start breeding (Huber et al., 1991). Their foraging range extends thousands of miles offshore into the central North Pacific. Adults tend to stay offshore, but juveniles and subadults are often seen along the coasts of Oregon, Washington, and British Columbia (Condit & Le Boeuf, 1984; Stewart & Huber, 1993).

In Washington inland waters, there are regular haulout sites at Smith and Minor Islands, Dungeness Spit, and Protection Island in the Strait of Juan de Fuca that are thought to be used year-round (Jeffries et al., 2000; Jeffries, 2012 personal communication) (Figure 4-2). Pupping has occurred at these sites, as well as Race Rocks on the British Columbia side of the Strait of Juan de Fuca (Jeffries, 2012 personal communication). Typically these sites have small numbers of 2 to 10 individuals present.

4.10.3 Site-Specific Occurrence

No haulouts occur in Puget Sound with the exception of individual elephant seals occasionally hauling out for two to four weeks to molt, usually during the spring and summer and typically on sandy beaches (Calambokidis & Baird, 1994; Norberg, 2012 personal communication (P. Yasenak, Pers. Comm., 2022). These animals are usually yearlings or subadults and their haulout locations are unpredictable (Norberg, 2012 personal communication). An adult female hauled out and molted for one month at Keyport in 2021 (P. Yasenak, Pers.Comm., 2022) and a yearling hauled out at NAVSTA Everett for several days in 2023 (A. Higgs, pers comm., 2023). Elephant seals have given birth several times on Whidbey Island including in 2023. A juvenile male elephant seal was seen hauled-out on the south end of Bainbridge Island, across Rich Passage from NAVBASE Kitsap Manchester in May 2023. The National Stranding Network database reported one male subadult elephant seal hauled out to molt at NAVBASE Kitsap Manchester in February 2004. Although regular small haulouts occur in the Strait of Juan de Fuca, the occurrence of elephant seals in Puget Sound is unpredictable and rare.

4.11 Harbor Seal

4.11.1 Status and Management

Harbor seals are not listed as depleted under the MMPA, nor are they listed under the ESA.

Three stocks occur in Washington's inland waters:

- Hood Canal stock (within the Action Area)
- Northern Inland Waters stock (within the Action Area)
- Southern Puget Sound stock (not included in the analysis)

None of these three stocks are considered depleted or strategic under the MMPA. Based on radiotelemetry and satellite tagging results, interchange between inland and coastal stocks is unlikely (Jeffries et al., 2003; London, 2006).

4.11.2 Distribution

Harbor seals are a coastal species, rarely found more than 12 mi. from shore, and frequently occupy bays, estuaries, and inlets (Baird 2001). Individual seals have been observed several miles upstream in coastal rivers (Baird 2001). Ideal harbor seal habitat includes haulout sites, shelter during the breeding periods, and sufficient food (Bjørge, 2002). Haulout areas can include intertidal and subtidal rock outcrops, sandbars, sandy beaches, peat banks in salt marshes, and man-made structures such as log booms, docks, and recreational floats (Wilson, 1978; Prescott, 1982; Schneider & Payne, 1983, Gilbert & Guldager, 1998; Jeffries et al., 2000; Lambourn et al., 2010). Harbor seals do not make extensive pelagic migrations, though some long distance movement of tagged animals in Alaska (108 mi) and along the U.S. west coast (up to 342 mi) have been recorded (Brown & Mate, 1983; Womble & Gende, 2013). Recent satellite tagging of harbor seals at NAVSTA Everett and just north in Port Susan showed high site fidelity and limited movements (< 8 miles; P. Thorson Pers. Comm., 2023). Harbor seals have also displayed strong fidelity to haulout sites.

Harbor seals are the most common, widely distributed marine mammal found in Washington marine waters and are frequently observed in the nearshore marine environment. They occur year-round and breed in Washington. Numerous harbor seal haulouts occur in Washington inland waters (Figure 4-2). Haulouts include intertidal and subtidal rock outcrops, beaches, reefs, sandbars, log booms, and floats. Numbers of individuals at haulouts range from a few to between 100 and 500 individuals (Jeffries et al., 2000).

4.11.3 Site-Specific Occurrence

Harbor seals are expected to occur year-round at all installations with the greatest numbers expected at installations with nearby haulout sites. In Hood Canal, where NAVBASE Kitsap Bangor is located, known haulouts occur on the west side of Hood Canal at the mouth of the Dosewallips River and on the western and northern shorelines in Dabob Bay located approximately 8.1 and 2.3 mi away from the Navy's installations, respectively (Figure 4-1). Vessel-based surveys conducted from 2007 to 2010 at NAVBASE Kitsap Bangor, observed harbor seals in every month of surveys (Agness & Tannenbaum, 2009; Tannenbaum et al., 2009, 2011). Harbor seals were routinely seen during marine mammal monitoring for two construction projects, the Test Pile Program and EHW-2 construction projects (HDR, 2012; Hart Crowser, 2013, 2014, 2015). Small numbers of harbor seals have been documented hauling out on the PSB floats, wavescreen at Carderock Pier, buoys, barges, marine vessels, and logs (Agness & Tannenbaum, 2009; Tannenbaum et al., 2009, 2011; Navy, 2015c) and on man-made floating structures near K/B Dock and Delta Pier. Incidental surveys by a NAVFAC biologist in August and September 2016 recorded as many as 28 harbor seals hauled out under Marginal Wharf or swimming in adjacent waters. On two occasions, four to six individuals were observed hauled out near Delta Pier.

Past IHA applications for NAVBASE Kitsap Bangor indicated a few observations of harbor seal births or neonates. In 2014, the Navy's knowledge of harbor seal births increased due to increased pinniped surveys on the waterfront and increased contact with waterfront personnel who have had lengthy careers at Bangor (Navy, 2015c). Known harbor seal births include one on the Carderock wave screen in August 2011 and at least one on a small 10 x 10 ft floating dock at EHW-2 in fall 2013 as reported by EHW-2 construction crew, and afterbirth on a float at Magnetic Silencing Facility with an unknown date. In addition, Navy biologists learned that harbor seal pupping has occurred on a section of the Service Pier since approximately 2001 according to the Port Operations vessel crews. Harbor seal mother and pup sets were observed in 2014 hauled out on the Carderock wavescreen and swimming in nearby waters, and swimming in the vicinity of Delta Pier (Navy, 2015c).

At NAVSTA Everett, Navy surveys conducted regularly beginning in July 2012 have documented up to 578 individual harbor seals hauled-out on log rafts and in the water adjacent to the installation in Notch Basin in the East Waterway (Figure 4-5) (Navy, 2023). However, the log rafts were removed from the East Waterway in the spring of 2022. Harbor seals occupy the waters and haulout sites near NAVSTA Everett year-round. Based on the survey data, the number of individuals is highest from August to October, with an average count per survey of 261 seals in September across all survey years. Mother-pup pairs have been observed at NAVSTA Everett each summer since 2018, with a peak count of 96 pups observed in August 2021.

No haulouts have been identified at NAVBASE Kitsap Bremerton or Manchester. The nearest documented haulout to NAVBASE Kitsap Manchester is Orchard Rocks Conservation Area in Rich Passage, approximately 1.0 miles away. In June 2020, NAVFAC NW began surveying the area around Orchard Rocks. The haulout is only accessible at lower tides, but when available, NAVFAC NW has counted up to 153 harbor seals hauled-out and in the water near Orchard Rocks (Navy 2023). Blakely Rocks is another known haulout in the vicinity of NAVBASE Kitsap Manchester, located approximately 3.5 mi away on the east side of Bainbridge Island. The nearest documented haulouts to NAVBASE Kitsap Bremerton are across Sinclair Inlet, approximately 0.7 mi away. The haulouts at Blakely Rocks and in Sinclair Inlet were estimated to have less than 100 individuals (Jeffries, 2012 personal communication).

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5 TAKE AUTHORIZATION REQUESTED

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

5.1 Take Authorization Request

Under Section 101 (a)(5)(D) of the MMPA, the Navy requests IHAs for the incidental take of marine mammals incidental to noise generated during vibratory pile extraction, vibratory, impact pile driving, and DTH drilling during pile replacement activities described in this application. The Navy is requesting two consecutive IHAs in order to complete the project. The IHA inclusive dates for the first year of the project will be between July 2024 and July 2025, with pile driving occurring between July 16, 2024 and January 15 or February 15, 2025 (depending on the installation work window). The second IHA is requested for the period of July 2025 to July 2026. The IHA inclusive dates for the second year of the project will be between July 2025 and July 2026, with pile driving occurring between July 16, 2025 and January 15 or February 15, 2026 (depending on the installation work window). If the work is not completed within the IHA inclusive dates, the Navy may request a renewal for the period of July 2026 to July 2027.

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).

5.2 Method of Incidental Taking

This authorization request considers noise from vibratory pile extraction and vibratory, impact, and DTH drilling installation as outlined in Section 1 that has the potential to disturb or displace marine mammals or produce a temporary shift in their hearing ability (temporary threshold shift) resulting in Level B harassment as defined above. Other pile repair activities included in the MPR Program are not included in this request. Some projects at the NAVBASE Kitsap Bangor and NAVSTA Everett location have the potential to produce a permanent shift in the ability of harbor seals to hear from steel impact pile driving resulting in Level A harassment. Level A harassment is only requested where species such as California sea lions or Pacific harbor seals are frequently found in substantial numbers within Navy installation waters or hauled out on Navy structures.

Level A harassment will be minimized to the extent practicable given the methods of installation and measures designed to minimize the possibility of injury to marine mammals. First, the majority of piles installed will be concrete (18-in and 24-in), which are not expected to cause injury to marine mammals due to the relatively low installation sound levels (<180 dB RMS re 1 µPa at 10 m). Second, vibratory pile drivers will be the primary method of steel pile installation. Vibratory pile drivers also have relatively low sound levels (<180 dB re 1 µPa at 10 m) and are not expected to cause injury to marine mammals. Third, impact driving of steel piles will not occur without a noise attenuation measure (such as a bubble curtain or other attenuating device) in place, and all pile driving will either not start or be halted if marine mammals approach the Level A injury zone ("shutdown zone") or, for harbor seals, a shutdown zone that encompasses the Level A injury zone to the extent practicable. Fourth, pile installation at NBK Manchester would likely use DTH drilling.

The Proposed Action is not anticipated to affect the prey base or significantly affect other habitat features of marine mammals that would meet the definition of take. To minimize, to the extent practicable, Level B harassment of ESA-listed humpback and Southern Resident killer whales, and non-ESA-listed whales and porpoises, the Navy will implement a shut-down of pile driving if whales or porpoises are seen entering a monitoring zone. This measure is intended to avoid exposure to any harassment. See Section 11 for more details on the impact reduction and mitigation measures proposed.

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6 NUMBERS AND SPECIES EXPOSED

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

6.1 Introduction

In-water pile driving will temporarily increase the local underwater and airborne noise environment in the vicinity of the MPR projects. Research suggests that increased noise may impact marine mammals in several ways and depends on many factors. This is 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. Although it is known that sound is important for marine mammal communication, navigation, and foraging (National Research Council, 2003, 2005), there are many unknowns in assessing impacts such as the potential interaction of different effects and the significance of responses by marine mammals to sound exposures (Nowacek et al., 2007; Southall et al., 2007). 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.

Vibratory pile driving for the projects described in Chapter 1 of this application is not expected to result in Level A exposure of marine mammals as defined under the MMPA. However, the noise related impacts discussed in this application may result in Level B harassment. Impact pile driving could result in Level A and Level B exposure of marine mammals as defined under the MMPA. The methods for estimating the number and types of exposure are summarized below.

Exposure of each species was determined at each installation by:

- Estimating the area of impact where noise levels exceed acoustic thresholds for marine mammals (Sections 6.2 and 6.3)
- Evaluating potential presence of each species at each installation based on historical occurrence, density, or by site-specific survey as outlined in Section 6.4
- Estimating potential harassment exposures by multiplying the density or site-specific abundance, as applicable, of each marine mammal species calculated in the area by their probable duration during construction (Section 6.5)

Each of the three items above is discussed in the sections following.

6.2 Description of Noise Sources

Ambient sound is a composite of sounds from multiple sources, including environmental events, biological sources, and anthropogenic activities. Physical noise sources include waves at the surface, precipitation, earthquakes, ice, and atmospheric noise, among other events. Biological sources include marine mammals, fish, and invertebrates. Anthropogenic sounds are produced by vessels (small and large), dredging, aircraft overflights, construction activities, geophysical explorations, commercial and military sonars, and other activities. Known noise levels and frequency ranges associated with anthropogenic sources similar to those that would be used for this project are summarized in Table 6-1.

Details of each of the sources are described in the following text.

In-water construction activities associated with the proposed projects include impact and vibratory pile driving, and DTH drilling. The sounds produced by these activities fall into two sound types: impulsive and non-impulsive (defined below). Impact pile driving produces impulsive sounds, while vibratory pile driving produces non-impulsive sounds. DTH drilling includes both impulsive and non-impulsive components. When evaluating Level B harassment, NMFS recommends treating DTH drilling as a continuous source and applying the RMS SPL thresholds of 120 dB re 1 µPa. When evaluating Level A harassment, NMFS recommends treating DTH drilling as an impulsive source. The distinction between these two general sound types is important because they have differing potential to cause physical effects, particularly with regard to hearing (Ward, 1997).

Impulsive sounds (e.g., explosions, seismic airgun pulses, and impact pile driving), which are referred to as pulsed sounds in Southall et al. (2007), are brief, broadband, atonal transients (Harris, 1998) and occur either as isolated events or repeated in some succession (Southall et al., 2007). 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).

Non-impulsive sounds (referred to as non-pulsed in Southall et al., 2007) can be tonal, broadband, or both. They lack the rapid rise time and can have longer durations than impulsive sounds. Non-impulsive sounds can be either intermittent or continuous. Examples of non-impulsive sounds include vessels, aircraft, and machinery operations such as drilling, dredging, and vibratory pile driving (Southall et al., 2007).

In some environments, the duration of both impulsive and non-impulsive sounds can be extended due to reverberations. Appendix B provides additional information on the fundamentals of underwater sound and a review of pile driving sound pressure levels from similar projects as those proposed in this application.

Table 6-1. 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 meter	Richardson et al., 1995; DEFRA, 2003; Reine et al., 2014
Small vessels	860–8,000	141–175 dB RMS re: 1 µPa at 1 meter	Galli et al., 2003; Matzner & Jones, 2011; Sebastianutto et al., 2011
Large ship	20–1,000	176–186 dB re: 1 μPa^2sec SEL at 1 meter	McKenna, 2011
Tug docking gravel barge	200–1,000	149 dB at 100 m	Blackwell and Greene, 2002

Key: dB = decibel; Hz = Hertz; RMS = root mean square; SEL = sound exposure level
dB re 1 µPa @ 1 m = decibels (dB) referenced to (re) 1 micro (µ) Pascal (Pa) at 1 meter

6.3 Vocalization and Hearing of Marine Mammals

All marine mammals that have been studied can produce sounds and use sounds to forage, orient, detect, and respond to predators, and facilitate social interactions (Richardson et al., 1995). Measurements of marine mammal sound production and hearing capabilities provide some basis for assessing whether exposure to a particular sound source may affect a marine mammal behaviorally or physiologically. Marine mammal hearing abilities are quantified using live animals either via behavioral audiometry or electrophysiology (see Schusterman, 1981; Au, 1993; Wartzok & Ketten, 1999; Nachtigall et al., 2007). Behavioral audiograms, which are plots of animals' exhibited hearing threshold versus frequency, are obtained from captive, trained live animals using standard testing procedures with appropriate controls and are considered to be a more accurate representation of a subject's hearing abilities. Behavioral audiograms of marine mammals are difficult to obtain because many species are too large, too rare, and too difficult to acquire and maintain for experiments in captivity. Consequently, our understanding of a species' hearing ability may be based on the behavioral audiogram of a single individual or small group of animals. In addition, captive animals may be exposed to local ambient sounds and other environmental factors that may impact their hearing abilities and may not accurately reflect the hearing abilities of free-swimming animals.

For animals not available in captive or stranded settings (including large whales and rare species), estimates of hearing capabilities are made based on anatomical and physiological structures, the frequency range of the species' vocalizations, and extrapolations from related species.

Electrophysiological audiometry measures small electrical voltages produced by neural activity when the auditory system is stimulated by sound. The technique is relatively fast, does not require a conscious response, and is routinely used to assess the hearing of newborn humans. It has recently been adapted for use on non-humans, including marine mammals (Dolphin, 2000, Houser et al., 2007, 2008; Nachtigall et al., 2007; Mooney et al., 2017). For both methods of evaluating hearing ability, hearing response in relation to frequency is a generalized U-shaped curve or audiogram showing the frequency range of best sensitivity (lowest hearing threshold) and frequencies above and below with higher threshold values.

NMFS reviewed studies of hearing sensitivity of marine mammals and developed thresholds for use as guidance when assessing the effects of anthropogenic sound on marine mammals based on measured or estimated hearing ranges (NMFS, 2018a). The guidance places marine mammals into the following functional hearing groups based on their generalized hearing sensitivities: high-frequency cetaceans, mid-frequency cetaceans, low-frequency cetaceans (mysticetes), phocid pinnipeds (true seals), and otariid pinnipeds (sea lions and fur seals). Table 6-2 provides a summary of sound production and hearing capabilities for marine mammal species assessed in this application.

Table 6-2. Hearing and Vocalization Ranges for Marine Mammal Functional Hearing Groups and Species Potentially Within the Project Areas

Functional Hearing Group	***Species***	***Functional Hearing Range [1]***
Low-frequency cetaceans	Humpback whale, gray whale, minke whale	7 Hz to 35 kHz
Mid-frequency cetaceans	Killer whale	150 Hz to 160 kHz
High-frequency cetaceans	Harbor porpoise, Dall's porpoise	275 Hz to 160 kHz
Phocidae	Harbor seal, elephant seal	In-water: 50 Hz to 86 kHz In-air: 75 Hz to 30 kHz
Otariidae	California sea lion, Steller sea lion	In-water: 60 Hz to 39 kHz In-air: 50 Hz to 75 kHz

Key: Hz = Hertz; kHz = kilohertz
Notes:
1. In-water hearing data from NMFS, 2018a. In-air data from Schusterman, 1981; Hemila et al., 2006; Southall et al., 2007.

6.4 Sound Exposure Criteria and Thresholds

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

To date, no studies have been conducted that examine impacts to marine mammals from pile driving sounds from which empirical noise thresholds have been established. Currently, NMFS uses underwater sound exposure thresholds to determine when an activity could result in impacts to a marine mammal defined as Level A (injury) or Level B (disturbance including behavioral and temporary threshold shift) harassment (NMFS, 2005). NMFS (2018) has recently developed acoustic threshold levels for determining the onset of permanent threshold shift (PTS) in marine mammals in response to underwater impulsive and non-impulsive sound sources. The criteria use cumulative SEL metrics (dB SEL_{CUM}) and peak pressure (dB PEAK) rather than the previously used dB RMS metric. NMFS equates the onset of PTS, which is a form of auditory injury, with Level A harassment under the MMPA and "harm" under the ESA. Level B harassment occurs when marine mammals are exposed to impulsive underwater sounds >160 dB RMS re 1 µPa, such as from impact pile driving, and to non-impulsive underwater sounds >120 dB RMS re 1 µPa, such as from vibratory pile driving (NMFS, 2005) (Table 6-3). The onset of temporary threshold shift (TTS) may be a form of Level B harassment under the MMPA and "harassment" under the ESA. All forms of harassment, either auditory or behavioral, constitute "incidental take" under these statutes.

NMFS uses generic sound exposure thresholds to determine when an activity in the ocean that produces airborne sound might result in impacts to a marine mammal (70 FR 1871). Construction-period airborne noise would have little impact to cetaceans because noise from airborne sources would not transmit as well underwater (Richardson et al., 1995); thus, noise would primarily be a problem for hauled-out pinnipeds near the project locations. NMFS has identified behavioral harassment threshold criteria for airborne noise generated by pile driving for pinnipeds regulated under the MMPA. Level A injury threshold criteria for airborne noise have not been established. The Level B behavioral harassment threshold for harbor seals is 90 dB RMS re 20 µPa (unweighted) and for all other pinnipeds is 100 dB RMS re 20 µPa (unweighted).

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 non-impulsive noise originated from research conducted by Malme et al. (1984, 1988) for California gray whale response to continuous industrial sounds such as drilling operations. (The 120 dB re 1 µPa non-impulsive sound threshold should not be confused with the species-specific 120 dB pulsed sound criterion established for migrating bowhead whales in the Arctic as a result of research in the Beaufort Sea [Richardson et al., 1995; Miller et al., 1999].)

To date, there is no research or data supporting a response by pinnipeds or odontocetes to non-impulsive sounds from vibratory pile driving as low as the 120 dB threshold. Southall et al. (2007) reviewed studies conducted to document behavioral responses of harbor seals and northern elephant seals to non-impulsive sounds under various conditions and 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.

Table 6-3. Injury and Disturbance Threshold Criteria for Underwater and Airborne Noise

Marine Mammal Functional Groups	*Airborne Noise (impact and vibratory pile driving) (re 20 µPa)*[1]	*Underwater Vibratory Pile Driving Noise (non-impulsive sounds) (re 1 µPa)*		*Underwater Impact Pile Driving Noise (impulsive sounds) (re 1 µPa)*	
	Disturbance Guideline (haulout)[2]	*PTS Onset (Level A) Threshold*	*Level B Disturbance Threshold*	*PTS Onset (Level A) Threshold*[3]	*Level B Disturbance Threshold*
Low-Frequency Cetaceans (Gray whale; humpback whale)	Not applicable	199 dB SEL_{CUM}[4]	120 dB RMS	219 dB Peak[5] 183 dB SEL_{CUM}[4]	160 dB RMS
Mid-Frequency Cetaceans (Killer whale)	Not applicable	198 dB SEL_{CUM}[4]	120 dB RMS	230 dB Peak[5] 185 dB SEL_{CUM}[4]	160 dB RMS
High-Frequency Cetaceans (Harbor porpoise)	Not applicable	173 dB SEL_{CUM}[4]	120 dB RMS	202 dB Peak[5] 155 dB SEL_{CUM}[4]	160 dB RMS
Otariidae (California sea; Steller sea lion)	100 dB RMS (unweighted)	219 dB SEL_{CUM}[4]	120 dB RMS	232 dB Peak[5] 203 dB SEL_{CUM}[4]	160 dB RMS
Phocidae (Elephant seal, harbor seal)	90 dB RMS (unweighted)	201 dB SEL_{CUM}[4]	120 dB RMS	218 dB Peak[5] 185 dB SEL_{CUM}[4]	160 dB RMS

Key: dB = decibel; PTS = permanent threshold shift; RMS = root mean square; SEL = sound exposure level
Notes:
1. Airborne disturbance thresholds not specific to pile driver type.
2. Sound level at which pinniped haulout disturbance has been documented. This is not considered an official threshold, but is used as a guideline.
3. Dual metric acoustic thresholds for impulsive sounds: Whichever results in the largest isopleth for calculating PTS onset is used in the analysis.
4. Cumulative sound exposure level over 24 hours.
5. Flat weighted or unweighted peak sound pressure within the generalized hearing range.

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

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

Based on the frequency overlap between noise produced by both vibratory and impact pile driving (10 Hz to 1.5 kHz) , animals that remain in a project area during steel pile driving may be vulnerable to masking for the duration of pile driving (typically 2 hours or less intermittently over the course of a day depending on site and project). Although SPLs from impact pile driving are greater, the zone of potential masking effects from vibratory pile driving may be as large or greater due to the duration and continuous nature of vibratory pile driving. The potential for masking differs between species, depending on the overlap between pile driving noise and the animals' hearing and vocalization frequencies. In this respect, harbor porpoises, which use HF sound, are probably less vulnerable to masking from pile driving than pinnipeds. In addition, cetaceans that may be subject to masking are rare and transitory within the vicinity of the Proposed Action area.

The animals most likely to be at risk for vocalization masking would be pinnipeds (harbor seals and sea lions). Animals will often compensate for increasing noise levels by increasing the signal level, repetition rate, duration, or changing the frequency, of their vocalizations, a phenomenon termed the "Lombard effect" (Hotchkin & Parks, 2013). Possible behavioral reactions to vocalization masking include changes to vocal behavior (including cessation of calling), habitat abandonment (long or short term), and modifications to the acoustic structure of vocalizations (which may help signalers compensate for masking) (Brumm & Slabbekoorn, 2005; Brumm & Zollinger, 2011). The extent to which the animals' behaviors would mitigate the potential for masking is uncertain, and, accordingly, the Navy has estimated that masking as well as compensatory behavioral responses are likely within the zones of behavioral harassment estimated for vibratory and impact pile driving and DTH drilling (see Section 6.3.2, Underwater Noise from Pile Driving) and; therefore, are taken into account in the exposure analysis.

6.7 Modeling Potential Noise Impacts from Pile Driving

6.7.1 Underwater Sound Propagation

Pile driving will generate underwater noise that potentially could result in disturbance to marine mammals swimming by a project area. Transmission loss (TL) underwater is the decrease in acoustic intensity as an acoustic pressure wave propagates out from a source until the source becomes indistinguishable from ambient sound. TL parameters vary with frequency, temperature, sea conditions, current, source and receiver depth, water depth, water chemistry, and bottom composition and topography. A standard sound propagation model was used to estimate the range from pile driving activity to various expected sound pressure levels at potential project structures. This model follows a geometric propagation loss based on the distance from the driven pile, resulting in a 4.5 dB reduction in

level for each doubling of distance from the source. In this model, the sound pressure level at some distance away from the source (e.g., driven pile) is governed by a measured source level, minus the transmission loss of the energy as it dissipates with distance.
The transmission loss equation is:

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

where

TL is the transmission loss in dB,

R_1 is the distance of the modeled sound pressure level (SPL) from the driven pile, and

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

The degree to which underwater noise propagates away from a noise source is dependent on a variety of factors, most notably by bathymetry and presence or absence of reflective or absorptive conditions including the sea surface and sediment type. The TL model described above was used to calculate the expected noise propagation from both impact and vibratory pile driving, using representative source levels to estimate the zone of influence (ZOI) or area exceeding the noise criteria. The extent of a representative ZOI is depicted in Figures 6-1 through 6-6 for NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, NAVBASE Kitsap Manchester, and NAVSTA Everett, respectively. At each structure depicted, at least one point representing a pile furthest from the shore was chosen to illustrate the maximum ZOI that would be produced from pile driving at a structure.

6.7.2 Underwater Noise from Pile Driving

The intensity of pile driving sound is greatly influenced by factors such as the type of piles, type of driver, and the physical environment in which the activity takes place. To determine reasonable sound pressure levels from pile driving, studies with similar properties to the Proposed Action were evaluated. Data from prior pile driving projects at the NAVBASE Kitsap Bangor and Bremerton waterfronts were reviewed in the analysis. The evaluation is presented in Appendix B and the representative sound pressure levels used in the analysis are presented in Table 6-4.

For the analyses that follow, the TL model described above was used to calculate the expected noise propagation from pile driving and DTH drilling. For behavioral zones and peak injury zones, a representative source level (Table 6-4) was use to estimate the area exceeding the noise criteria. For vibratory pile driving distances to the PTS thresholds, the TL model described above incorporated the auditory weighting functions for each hearing group using a single frequency as described in the NMFS Spreadsheet (NMFS, 2018b). For impact pile driving and DTH drilling distances to the PTS thresholds for 24-in and 36-in steel pile and 24-in concrete pile, the TL model described above incorporated frequency weighting adjustments by applying the auditory weighting function over the entire one-second SEL spectral data sets from impact pile driving. If a source level for a particular pile size was not available, the next highest source level was used to produce a conservative estimate of areas above threshold values.

A bubble curtain will be used to minimize the noise generated by impact driving steel pipe piles. The bubble curtain is expected to attenuate impact pile driving sound levels an average of 8 dB (Navy 2015d); therefore, 8 dB was subtracted from the peak and RMS values in Table 6-4 prior to modeling the behavioral and peak PTS thresholds for impact pile driving steel pipe piles. For the cumulative SEL PTS thresholds, auditory weighting functions were applied to the attenuated one-second SEL spectra for steel pipe piles. If a new method of sound attenuation is developed that has demonstrated an average of at least 8 dB of attenuation, then this method could be employed instead of a bubble curtain for driving steel pile.

Because impact driving of concrete piles, has a less impulsive waveform, lower SPLs, and lower sound exposure levels than impact driving steel piles, bubble curtains are not proposed for concrete and are not required as an additional measure to reduce noise impacts to ESA-listed species, including ESA-listed

Table 6-4. Underwater Noise Source Levels Modeled for Impact and Vibratory Pile Driving

<table>
<tr><th>Pile Driving Method</th><th>Pile Type</th><th>Pile Diameter (inches)</th><th>RMS² (dB re 1 μPa)</th><th>Peak² (dB re 1 μPa)</th><th>SEL² (dB re 1 μPa²•sec)</th></tr>
<tr><td rowspan="4">Impact Installation[1]</td><td rowspan="2">Concrete</td><td>18 (Square)</td><td>170</td><td>184</td><td>159</td></tr>
<tr><td>24</td><td>174</td><td>188</td><td>164</td></tr>
<tr><td rowspan="2">Steel Pipe</td><td>12</td><td>177</td><td>192</td><td>167</td></tr>
<tr><td>36</td><td>194 (Bangor only)</td><td>211</td><td>181 (Bangor only)</td></tr>
<tr><td rowspan="4">Vibratory Installation and Extraction[3]</td><td>Timber</td><td>13</td><td>161</td><td>N/A</td><td>N/A</td></tr>
<tr><td rowspan="3">Steel pipe</td><td>12</td><td>153</td><td>N/A</td><td>N/A</td></tr>
<tr><td>24</td><td>161</td><td>N/A</td><td>N/A</td></tr>
<tr><td>36</td><td>166 (Bangor only)</td><td>N/A</td><td>N/A</td></tr>
<tr><td rowspan="2">Down the Hole (Drilling and Impact)[4]</td><td>Concrete (Impulse)</td><td>24</td><td>N/A</td><td>184</td><td>159</td></tr>
<tr><td>Concrete (Continuous)</td><td>24</td><td>167</td><td>N/A</td><td>N/A</td></tr>
</table>

Source: Navy, 2015d (in Appendix B), 12-in steel impact sound levels from ICF Jones & Stokes, & Illingworth & Rodkin, 2012, and 24-in concrete from Navy, 2016c. 18-in concrete square pile sound levels are from 16- and 24-in steel piles (Navy 2015d). Timber extraction levels from Greenbusch Group Inc, 2019.
Key: N/A = not applicable; RMS = root mean square; SEL = sound exposure level
Notes:
1. Peak and RMS values modeled for impact driving 24-in, 30-in, and 36-in steel piles will be reduced by 8 dB for noise exposure modeling to account for attenuation from a bubble curtain (Navy, 2015d).
2. Sound pressure levels are presented for a distance of 10 m from the pile. RMS and Peak levels are relative to 1 μPa and cumulative SEL levels are relative to 1 μPa^2•sec
3. Vibratory extraction source level assumed to be the same as vibratory installation source level.
4. National Marine Fisheries Service: Acoustic Guidance for Assessment of Down the Hole (DTH) Systems. November 2022. 5 pp.

marine mammals. Additionally, vibratory pile driving sound levels can be 20 to 30 or more decibels lower than impact driving sound levels and do not produce high peak amplitudes with fast rise times typical of steel pile driving. Therefore, bubble curtains are not used for vibratory pile driving.

Calculated distances to the underwater marine mammal thresholds during impact pile driving and DTH drilling for the various hearing groups are provided in Table 6-5 and distances to the Peak PTS onset thresholds are provided in Table 6-6. Calculated distances to the underwater marine mammal thresholds during vibratory driving and DTH drilling are provided in Table 6-7. Adjusted maximum distances are provided where the extent of noise reaches land prior to reaching the calculated radial distance to the threshold. Areas encompassed within the threshold (zone of influence, or ZOI) were calculated using the location of a representative pile that might be driven at one or more structures at each installation. Pile locations were chosen to model the greatest possible affected areas at each installation; typically these locations would be at the seaward end of a pier that extends the farthest into the marine environment or is close to a known pinniped haulout site. Figures 6-1 through 6-5 illustrate the extent and area of each ZOI for a pile representing the worst-case extent of noise propagation (furthest from the shore) for at least one structure at each installation. Distances to certain thresholds are not depicted in these figures if they are smaller than the "worst-case scenario.

6.8 Airborne Sound Propagation

Pile driving can generate airborne noise that could potentially result in disturbance to marine mammals (pinnipeds) that are hauled out or at the water's surface. As a result, the Navy analyzed the potential for pinnipeds hauled out or swimming at the surface to be exposed to airborne sound pressure levels that could result in Level B behavioral harassment. The airborne noise threshold for behavioral harassment for all pinnipeds, except harbor seals, is 100 dB RMS re 20 µPa (unweighted) and for harbor seals is 90 dB RMS re 20 µPa (unweighted) (see Table 6-3). Construction noise behaves as point-source and, thus, propagates in a spherical manner with a 6 dB decrease in sound pressure level over water ("hard-site" condition) per doubling of distance (Washington State Department of Transportation, 2015). A spherical spreading loss model, assuming average atmospheric conditions, was used to estimate the distance to the 100 dB and 90 dB RMS re 20 µPa (unweighted) airborne thresholds. The transmission loss equation is:

$$TL = 20\log_{10}\left(\frac{R_1}{R_2}\right)$$

where

TL is the transmission loss in dB,

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

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

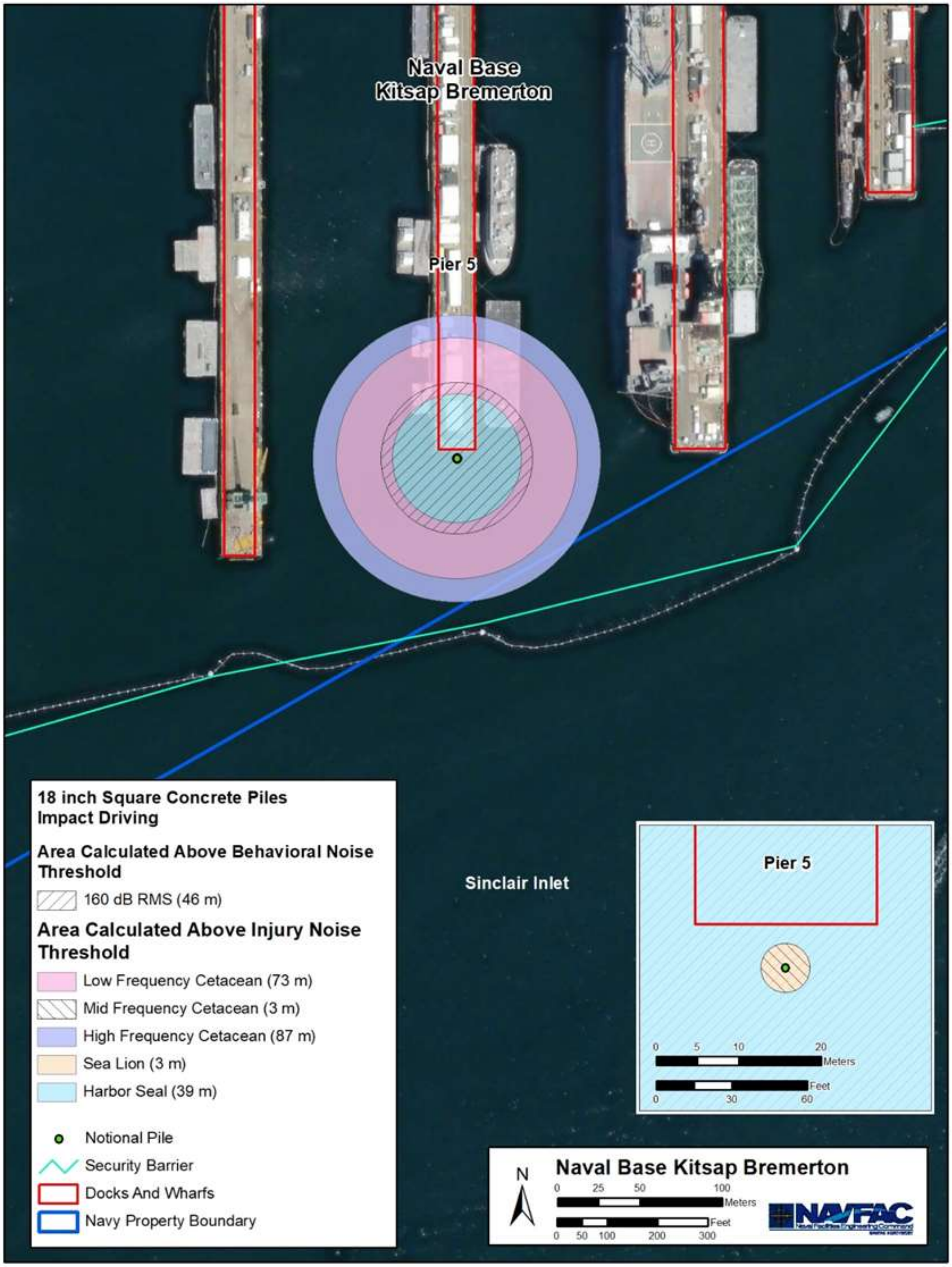

Figure 6-1. Representative Zones of Influence for Pile Driving Noise at NAVBASE Kitsap Bremerton Pier 5, Impact Installation of 18 in Concrete Piles During the Period of July 2024 to July 2025

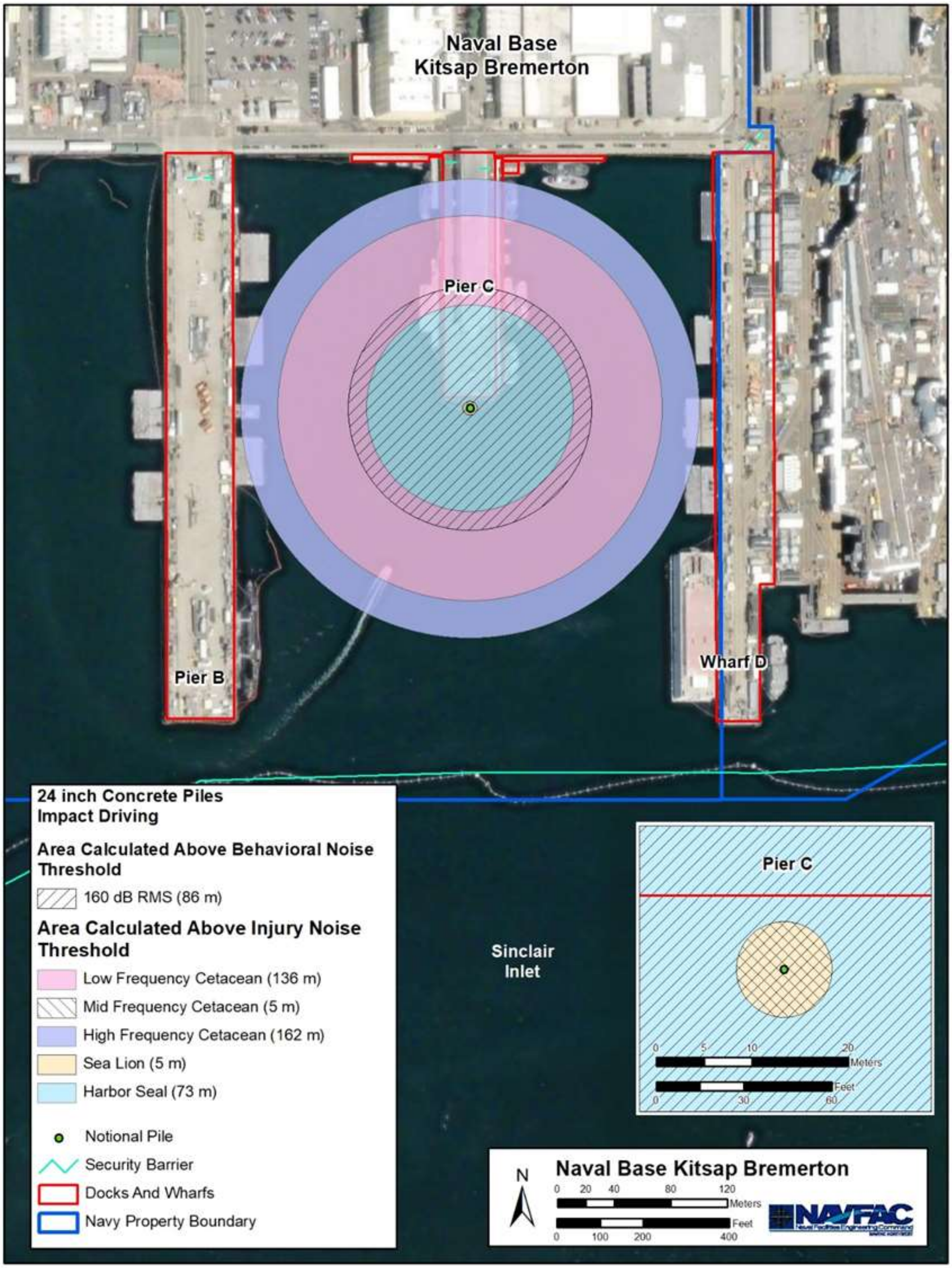

Figure 6-2. Representative Zones of Influence for Pile Driving Noise at NAVBASE Kitsap Bremerton Pier C, Impact Installation of 24 in Concrete Piles During the Period of July 2024 to July 2025

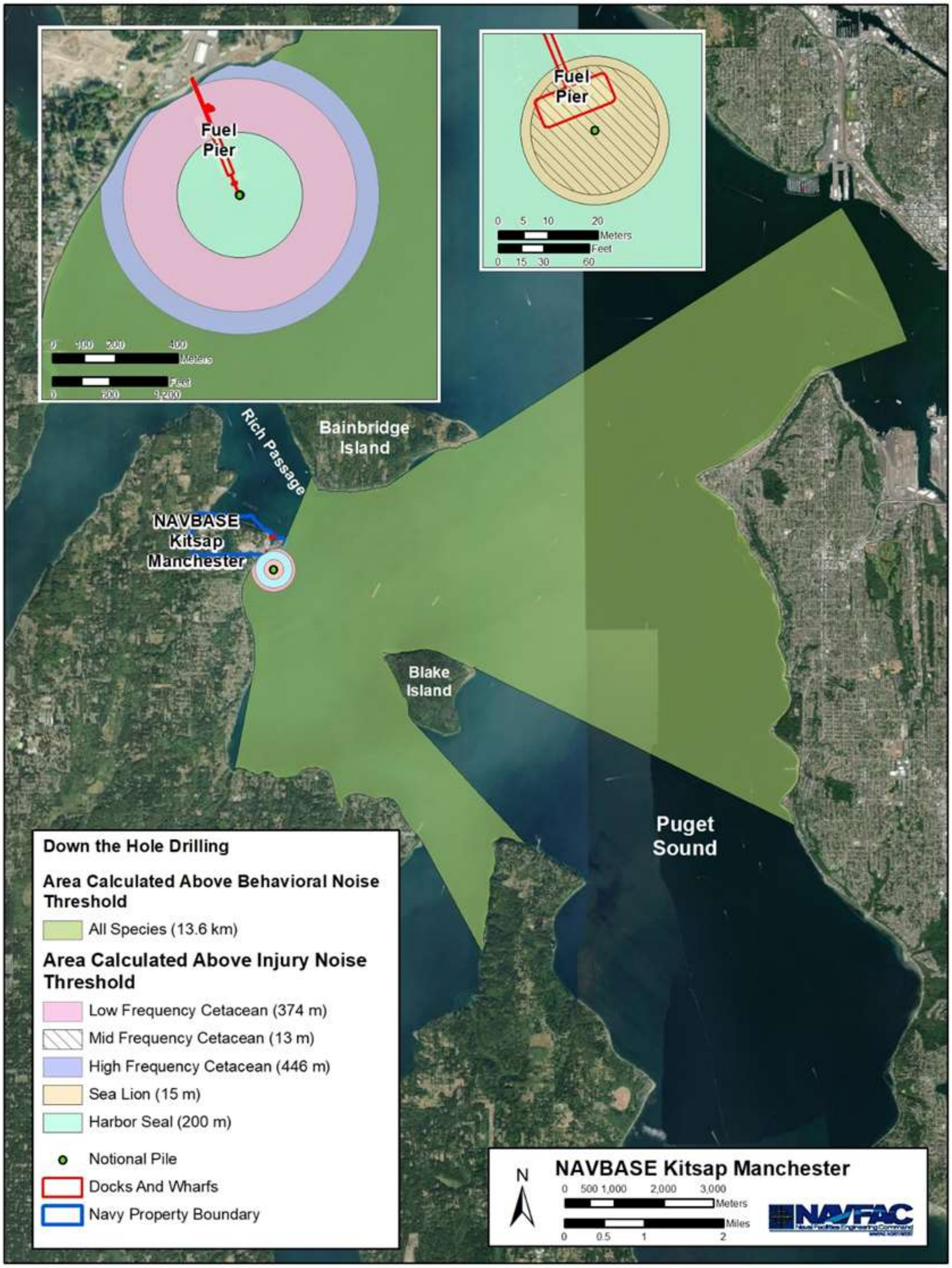

Figure 6-3. Representative Zones of Influence for Pile Driving Noise at NAVBASE Kitsap Manchester, Installation of 24 in Concrete Piles Using "Down the Hole" Drilling or Impact Driving During the Period of July 2024 to July 2025

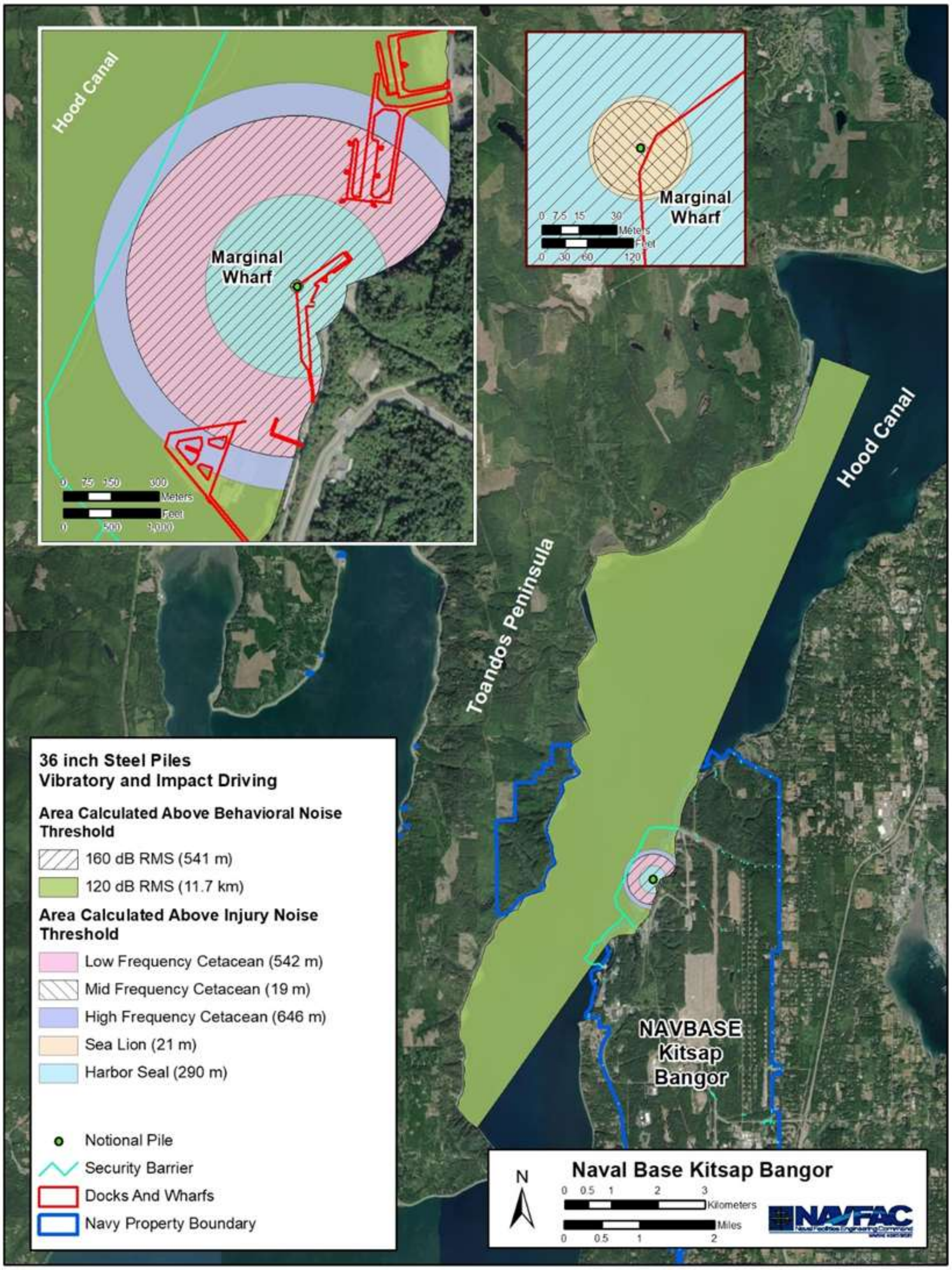

Figure 6-4. Representative Zones of Influence for Pile Driving Noise at NAVBASE Kitsap Bangor, Removal of 36 in Steel Piles (Cut or Pull) and Installation of 36 in Steel Piles (Vibratory and Impact) During the Period of July 2025 to July 2026

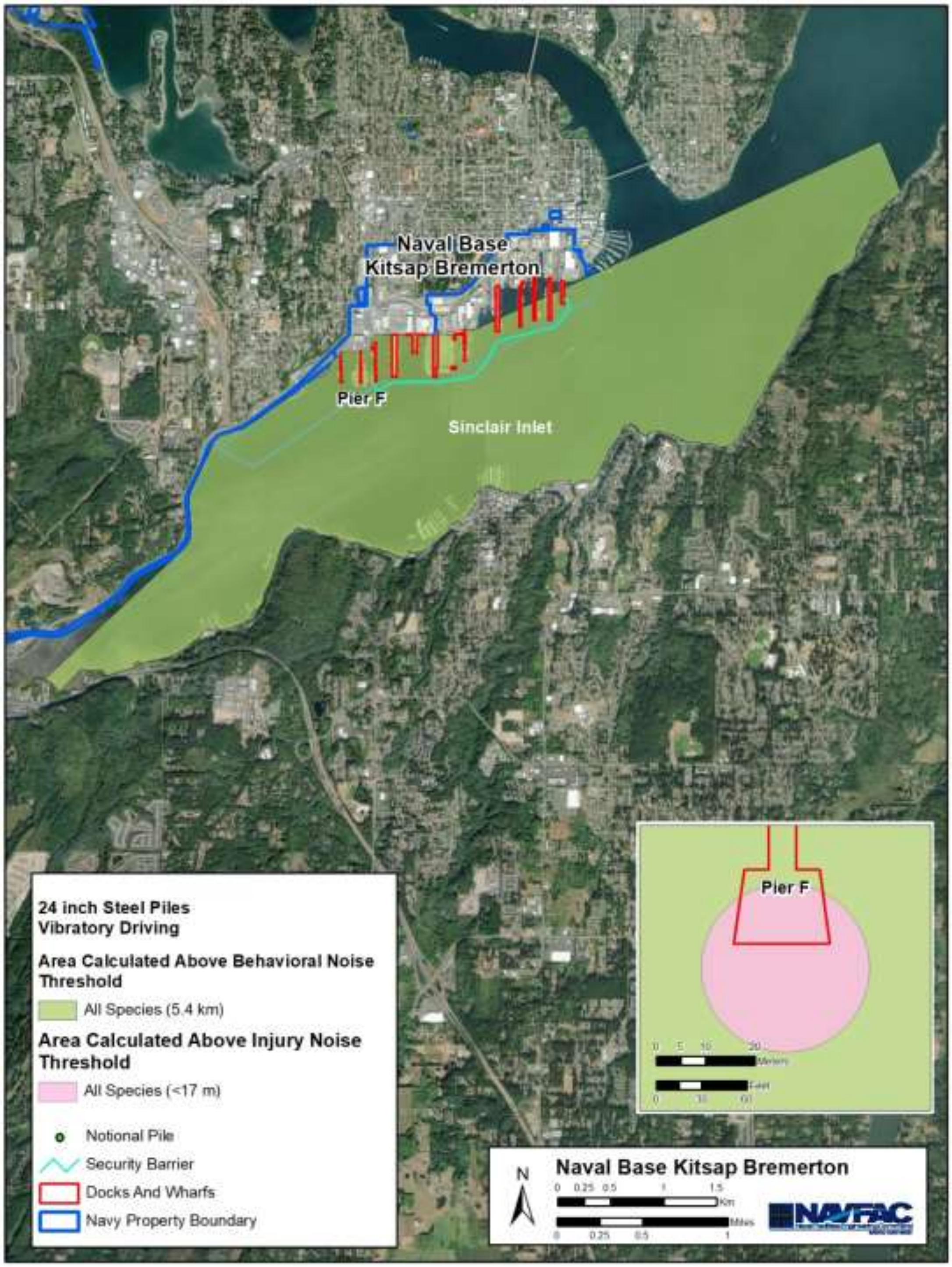

Figure 6-5. Representative Zones of Influence for Pile Driving Noise at NAVBASE Kitsap Bremerton Pier F, Vibratory Removal of 24 in Steel Piles and Vibratory Installation of 24 in Steel Fender Piles During the Period of July 2025 to July 2026

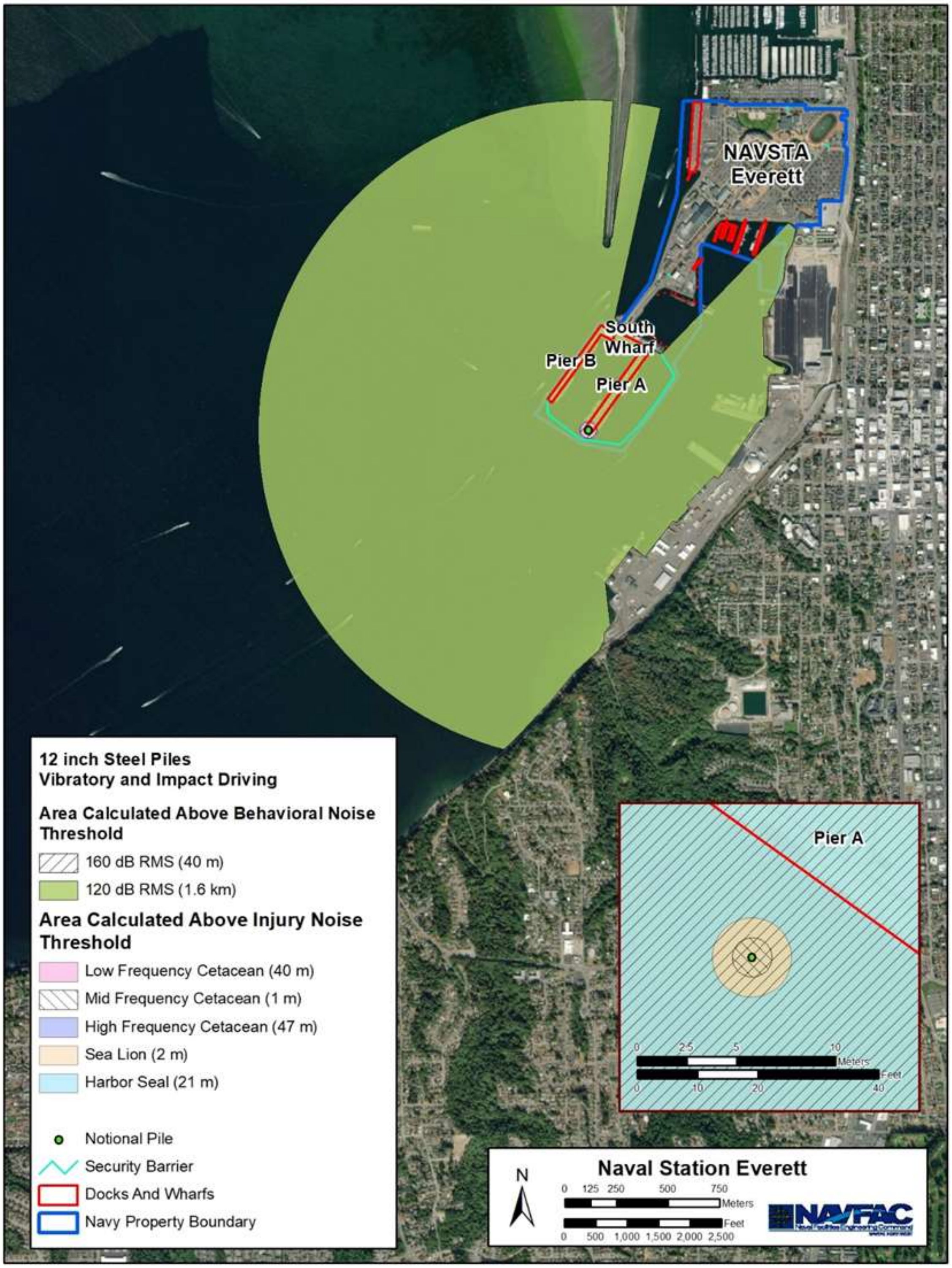

Figure 6-6. Representative Zones of Influence for Pile Driving Noise at NAVSTA Everett Pier A, Vibratory Removal of 12 in Steel Piles and Installation of 12 in Steel Piles (Impact or Vibratory) During the Period of July 2025 to July 2026

Table 6-5. Calculated Radial Distance(s) to Underwater Marine Mammal Impact Or Impulsive Pile Driving Noise Thresholds and Areas Encompassed Within Threshold Distance[1]

Pile Size and Type	*Injury (PTS Onset) Level A Pinnipeds[2]*		*Injury (PTS Onset) Level A Cetaceans[2]*			*Behavioral Disturbance Level B (160 dB RMS)[3]*	
	PW	OW	LF	MF	HF	*Radial Distance to Threshold*	*Area Encompassed by Threshold[4]*
18-in concrete[5]	39 m	3 m	73 m	3 m	87 m	46 m	0.007 km^2
24-in concrete[5]	73 m	5 m	136 m	5 m	162 m	86 m	0.02 km^2
24-in DTH drilling[6]	200 m	15 m	374 m	13 m	446 m	N/A	N/A
12-in steel	21 m	2 m	40 m	1 m	47 m	40 m	0.05 km^2
36-in steel[7]	290 m	21 m	542 m	19 m	646 m	541 m	0.7 km^2

Key: HF = high frequency cetacean, km = kilometer; LF = low frequency cetacean; m = meter; MF = mid- frequency cetacean, OW= otariid (sea lion); PTS = permanent threshold shift; PW = phocid (harbor seal);

The DTH Vibratory is used for the Level B behavioral harassment zones and DTH drilling Impulse is used for Level A injury zone.

Notes:

1. Calculations based on SEL_{CUM} threshold criteria shown in Table 6-3 and source levels shown in Table 6-4. Threshold distances and ensonified areas calculated for representative piles located at seaward ends of wharfs, intended to model a conservative scenario for pile driving at each MPR location.
2. Representative spectra were used to calculate the distances to the injury (PTS onset) thresholds for each functional hearing group for 24-in, and 36-in steel pile, and 24-in concrete pile.
3. Distances to behavioral disturbance thresholds calculated using practical spreading loss model.
4. Areas were adjusted wherever land masses are encountered prior to reaching the full extent of the radius around the driven pile.
5. Assumes 4000 strikes/day. No bubble curtain proposed for concrete pile.
6. For DTH drilling, assumes two piles per day.
7. Assumes 1000 strikes/day. Bubble curtain will be used for 12-in and 36-in steel piles at NAVBASE Bangor and NAVSTA Everett. Where bubble curtain used, 8 dB attenuation assumed. Steel piles will not be installed at Manchester.

Table 6-6. Calculated Radial Distance(s) to Underwater Marine Mammal Impact Pile Driving—Peak PTS Thresholds[1]

Pile Size and Type	Injury (PTS Onset) Level A Pinnipeds[2] (m)		Injury (PTS Onset) Level A Cetaceans[2] (m)		
	PW	OW	LF	MF	HF
24-in concrete	0	0	0	0	1
24-in concrete (DTH)	0	0	0	0	1
12 in steel	0	0	0	0	1
24-in steel[3]	1	0	1	0	10
30-in steel[3]	2	0	2	0	25
36-in steel[3]	1	0	1	0	12

Key: BC = bubble curtain); HF = high frequency cetacean, LF = low frequency cetacean; m = meter; MF = mid-frequency cetacean, No BC = no bubble curtain; OW= otariid (sea lion); PTS = permanent threshold shift; PW = phocid (harbor seal)

Notes:

1. Calculations based on Peak threshold criteria shown in Table 6-3 and source levels in Table 6-4. Distances to peak PTS thresholds calculated using practical spreading loss model.
2. Frequency spectrum information required for Level A analysis for these pile types was not available. The zones would be smaller than the smallest zones calculated for 18-in concrete, which is the smallest non-steel pile type that was analyzed for Level A threshold distances.
3. Bubble curtain will be used for steel piles at NAVBASE Bangor and NAVSTA Everett and; therefore, 8 dB attenuation assumed. Down the hole drilling will be conducted at NAVBASE Manchester.

Table 6-7. Calculated Radial Distance(s) to Underwater Marine Mammal Vibratory Pile Driving Noise Thresholds and Areas Encompassed Within Threshold Distance[1]

Pile Size and Type	*Injury (PTS Onset) Level A*					*Behavioral Disturbance Level B (120 dB RMS)[3]*	
	Pinnipeds[2]		*Cetaceans[2]*			*Radial Distance to Threshold*	*Area Encompassed by Threshold[4]*
	PW	OW	LF	MF	HF		
13-in timber[5]	5 m	<1 m	9 m	<1 m	13 m	5.4 km	16.0 km
12-in steel	1 m	<1 m	1 m	<1 m	2 m	1.6 km	8.0 km
24-in steel[5]	5 m	1 m	9 m	1 m	13 m	5.4 km	16.0 km
24-in (DTH drilling)	N/A	N/A	N/A	N/A	N/A	13.6 km	75.8 km (Manchester)
36-in steel	15 m	1 m	25 m	2 m	37 m	11.7 km	31.0 km

Key: HF = high frequency cetacean; km = kilometer; LF = low frequency cetacean; m = meter; MF = mid- frequency cetacean, OW= otariid (sea lion); PTS = permanent threshold shift; PW = phocid (harbor seal).

The DTH drilling Vibratory is used for the Level B behavioral harassment zones and DTH drilling Impulse is used for Level A injury zone (NMFS, 2022).

Notes:

1. Calculations based on threshold criteria shown in Table 6-3. Threshold distances and ensonified areas calculated for representative piles located at seaward ends of wharfs, intended to model a conservative scenario for pile driving at each MPR location.
2. Distances to the injury (PTS onset) thresholds calculated using NOAA calculator with default Weighting Factor Adjustment of 2.5 (NOAA 2016. http://www.nmfs.noaa.gov/pr/acoustics/guidelines.htm). WFA = 2.5.
3. Distances to the behavioral disturbance thresholds calculated using practical spreading loss model.
4. Areas were adjusted wherever land masses are encountered prior to reaching the full extent of the radius around the driven pile.
5. Removal may also occur by pulling and would not use the vibratory method.

The intensity of pile driving sounds is greatly influenced by factors such as the type of piles, hammers, and the physical environment in which the activity takes place. To determine reasonable airborne source sound pressure levels, source levels were chosen based on a review of available pile driving in-situ recordings (see analysis in Appendix B). Available data were limited to concrete and steel pile installation (Table 6-8). The level of airborne noise from impact or vibratory pile driving of other pile types is anticipated to be quieter than the levels presented in Table 6-8.

Table 6-8. Airborne Sound Levels from Impact and Vibratory Pile Driving (dB)

Pile Type	Size (diameter in inches)	Installation Method	
		Impact RMS L_{max} Impact	Vibratory RMS L_{eq} Vibratory
Concrete	24	109	N/A
Steel	12	110	88
	24	110[2]	92[2]
	36	112	95

Source: Navy, 2015d in Appendix B; Navy, 2016b
Key: L_{eq} = equivalent sound level; L_{max} = maximum sound level; N/A = not available
Notes: All values relative to 20 µPa and at 15 m (50 ft) from pile. All values unweighted.

1. Data not available for this pile size. Source level assumed to be equivalent to next larger size pile.
2. Limited data set.
3. Data not available. Source level assumed to be equivalent to 24-in steel pile

The distances to the airborne harassment thresholds were calculated for steel pile impact and vibratory driving and concrete pile driving with the airborne transmission loss formula. The distances to the pinniped airborne noise thresholds produced by the loudest pile installation method (impact installation of 36-in steel pipe), are shown in Table 6-9. Because these areas are smaller than the underwater behavioral threshold zones, a separate analysis of Level B take was not conducted for the airborne zones. Animals in the airborne zones would already have been exposed within a Level B underwater zone; therefore, no additional takes due to exposure to airborne noise are requested.

Table 6-9. Calculated and Measured Distances to Pinniped Behavioral Airborne Noise Thresholds

Installation Method	*Pile Size and Type*	*Harbor Seal Threshold = 90 dB RMS*	*California Sea Lions and Steller Sea lions Thresholds = 100 dB RMS*
Impact	12-in steel	150 m	47 m
	18-24-in concrete	134 m	42 m
	36-in steel	189 m	60 m
Vibratory	36-in steel	Measured mean[1] = 33 m (51 m max) Calculated[2] = 27 m	Measured mean[1] = 10 m (16 m max) Calculated[2] = 8 m

Notes:

1. Measured during EHW-2 construction, Illingworth & Rodkin, 2012
2. Calculated using spherical spreading model

6.9 Estimated Duration of Pile Driving

Each project's pile driving daily duration will vary by the size and complexity of the project, the types of piles installed, the number of piles to be installed (Tables 6-10 and 6-11), and the need to move barges or equipment. For example, a project that requires structural pile repairs beneath an existing structure at multiple locations would be expected to conduct pile driving much slower than a fender pile replacement where all piles are located on the exterior of a structure, are not load bearing, and are lined up in a row. For many projects the design details are not known; thus, it is not possible to state the number of pile driving days that will be required. Days of pile driving at each site were based on the estimated work days using a slow production rate (e.g., providing the maximum number of potential exposures): an average production rate of 4-6 piles per day for fender pile replacement. Note that this is not meant to indicate these rates are planned production rates. The rates are used solely to assess the number of days pile driving could occur if production was delayed due to equipment failure, safety, etc. In a real construction situation, pile driving production rates would be maximized when possible.

Table 6.10. Year 1 –July 2024 to July 2025 Summary of the Number of Pile Removals and Installations

Pile Type/Size	*Activity*	*Bangor*	*Bremerton*	*Manchester*	*Everett*
Removal					
Timber 13 in (Fender Pile)	Vibratory		25 (Piers C)		
Timber 13 in	Pull or Cut		53 (Piers 5)		
Steel 26-in	Pull or Cut			72 (Fuel Pier)	
Installation					
Concrete 18-in	Vibratory		65 (Pier 5)		
Concrete 24-in (Fender Pile)	Impact		25 (Pier C)		
Concrete 24-in	Down the Hole Drilling			74 (Fuel Pier)	

Table 6.11. Year 2 - July 2025 to July 2026 Summary of the Number of Pile Removals and Installations

Pile Size	*Activity*	*Bangor*	*Bremerton*	*Manchester*	*Everett*
Removal					
Steel 12 in	Vibratory[1]				4 (Pier A)
Steel 24 in (Fender Pile)	Pull or Vibratory		48 (Pier F)		
Steel 36 in (Fender Pile)	Cut, Pull or Vibratory	78 (Marginal Wharf)			
Installation					
Steel 12 in	Vibratory/Impact				4 (Pier A)
Steel 24 in (Fender Pile)	Vibratory		48 (Pier F)		
Steel 36 in (Fender Pile)	Continuous and Impulse	78 (Marginal Wharf)			

Table 6-12 is a conservative estimate of pile driving days at each installation over the duration of the one-year MPR IHA based on the assumption that pile driving rates would be relatively slow. Actual daily production rates may be higher, resulting in fewer actual pile driving days. Pile driving days indicated in Table 6-12 include both removal of existing piles and installation of new piles.

To provide a general estimate of pile driving daily durations, information from past projects was reviewed. The estimated duration of impact and vibratory pile installation is summarized in Table 6-9. Navy geotechnical and engineering staff used data from a large wharf construction project in Hood Canal to estimate pile driving time and strikes needed to install steel piles using diesel hammers.

Table 6-12. Estimated Number of Pile Driving Days For Removal and Installation at MPR Installations During Each One-Year IHA*

	Bangor	*Bremerton*	*Manchester*	*Everett*
July 2024-July 2025				
Total Pile Driving Days		31	37	
July 2025-July 2026				
Total Pile Driving Days	36	24		8

Note:

Most removals are vibratory; however, removal methods may vary by installation, using vibratory, pull, or cut. Pull or cut would decrease the number of monitored pile driving days.

Pile driving days represent an average per day but production rates may be higher; therefore, decreasing the number of days of pile driving. In addition, pile driving days may be combined with vibratory followed by impact driving on the same piles.

To provide a general estimate of pile driving daily durations, information from past projects was reviewed and current information from Navy engineers and contractors. The estimated duration of impact and vibratory pile installation is summarized in Table 6-9. Navy geotechnical and engineering staff used data from a large wharf construction project in Hood Canal to estimate pile driving time and strikes needed to install steel piles using diesel hammers. Vibratory installation was estimated to take a median time of 10 minutes per pile with 45 minutes estimated as a maximum.[3] For steel piles that are "proofed" a median of 14 minutes per pile (approximately 600 strikes) was estimated.[4] However, not all projects will require proofing every pile. Some projects will require only a subset of piles be proofed and some projects, such as those installing fender piles, may not require any proofing because the structure is not load bearing. Other piles may encounter difficult substrate and need to be advanced further with an impact driver. For piles that cannot be advanced with a vibratory driver, less than 30 minutes of impact driving (approximately 1,300 strikes) was conservatively estimated to complete installation.[5] This estimate would account for approximately 6 steel piles installed with a median time of 14 minutes per pile (~1.5 hours of drive time) or 3 steel piles needing extended driving. Actual driving duration at any of the project sites will vary due to substrate conditions and the type and energy of impact hammers. For example, at EHW-1 at NAVBASE Kitsap Bangor, where most of the steel pile work will occur, four piles were installed with a vibratory driver and impact proofing in 61 minutes total (vibratory and impact driving) with an average of 172 strikes/pile.[6] Additionally, some of the anticipated pile driving is contingent on emergent needs or emergencies that could potentially never occur. Therefore, estimates of marine mammal exposure based on the maximum strike numbers would be too conservative for this

[3] Based on data from 809 piles installed with a vibratory driver at EHW-2, NAVBASE Kitsap Bangor. The 95th percentile installation time was 44 minutes/pile.

[4] Based on data from 501 piles installed at EHW-2, the median was 14 minutes/pile and the 95th percentile was 26 minutes/pile. Strike number estimates assumed an average estimated strike rate of 44 strikes per minute (or almost a strike every second and a half) rounded up from 3,960.

[5] Based on data from 501 piles installed at EHW-2, the median was 14 minutes/pile and the 95th percentile was 26 minutes/pile. Strike number estimates assumed an average estimated strike rate of 44 strikes per minute (or almost a strike every second and a half) rounded up from 3,960.

[6] Data from NAVBASE Kitsap Bangor, EHW-1 Bent 27 repairs, August 2015.

one-year programmatic analysis of all potential project sites. Therefore, Table 6-13 presents an estimated average strikes per day that is used in the exposure analysis.

Estimates of concrete pile impact driving durations are based on Pier B and Pier 6 data at NAVBASE Kitsap Bremerton for the installation of fender piles. Drive time durations from Pier B were estimated based on pile driving logs from installation of 18-in square, 20-in square, and 24-in octagonal piles. At Pier B, a maximum of 11 piles were installed per day (average 6.3 piles/day) with a maximum drive time per day of 3 hours and 38 minutes (average 89 minutes/day). For this analysis we estimated that the maximum number of piles installed per day would be up to 11 with a drive time of up to 4 hours per day. Strikes per piles were calculated at 544 based on Pier B data where the average impact time per pile was 14.2 minutes and the average strike rate was 38.5 strikes/minute (14.2 minutes/pile × 38.3 strikes/minute = 547 strikes/pile). Only strike numbers were available from 10 concrete piles at Pier 6. Strike numbers were considerably less than at Pier B and only ranged from 10 to 218 per pile with an average of 125 strikes per pile. Therefore, the numbers presented in Table 6-9 will likely overestimate strike numbers for some projects. Because substrate conditions vary at each project site and the type and energy of impact hammers will likely vary, the strike number and strike rate estimates will vary between project sites. For purposes of analysis, impact pile driving of concrete piles is estimated to take a maximum of 4 hours or an average of 1.5 hours in a day.

Table 6-13. Pile Driving Duration Summary

Installation Method and Pile Type and Size	*Installation Rate for Replacement Piles*	*Estimated Duration*				
		Median/ Pile[1]	*Maximum/ Pile*[2]	*Daily Time*[3]	*MPR Estimated Average Strikes/Day*	*MPR Estimated Maximum Strikes/Day*
Vibratory Timber 13-in (Removal)	Mean of 6 piles per day (Up to 10 piles/day)	10 minutes	45 minutes	60-100 Minutes	N/A	N/A
Impact steel 12-in	Up to two piles per day	No data	No data	No data	<<1,000	<<1,000
Impact concrete 24-in	4 piles/day	—	4 hours	3 minutes to 4 hours[4]	2,000[5]	6,000[5]
Vibratory steel 12in	Up to 2 piles/day	10 minutes	30 minutes	20 to 60 minutes[6]	N/A	N/A
Vibratory steel 24 in	1 to 6 piles/day	10 minutes	45 minutes	10 minutes to 4.5 hours[7]	N/A	N/A
Vibratory steel 36-in	4 piles/day	10 minutes	45 minutes	40 minutes to 3 hours	N/A	N/A
Impact steel 36-in	4 piles/day	14 minutes	26 minutes	60 minutes	2,000	2,000
Down the Hole Drilling[8]	1-2 piles/day	9-72 minutes	72 minutes	18 minutes to 2.4 hours	12 Hz	N/A

Note: Pile driving duration and/or number of strikes presented are based on past monitoring but will vary for the proposed pile driving based on the locations, substrate, and type and size of piles. Number of piles per day and strikes for impact driving were provided by construction engineers

Key: in = inch; N/A = not applicable; "—" = not calculated

1. Median based on data from 501 piles installed at EHW-2.
2. Maximum based on data from 501 piles installed at EHW-2.
3. Daily minimum based on data from 4 piles installed at NAVBASE Kitsap Bangor, EHW-1 Bent 27 repairs, August 2015. Maximum assumes 6 piles each taking ~14 minutes to install or 3 piles advanced through difficult substrate taking ~30 minutes each.
4. Minimum daily time based on 10 piles installed at NAVBASE Kitsap Bremerton Pier 6, September 2015. Maximum daily time based on data from 272 piles installed at NAVBASE Kitsap Bremerton Pier B.
5. Estimates based on data from 272 piles installed at NAVBASE Kitsap Bremerton Pier B.
6. Data from NAVBASE Kitsap Bremerton, Piers 5 and 6, fender pile installation, n = 70 piles.
7. Maximum duration assumes 6 piles advanced at rate of 45 minutes/pile, based on data from 809 piles installed with a vibratory driver at EHW-2, NAVBASE Kitsap Bangor.
8. Reyff & Ambaskar, 2023.

6.10 Evaluation of Potential Species Presence

In prior Navy applications, either density data from the Navy's Marine Mammal Species Density Database (NMSDD) (Navy, 2019) or site-specific survey information has been used to quantify take. However, as described in Section 3.1, using a density based analysis for species that occur intermittently does not adequately account for their unique temporal and spatial distributions.[7] For intermittently occurring species, historical occurrence and numbers as well as group size were reviewed to develop a realistic estimate of potential exposure. Therefore, potential exposure estimates in this application for species without a predictable occurrence are based on a historical likelihood of encounter. The following species were in this category for all installations in Puget Sound (Table 6-14): Humpback whale, minke whale, gray whale, transient killer whale, Southern Resident killer whale, Dall's porpoise in Hood Canal, and elephant seal.

Table 6-14. Evaluation Method for Potential Marine Mammal Species at Installations

Installation	***Species***	***Analysis Method***
NAVBASE Kitsap Bangor	Humpback whale, minke whale, gray whale, transient killer whale, Southern Resident killer whale, Dall's porpoise, and elephant seal	Historical occurrence
	Harbor porpoise	Density[1]
	California sea lion, Steller sea lion, harbor seal	Installation-specific abundance[2]
NAVBASE Kitsap Bremerton	Humpback whale, minke whale, gray whale, transient killer whale, Southern Resident killer whale, harbor porpoise, **Dall's porpoise,** Steller sea lion, and elephant seal	Historical occurrence
	Harbor porpoise, Steller sea lion	Density[1]
	California sea lion, harbor seal	Installation-specific abundance[2]
Manchester	Humpback whale, minke whale, gray whale, transient killer whale, Southern Resident killer whale, elephant seal, and Dall's porpoise,	Historical occurrence[1]
	Harbor porpoise, Steller sea lion, harbor seal	Density[1]
	California sea lion, harbor seals (nearshore)	Installation-specific abundance[2]
NAVSTA Everett	Humpback whale, minke whale, gray whale, transient killer whale, Southern Resident killer whale, and elephant seal, Dall's porpoise	Historical occurrence
	Harbor porpoise	Density[1]
	California sea lion, harbor seal, Steller sea lion	Installation-specific abundance[2]

[1] U.S. Navy Marine Species Density Database Phase III for the Northwest Training and Testing Study Area (Navy, 2019)
[2] Summary Of Weekly Marine Mammal Surveys At Navy Region Northwest Installations: 2008-2022 (Navy, 2023)

For species with more frequent occurrence, but no site-specific surveys at MPR installations (Table 6-14), density estimates in inland waters (Navy, 2019) were used for quantification of potential exposure for large monitoring zones for vibratory driving (greater than 1,000 meters). These species include harbor porpoise, Dall's porpoise, Steller sea lion, California sea lion, and harbor seal, except as noted in the below.

[7] Previously a density based exposure analysis was required for these species. The analyses often resulted in zero exposure estimates. Therefore, to obtain IHA coverage for potential exposure to these animals, the Navy would typically augmented the requested take by the typical group size of animals. NMFS has subsequently requested that future Navy IHA applications for Puget Sound do not use a density estimate for marine mammal species with a low likelihood of occurrence.

Long-term monitoring data are available for pinniped species (California sea lion, Steller sea lion, and harbor seal) at several installations, resulting in data on installation-specific abundances. As discussed in detail in Section 3.1, these abundances were used to calculate potential exposure within 1,000 meters of the monitored installations (Table 6-14) (Appendix C).

6.11 Estimating Potential Level B Harassment Exposures

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

Pinnipeds (seals and sea lions) spend significant amounts of time out of the water during breeding, molting, and hauling out periods. In the water, pinnipeds spend varying amounts of time underwater. California sea lions are known to rest at the surface in large groups for long amounts of time. When not actively diving, pinnipeds at the surface often orient their bodies vertically in the water column and hold their heads above the water surface. Consequently, pinnipeds may not be exposed to underwater sounds to the same extent as cetaceans.

For the purpose of assessing impacts from underwater sound, the Navy assumed that all cetacean and pinniped species spend 100 percent of their time underwater. This approach is conservative because pinnipeds spend a portion of their time hauled out and, therefore, are expected to be exposed to less sound than is estimated by this approach.

To quantitatively assess exposure of marine mammals to noise levels from pile driving over the NMFS threshold guidance, one of three methods were used depending on the species spatial and temporal occurrence. For species with rare or infrequent occurrence during the in-water work window, the likelihood of occurrence was reviewed based on the information in Chapter 3 and the potential maximum duration of work days at each installation and total work days for all installations. Based on this review, none of the species in this category are anticipated to linger for multiple days. Therefore, for species in this category the duration of occurrence was set to 2 days, equivalent to a transit by a project site going one direction and then back. The calculation for species with rare or infrequent occurrence was:

(1) Exposure estimate = Probable abundance during construction × Probable duration

Where:

Probable abundance = maximum expected group size or number per day.

Probable duration = probable duration of animal(s) presence at construction sites during in-water work window.

For species that regularly occur in Puget Sound, but do not have site-specific abundances, marine mammal density estimates were used to determine the number of animals potentially exposed in a ZOI on any one day of pile driving or extraction (Table 6-15). The density estimates used for this analysis come from the Pacific NMSDD, NAVFAC Pacific Technical Report (Navy, 2019) and Smultea et al., (2017) (for harbor porpoise). The maximum density value for each species during the in-water work window at each site was used in the marine mammal take assessment calculation.

Table 6-15. Marine Mammal Species Densities Used in Exposure Calculations (Densities In Bold Were Used In The Exposure Calculations)

Species	*Region Location*	*Density (June–February) Animals/km²*
Harbor porpoise[1]	Hood Canal (Bangor) East Whidbey (Everett) Bainbridge (Bremerton) Vashon (Manchester)	**0.812** **0.75** **0.53** **0.25**
Dall's porpoise	Puget Sound	**0.00045 Annual**
Steller sea lion	Puget Sound	**0.0478 Fall/Winter** 0.0010 Summer
	Everett	**1 sea lion/day**
	Hood Canal	**7.25 sea lions/day**
California sea lion	Puget Sound	0.1577 Winter 0.2211 Fall **48 sea lions/day**
	Everett	**98 sea lions/day**
	Hood Canal	0.1100 Winter 0.1798 Fall **25 sea lions/day**
Harbor seal	Sinclair Inlet-Manchester Fuel Depot	3.91 Winter/Spring/Summer 3.91 Fall 3.91 Spring/Summer **2 seals/day**
	Hood Canal	0.73 Winter 1.64 Spring 0.82 Fall 1.25 Summer **16 seals/day**
	Everett	2.83 Annual **266 seals/day**

Sources: NMSDD (Navy, 2019); Smultea et al. (2017); Rune et al. (2024).

1. For harbor porpoise density estimates, Smultea et al. (2017) sub-divided Puget Sound into sub-regions. The sub-region that includes each MPR location is indicated in parentheses in this table.

The equation for species likely to occur with only density estimates and no site-specific abundance was:

(2) Exposure estimate = N × ZOI × maximum days of pile driving[8]

Where:

[8] The product is rounded up to a whole number.

N = density estimate used for each species

ZOI = Zone of Influence; the area where noise exceeds the noise threshold value

For species with site-specific surveys available, exposures were estimated by:

(3) Exposure estimate = Abundance × maximum days of pile driving

where:

Abundance = average monthly maximum over the time period when pile driving will occur

Average monthly maximum counts were averaged over the in-water work window. The maximum number of animals observed during the month(s) with the highest number of animals present on a survey day was used in the analysis.

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

- For formulas (2) and (3), each species will be present in the project area each day during construction. The timeframe for takings would be one potential take (Level B harassment exposure) per individual, per 24 hours.
- For projects that do not have a pile type or size specified, the pile type, size, and installation method that produces the largest ZOI were used to estimate exposure of marine mammals to noise impacts. For example, piles to be installed at NAVBASE Kitsap Bangor may be steel up to 36 in or concrete up to 24 in. Since vibratory installation of 30- to 36-in steel piles creates the largest ZOI, the exposure analysis assumes that all of the piles will be 30- to 36-in steel.
- All pilings installed at each site will have an **underwater** noise disturbance distance equal to the pile that causes the greatest noise disturbance (i.e., the piling farthest from shore) installed with the method that has the largest ZOI. If vibratory pile driving would occur, the largest ZOI will be produced by vibratory driving. In this case, the ZOI for an impact hammer will be encompassed by the larger ZOI from the vibratory driver. Vibratory driving was assumed to occur on all days of pile driving where steel piles could be installed. Where other pile types are installed, an impact hammer would produce the largest ZOI.
- All pilings installed at each site will have an **airborne** noise disturbance distance equal to the pile that causes the greatest noise disturbance (i.e., the piling furthest from shore) installed with the method that has the largest ZOI. The largest ZOI will be produced by impact driving. The ZOI for a vibratory hammer will be encompassed by the larger ZOI from the impact driver. Impact pile driving was assumed to occur on all days of pile driving. Exposures to airborne noise were considered included in the larger underwater ZOIs from vibratory or impact driving and were not calculated for pinnipeds.
- Days of pile driving at each installation (Table 6-10) were conservatively based on a relatively slow daily production rate, but actual daily production rates may be higher, resulting in fewer actual pile driving days. Pile driving days include both pile extraction and installation. The pile driving days listed in Table 6-10 are used solely to assess the number of days during which pile driving could occur if production was delayed due to equipment failure, safety, etc. In a real construction situation, pile driving production rates would be maximized when possible.

Of significant note is that successful implementation of mitigation methods (i.e., visual monitoring, the use of near real-time Orca Network sightings, and the use of shutdown zones) will result in no Level A exposure to all marine mammals, except harbor seals and California sea lions. Harbor seal and California sea lion Level A exposures may occur as a result of being hauled out within or moving underwater into the injury zone. Therefore, Level A exposures were only calculated for California sea lions and harbor seals, which may occur within the injury zone. The exposure assessment estimates the numbers of individuals potentially exposed to the effects of pile driving noise exceeding NMFS established thresholds. Results from acoustic impact exposure assessments should be regarded as conservative overestimates that are strongly influenced by limited marine mammal data, the assumption that marine mammals will be present during pile driving, and the assumptions that the maximum number of piles will be extracted or installed.

6.12 Estimating Potential Level A Harassment Exposures

Generally, Level A injury zones are small and can be completely monitored. Cetaceans are further offshore of the installations and would not approach the Level A zones. The exceptions are California sea lions and harbor seals. Both species are often found within the installations waters, using Navy structures to haulout on or foraging in the area. When hauled out, sea lions and harbor seals may not be within an airborne harassment zone but will be exposed when they enter the water to leave the haulout or when they return to haulout. Observations of both species has showed that they are opportunistic feeders and will take prey in the installation waters when available. It is likely that there will be some Level A exposures of California sea lions and harbor seals, despite rigorous marine mammal monitoring. Therefore, Level A takes are requested only for California sea lions and harbor seals. Based on past monitoring, the number Level A takes requested is 5% of the Level B takes with the exception of 10% for harbor seals at NBK Bangor.

6.13 Exposure Estimates

Exposure estimates for each species for each of the one-year periods of this application are discussed in the following sections and presented in Tables 6-16 to 19, and details (The type of pile and installation/removal method, ZOIs, number of days, and species densities or local abundance) are presented in Appendix A. Annual reporting requirements will provide details of how many actual and extrapolated animals of each species are exposed to noise levels considered potential Level A or Level B harassment at each location.

Exposure estimates generally do not differentiate age, sex, or reproductive condition. However, some inferences can be made based on what is known about the life stages of the animals that visit or inhabit Puget Sound. When possible and with the available data, this is discussed by species in the sections that follow.

The assumptions described above tend to produce highly conservative exposure estimates. At NAVBASE Kitsap Bremerton, for example, construction of Pier 6 provides a contrast between estimated exposures and actual reported exposure of several marine mammal species (Navy, 2016c). The Navy requested takes of three species (harbor seal, California sea lion, Steller sea lion) but reported that only a fraction of the requested number of harbor seals and California sea lions were actually potentially exposed to noise levels above the harassment threshold (all due to use of vibratory pile drivers). Underwater acoustic monitoring for the Service Pier Extension at NBK Bangor determined that the calculated Level A zone (calculated by the NMFS 2018 spreadsheet) was twice the actual Level A zone (Calculated Level A zone =198; measured Level A zone = 92 meters) as measure on site (SMRU, 2019).

6.13.1 Humpback Whale

Humpback whales are considered rare in the project areas. Based on the Navy's analysis of humpback whales' intermittent occurrence in Puget Sound, density estimates were not used to determine animals potentially exposed to pile driving noise. Humpback whales have been observed in the waters of Puget

Sound in every month of the year, singly or in pairs. Because known feeding areas are not present at any of the installations included in this application, any exposure to elevated project noise levels is expected to be of short duration as the animal(s) moves through an area. Therefore, based on a low probability of occurrence at any project site and mitigation measures, the Navy will request four takes of humpback whales for all installations for each year.

To protect this species, with two ESA-listed DPSs potentially present, from noise impacts, the Navy will implement a shutdown if sighting or tracking information from the local sighting networks shows humpback whales are approaching or within the behavioral harassment zone, or are sighted by protected species observers (PSOs) (see mitigation measures in Chapter 11). A monitor will be stationed at locations from which the injury zone for impact pile driving is visible and will implement shutdown if a whale enters either zone. Because pile driving will be shut down if whales are approaching or within the Level B harassment zone, no Level A take is requested. Any exposure of humpback whales to pile driving noise will be minimized to short-term Level B behavioral harassment in areas beyond the visually monitorable portion of the disturbance zone during vibratory pile driving or DTH drilling.

Table 6-16. Total Underwater Level B Exposure Estimates by Species For the Period of July 2024-July 2025[1]

Species and/or Stock	*Bremerton*	*Manchester*	*Total[1]*
Humpback whale[2] (Hawaii, Central America-Southern Mexico, and Mainland Mexico stocks)	Applies to all installations		**4**
Minke whale[2]	Applies to all installations		**4**
Gray whale[2]	Applies to all installations		**4**
Transient killer whale[2]	Applies to all installations		**12**
Southern Resident killer whale[2]	Applies to all installations		**20**
Harbor porpoise[3]	93	701	**794**
Dall's porpoise[2]	Applies to all installations		**10**
Steller sea lion	9	222	**231**
California sea lion	3,038	888	**3,926**
Northern elephant seal[2]	Applies to all installations		**2**
Harbor seal (Washington Northern Inland Water stocks)	62	370	**432**

[1]Calculations of exposures using species density or installation surveys, ZOI, and number of days are provided in appendix A.

[2]These species or stocks are unlikely to be exposed to pile driving sound due to their low numbers, distribution, or the use of mitigation measures such as using near real time locations and social media locations of whales to delay or shut down work.

[3]Group size of 1-3.

[4]The mean number per day from the weekly surveys (Navy, 2023) was used for the nearshore area and the Navy at sea density was used for the offshore area (Navy, 2019).

Table 6-17. Total Underwater Level A Exposure Estimates by Species For the Period of July 2024-July 2025

Species	*Bremerton*	*Manchester*	*Total*
Harbor seal	20	37	**57**

Table 6-18. Total Underwater Level B Exposure Estimates by Species For the Period of July 2025-July 2026[1]

Species	*Bangor*	*Bremerton*	*Everett*	*Total[1]*
Humpback whale[2] (Hawaii, Central America-Southern Mexico, and Mainland Mexico stocks)	Applies to all installations			**4**
Minke whale[2]	Applies to all installations			**4**
Gray whale[2]	Applies to all installations			**4**
Transient killer whale[2]	Applies to all installations			**12**
Southern Resident killer whale[2]	Applies to all installations			**20**
Harbor porpoise[3]	905	204	48	**1,157**
Dall's porpoise[2]	Applies to all installations			**10**
Steller sea lion	261	18	8	**287**
California sea lion	900	2,352	384	**3,636**
Northern elephant seal[2]	Applies to all installations			**2**
Harbor seal (Hood Canal and Washington Northern Inland Water stocks)	576	48	2,128	**2,752**

Note: Vibratory driving followed by impact pile driving of the same piles may occur within the same day; therefore, decreasing Level B exposures.

[1]Calculations of exposures using species density or installation surveys, ZOI, and number of days are provided in appendix A.

[2]These species or stocks are unlikely to be exposed to pile driving sound due to their low numbers, distribution, or the use of mitigation measures such as using near real time locations and social media locations of whales to delay or shut down work.

[3]Group size of 1-3

Table 6-19. Total Underwater Level A Exposure Estimates by Species For the Period of July 2025-July 2026

Species	*Bangor*	*Bremerton*	*Everett*	*Total*
Harbor seal	20	0	0	**20**

6.13.2 Minke Whale

Minke whales in Washington inland waters typically feed in the areas around the San Juan Islands and along banks in the Strait of Juan de Fuca. Minke whales are infrequent visitors to Puget Sound, especially east of Admiralty Inlet (see Figure 1-1). When present, minke whales are usually seen singly or in pairs. Therefore, based on a low probability of occurrence at any one project site, the Navy used formula (1) described in Section 6.11 to calculate potential Level B exposure and requests takes for exposure for up to four minke whales at any of the potential project locations for the duration of the one-year MPR IHA for the period of July 2024-July 2025 and for the second MPR IHA for the period of July 2025-July 2026. If present, minke whales of the California/Oregon/Washington stock would be exposed to noise levels considered Level B harassment. Animals of any age, sex, or reproductive status could be affected.

To protect minke whales from noise impacts, the Navy will implement a shutdown if minke whales are seen by marine mammal monitors in an injury or behavioral harassment zone (see mitigation measures in Chapter 11). A monitor will be stationed at locations from which the injury zone for impact pile driving is visible and will implement shutdown if a whale enters either zone. With the implementation of monitoring, even if a whale enters an injury zone, shutdown would occur before cumulative exposure to noise levels that would result in PTS could occur. Because pile driving will be shut down if whales are in the injury zone, no Level A take is requested. Any exposure of minke whales to pile driving noise will be minimized to short-term Level B behavioral harassment in areas beyond the visually monitorable portion of the disturbance zone during vibratory pile driving.

6.13.3 Gray Whale

Most gray whales in Puget Sound utilize the feeding areas in northern Puget Sound around Whidbey Island and in Port Susan in March through June with a few individual sightings occurring year-round that are not always associated with feeding areas. Gray whales utilizing the feeding areas around Whidbey Island and in Port Susan pass by NAVSTA Everett but do not forage in the East Waterway. Pile driving sound from NAVSTA Everett would be blocked by the mainland areas of the installation and Jetty Island to the west. However, because known feeding areas are not present at any of the installations included in this application, any exposure to elevated project noise levels are expected to be of short duration as the animal(s) moves through an area. Moreover, the majority of in-water work will occur during the fall and winter when gray whales utilizing these areas are less likely to be present in Puget Sound. Individuals have been observed in the waterways near NAVBASE Kitsap Bremerton, NAVBASE Kitsap Manchester, and NAVSTA Everett. Gray whales have not been reported in Hood Canal since 1999 and, therefore, are not expected to be present in the vicinity of NAVBASE Kitsap Bangor. Based on a low probability of occurrence at any project site during the time period of potential pile driving and the small number of pile driving days proposed, the Navy used formula (1) described in Section 6.11 to calculate potential exposure and requests Level B takes for exposure for up to four gray whales at any of the potential project locations for the duration of the one-year MPR IHA for the period of July 2024-July 2025 and for the second MPR IHA for the period of July 2025-July 2026. Animals of any age, sex, or reproductive status could be exposed.

To protect gray whales from noise impacts, the Navy will implement a shutdown if gray whales are seen by marine mammal monitors in an injury or behavioral harassment zone (see mitigation measures in Chapter 11). A monitor will be stationed at locations from which the injury zone for impact pile driving is visible and will implement shutdown if a whale enters either zone. With the implementation of monitoring, even if a whale enters an injury zone, shutdown would occur before cumulative exposure to noise levels that would result in PTS could occur. Because pile driving will be shut down if whales are in the injury zone, no Level A take is requested. Any exposure of gray whales to pile driving noise will be minimized to short-term Level B behavioral harassment in areas beyond the visually monitorable portion of the disturbance zone during vibratory pile driving.

6.13.4 Killer Whale, West Coast Transient Stock

Transient killer whales occasionally occur throughout Puget Sound with sightings at all Puget Sound installations. They are typically observed in small groups with an average group size in Puget Sound of six individuals. Based on a low probability of occurrence at any project site during the in-water work window, the Navy used formula (1) described in Section 6.11 to calculate exposure to Level B noise levels at any of the project locations for a group of 6 individuals over 2 days. The Navy requests incidental takes of up to 12 individuals from Level B harassment from underwater sound incidental to pile driving for the duration of the one-year MPR IHA for the period of July 2024-July 2025 and for the second MPR IHA for the period of July 2025-July 2026. Twelve individuals will account for two groups of average size in Puget Sound passing a project site twice or a single larger than average group passing once. Killer whales of any age, sex or reproductive status would be exposed.

To protect transient killer whales from noise impacts, the Navy will implement a shutdown if killer whales are seen by marine mammal monitors in an injury or behavioral harassment zone (see mitigation measures in Chapter 11). A monitor will be stationed at locations from which the injury zone for impact pile driving is visible and will implement shutdown if a whale enters either zone. With the implementation of monitoring, even if a whale enters an injury zone, shutdown would occur before cumulative exposure to noise levels that would result in PTS could occur. Because pile driving will be shut down if whales are in the injury zone, no Level A take is requested. Any exposure of killer whales to pile driving noise will be minimized to short-term behavioral harassment in areas beyond the visually monitorable portion of the disturbance zone during vibratory pile driving.

6.13.5 Killer Whale, Eastern North Pacific Southern Resident Stock/Distinct Population Segment

Eastern North Pacific Southern Resident killer whales occur seasonally in Puget Sound, although they have not been reported in Hood Canal since at least 1995 and only twice in Sinclair Inlet since 1997 (The Whale Museum, 2023). Animals, when present, are most frequently seen in inland waters north of the MPR installation locations in late spring, summer, and fall. They are occasionally observed in Puget Sound in the fall and winter months. Based on a low probability of occurrence at any project site during the in-water work window, the Navy will attempt to avoid any takes of Southern Resident killer whales.

To protect Southern Resident killer whales from noise impacts, the Navy will implement a shutdown if sighting or tracking information from the local sighting networks shows SRKWs are approaching or within the behavioral harassment zone, or are sighted by PSOs (see mitigation measures in Chapter 11). A monitor will be stationed at locations from which the injury zone for impact pile driving is visible and will implement shutdown if a whale enters either zone. With the implementation of monitoring, shutdown would likely occur before the whales approach or enter the Level B Behavioral harassment zone. Therefore, based on a low probability of occurrence at any project site and mitigation measures, the Navy will request 20 takes of SRKWs that may enter the Level B Harassment Zone before shutdown can be implemented, for all installations for each year. Any exposure of SRKWs to pile driving noise will be minimized to short-term Level B behavioral harassment in areas beyond the visually monitorable portion of the disturbance zone during vibratory pile driving and DTH drilling.

6.13.6 Harbor Porpoise

Harbor porpoises may be present in all major regions of Puget Sound throughout the year. Group sizes ranging from 1 to 150 individuals were reported in aerial surveys conducted from summer 2013 to spring 2016 but mean group size was 1.7 animals (Smultea et al., 2017). The estimated harbor porpoise density in inland waters is provided in Table 6-10. Level B exposure estimates utilized formula (2) as described in Section 6.11.

To protect harbor porpoises from noise impacts, the Navy will implement a shutdown if porpoises are seen by marine mammal monitors in an injury harassment zone (see mitigation measures in Chapter 11). A monitor will be stationed at locations from which the injury zones for impact pile driving are visible and will implement shutdown if a porpoise enters either zone. With the implementation of monitoring, even if a harbor porpoise enters an injury zone, shutdown would occur before cumulative exposure to noise levels that would result in PTS could occur.

July 2024-July 2025

NAVBASE Kitsap Bremerton

The Navy applied the Bainbridge sub-region density of 0.53 porpoises/km^2 for 11 days of pile driving for removal of 13-in timber piles at two piers (Pier C and Pier 5) and 20 days of installation using the ZOI calculated for pile driving at this location (16 km^2 for removal and 0.02 km^2 for installation of piles at Pier C, and 16 km^2 for removal and 0.007 km^2 for Pier 5) for installation of piles at Pier C) (Table 6-7; Appendix A). The Navy requests takes for Level B exposure of up to 93 harbor porpoises for the duration of the MPR IHA at Bremerton (Table 6-16).

NAVBASE Kitsap Manchester

The Navy applied the Vashon sub-region density (0.25 porpoises/km^2), 37 days of DTH drilling or impact pile driving, and the largest ZOI calculated for pile driving at this location (75.8 km^2 for installation) (Table 6-7). The Navy requests 701 takes for Level B exposure for the duration of the MPR IHA at Manchester (Table 6-16).

July 2025-July 2026

NAVBASE Kitsap Bangor

The Navy applied the Bangor sighting average of 0.812 porpoises/km^2 (Rune et al., 2024), 36 days of pile driving (mix of both vibratory and impact driving), and the largest ZOI calculated for pile driving at this location (31 km^2 for vibratory installation of 36-in steel piles) (Table 6-7). The Navy requests takes for Level B exposure of up to 905 harbor porpoises for the duration of the MPR IHA at Bangor (Table 6-18).

NAVBASE Kitsap Bremerton

The Navy applied the Bainbridge sub-region density of 0.53 porpoises/km^2, 24 days of pile driving, and ZOI of 16 km^2 calculated for pile driving at this location (Table 6-7). The Navy requests takes for Level B exposure of up to 204 harbor porpoises for the duration of the MPR IHA at Bremerton (Table 6-18).

NAVSTA Everett

Only four 12-in piles are anticipated to be removed and new piles installed with a vibratory driver and the likelihood of exposure of harbor porpoises during the relatively brief installation of this pile is low. Therefore, the Navy applied the East Whidbey sector density (0.75 porpoises/km^2), eight days of vibratory pile driving for removal and installation with ZOI calculated for pile driving at this location (8 km^2), and four days of impact pile driving with a Level B zone of 0.05 km^2 (Table 6-7). The Navy requests takes for Level B exposure of up to 48 harbor porpoises for the duration of the MPR IHA at Everett (Table 6-18). Exposures may be lower if vibratory and impact installation occur on the same.

Because pile driving will be shut down if porpoises are in the injury zone, no Level A take is requested. Any exposure of porpoises to pile driving noise will be minimized to short-term behavioral harassment in areas beyond the visually monitorable portion of the disturbance zone during vibratory pile driving.

6.13.7 Dall's Porpoise

In Washington inland waters, Dall's porpoises are most abundant in the Strait of Juan de Fuca and Haro Strait in the San Juan Island area, but may be present in Puget Sound year-round. Group size is usually one to three. Based on historical records, no Dall's porpoises are anticipated In Hood Canal. In Puget Sound, where Dall's porpoise are more likely to occur, the Navy has estimated that Dall's porpoise density is 0.039 animals/km^2 (Table 6-10), although they have not been reported near the Navy's installations in recent years and their occurrence in Puget Sound appears to be declining (Smultea et al., 2015; Jefferson et al., 2016). In the unlikely event that Dall's porpoises do occur, the Navy requests takes for Level B exposure of up to four Dall's porpoises for the duration of the MPR IHA at all installations for the period of the IHA from July 2024 to July 2025 (Table 6-16). The Navy requests takes for Level B exposure of up to 10 Dall's porpoises for the duration of the MPR IHA at all installations for the period of the IHA from July 2025 to July 2026 (Table 6-18).

To protect Dall's porpoises from noise impacts, the Navy will implement a shutdown if Dall's porpoises are seen by marine mammal monitors in an injury harassment zone (see mitigation measures in Chapter 11). A monitor will be stationed at locations from which the injury zone for impact pile driving are visible and will implement shutdown if a porpoise enters either zone. With the implementation of monitoring, even if a porpoise enters an injury zone, shutdown would occur before cumulative exposure to noise levels that would result in PTS could occur. Because pile driving will be shut down if porpoises are in the injury zone, no Level A take is requested. Any exposure of porpoises to pile driving noise will be minimized to short-term behavioral harassment in areas beyond the visually monitorable portion of the disturbance zone during vibratory pile driving.

6.13.8 Steller Sea Lion

Steller sea lions occur seasonally in Puget Sound primarily from September through May. Two installations have haulouts on-site or nearby: NAVBASE Kitsap Bangor and near NAVBASE Kitsap Manchester. Exposure may occur if these animals move through ZOIs during impact or vibratory pile driving. Formula (3) as described in Section 6.11 was used with site-specific abundance data to calculate potential exposures of Steller sea lions at NAVBASE Kitsap Bangor and NAVBASE Kitsap Manchester. At all other installations, haulouts are greater than 8.5 mi away; therefore, formula (2) using density estimates was used. Estimates of Steller sea lion exposure at each installation are provided below. Exposures are expected to be limited to subadult or adult males at all locations. Animals could be exposed when traveling, resting, and foraging. Because a Level A injury zone can be effectively monitored, a shut-down zone will be implemented, and no exposure to Level A noise levels is anticipated at any location.

If project work occurs during months when Steller sea lions are less likely to be present, actual exposures would be less. Additionally, if daily pile driving duration is short, exposure would be expected to be less because some animals would remain hauled out for the duration of pile driving. Any exposure of Steller sea lions to pile driving noise will be minimized to short-term behavioral harassment.

NAVBASE Kitsap Bremerton

Steller sea lions have been documented only twice at this installation, once in 2012 and once in 2013, hauled out on a float. The nearest Steller sea lion haulout to NAVBASE Kitsap Bremerton is at NAVBASE Kitsap Manchester. Given the unlikely occurrence of Steller sea lions, the Navy requests only nine takes for Steller sea lions at NAVBASE Kitsap Bremerton for the duration of the one-year MPR IHA (Table 6-16).

NAVBASE Kitsap Manchester

California sea lions and Steller sea lions haul out on floats approximately 0.5 mi offshore from the Rich Passage side of the NAVBASE Kitsap Manchester although those are intermittently removed (Figure 4-4). The Navy has determined abundance of Steller sea lions in the vicinity based on shore-based observations conducted intermittently in 2012–2013 and more frequently in 2014–2016, in addition to aerial surveys conducted by WDFW in selected months in 2013–2014 (Appendix C). Steller sea lions have been present in surveys conducted from October through May, with the largest number counted in a survey in November 2014. The Navy used the density of Steller sea lions (0.0478 sea lions/km^2; Appendix A). The Navy requests 222 takes for Level B exposure to Steller sea lions at NAVBASE Kitsap Manchester for the duration of the one-year MPR IHA (Table 6-16).

<u>July 2025-July 2026</u>

<u>NAVBASE Kitsap Bangor</u>

Steller sea lions are routinely seen hauled out from mid-September through May on submarines at NAVBASE, Bangor, with a maximum haulout count of 21 individuals in November 2014. Because the daily average number of Steller sea lions hauled out at Bangor has increased since 2013 compared to prior years, the Navy relied on monitoring data from 2013 through June 2023 to determine the average of the maximum count of hauled out Steller sea lions for each month in the in-water work window (Appendix C). Therefore, the Navy requests takes for the average of the monthly maximum counts during the in-water work window, or 7.25 exposures per day for an estimated 36 days of pile driving at Bangor (Table 6-11). The Navy requests takes for exposure of up to 261 Steller sea lions at NAVBASE Kitsap Bangor for the duration of the one-year MPR IHA for the period of July 2025 to July 2026 (Table 6-18). Exposures may be lower if vibratory and impact installation occur on the same.

<u>NAVBASE Kitsap Bremerton</u>

Steller sea lions have been documented only twice at this installation, once in 2012 and once in 2013, hauled out on a float. The nearest Steller sea lion haulout to NAVBASE Kitsap Bremerton is at NAVBASE Kitsap Manchester. Surveys at NAVBASE Kitsap Manchester have not been conducted in all months of the in-water work window; however, animals are documented on floats in Clam Bay off Rich Passage in the November through January timeframe. Therefore during this time period, animals from the haulout near NAVBASE Kitsap Manchester could be present in the ZOI for Level B exposure at Bremerton during pile driving. The Navy used the density of Steller sea lions (0.0478 sea lions/km^2; Appendix A). The Navy request 18 takes of Steller sea lions at NAVBASE Kitsap Bremerton for the duration of the one-year MPR IHA (Table 6-18).

<u>NAVSTA Everett</u>

The nearest Steller sea lion haulout to NAVSTA Everett is in Admiralty Inlet over 14 mi away where an estimated two individuals occur on a navigation buoy (Figure 4-1). The Navy has estimated that Steller sea lion of two per day based on the weekly surveys (Navy, 2023). Only four piles will be removed and four new piles installed over the course of eight days. The Navy requests takes for level B exposure of up to eight Steller sea lions for the duration of the MPR IHA at Everett (Table 6-18). Exposures may be lower if vibratory and impact installation occur on the same.

6.13.9 California Sea Lion

California sea lions occur in Puget Sound from August to June. This species hauls out at three of the installations: NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, and NAVSTA Everett. These haulouts are adjacent to, in, or near the Level B ZOIs, so exposure may occur if animals move through ZOIs during impact or vibratory pile driving activities. A fourth haulout is located approximately 0.5 mi from NAVBASE Kitsap Manchester. Estimates of California sea lion exposure at each installation are provided below. Since primarily only male California sea lions migrate into the Study Area (Jeffries et al., 2000), all exposures are expected to be sub-adult or adult males. Animals could be exposed when traveling, resting, and foraging. Although Level A injury zones can be effectively monitored and a shut-down zone will be implemented, Level A exposures of California sea lions will be included because they often found in large numbers and near pile driving areas. If project work occurs during months when California sea lions are less likely to be present, actual exposures would be less. Additionally, if daily pile driving duration is short, exposure would be expected to be less because some animals would remain hauled out for the duration of pile driving. Any exposure of California sea lions to pile driving noise will be minimized to short-term behavioral harassment.

July 2024-July 2025

NAVBASE Kitsap Bremerton

California sea lions are routinely seen hauled out on the PSB floats at NAVBASE Kitsap Bremerton. Survey data from 2012 through June 2022 indicate as many as 212 animals hauled out each day during this time period with the majority of animals observed August through May and the greatest numbers observed in November (Navy, 2023). Since 30 days of pile driving are proposed at NAVBASE Kitsap Bremerton (Table 6-12), the Navy determined abundance of California sea lions based on the average monthly maximum counts during the in-water work window (Appendix C), for an average maximum count of 98 individuals. The Navy conservatively assumes that any California sea lion that hauls out at Bremerton could swim into the behavioral harassment zone each day during pile driving because this zone extends across Sinclair Inlet from the driven pile. The Navy requests takes for Level B exposure of up to 900 California sea lions at NAVBASE Kitsap Bremerton for the duration of the one-year MPR IHA (Table 6-16). The Navy does not request any Level A takes of California sea lions at NAVBASE Kitsap Bremerton.

NAVBASE Kitsap Manchester

California sea lions and Steller sea lions haul out on floats approximately 0.5 mi offshore from the Rich Passage side of the NAVBASE Kitsap Manchester (Figure 4-4). The Navy has determined abundance of California sea lions in the vicinity based on shore-based observations conducted between 2012 and 2022, in addition to aerial surveys conducted by WDFW in selected months in 2013–2014 (Appendix C). California sea lions have been present in shore-based surveys conducted in all months but peak presence occurs between October and February, with the largest number ever counted in a single survey in February 2022 (212 individuals). The Navy used these monitoring data to determine the average of the maximum count of hauled out California sea lions for each month (Appendix C). The Navy determined abundance of California sea lions based on the average counts during the in-water work window, for an average count of 24 individuals. Since the haulout is 0.5 mi away, the Navy assumes that few California sea lions would swim into the behavioral harassment zone during pile driving at NAVBASE Kitsap Manchester. The Navy conservatively assumes that any California sea lion that hauls out at the floats near Manchester could be exposed to behavioral harassment each day during pile extraction. The Navy requests takes for Level B exposure of up to 888 California sea lions at NAVBASE Kitsap Manchester for the duration of the one-year MPR IHA (Table 6-16). The Navy does not request any Level A takes of California sea lions at NAVBASE Kitsap Manchester.

July 2025-July 2026

NAVBASE Kitsap Bangor

California sea lions are routinely seen hauled out from August through June on the PSB floats and submarines at NAVBASE Kitsap Bangor, the Navy relied on monitoring data from 2013 through June 2022 to determine the average of the maximum count of hauled out California sea lions for each month (Appendix C). Since 36 days of pile driving are proposed at NAVBASE Kitsap Bangor (Table 6-10), the Navy determined abundance of California sea lions based on the average monthly maximum counts during the in-water work window (Appendix C), respectively, for an average maximum count of 37 individuals. The Navy conservatively assumes that any California sea lion that hauls out at Bangor could swim into the behavioral harassment zone each day during pile driving because this zone extends across Hood Canal and up to 11.7 km from the driven pile. Therefore, the Navy requests take for 37 exposures per day for an estimated 36 days of pile driving at Bangor. These values provide a worst case assumption that on all 36 days of pile driving all animals would be in the water each day during pile driving. The Navy requests takes for Level B exposure of up to 900 California sea lions at NAVBASE Kitsap Bangor for the duration of the one-year MPR IHA (Table 6-18). The Navy does not request any Level A takes of California sea lions at NAVBASE Kitsap Bangor.

NAVBASE Kitsap Bremerton

California sea lions are routinely seen hauled out on the PSB floats at NAVBASE Kitsap Bremerton. Survey data from 2012 through June 2022 indicate as many as 212 animals hauled out each day during this time period with the majority of animals observed August through May and the greatest numbers observed in November. The Navy determined abundance of California sea lions based on the average monthly maximum counts during the in-water work window (Appendix C), for an average maximum count of 98 individuals. The Navy conservatively assumes that any California sea lion that hauls out at Bremerton could swim into the behavioral harassment zone each day during pile driving because this zone extends across Sinclair Inlet for a ZOI of 16 km^2. Therefore, the Navy requests take for 98 Level B exposures per day for an estimated 24 days of pile driving at Bremerton for a total of 2,352 takes by Level B harassment. These values provide a worst case assumption that on all 24 days of pile driving all animals would be in the water each day during pile driving (Table 6-18). The Navy does not request any Level A takes of California sea lions at NAVBASE Kitsap Bremerton.

NAVSTA Everett

California sea lions are routinely seen hauled out from August through June on the PSB floats at NAVSTA Everett. A few animals have been observed in July. Surveys from 2012 through June 2022 indicate as many as 179 animals hauled out each day during the in-water work period from July through February with the maximum number observed in November. Since four days of pile removal and four days of pile installation are proposed at NAVSTA Everett (Table 6-10), the Navy determined abundance of California sea lions based on the average monthly counts during the in-water work window (Appendix C), respectively, for an average maximum count of 48 individuals. The Navy assumes that any California sea lion that hauls out at Everett could swim into the behavioral harassment zone each day during pile driving. Only four 12-in steel piles are to be installed at Everett. Vibratory driving and extraction of existing steel piles could produce a ZOI up to 2.9 km^2. Therefore, the Navy requests take for 48 Level B exposures per day for an estimated eight days of pile driving at Everett for a total of 384 takes by Level B harassment. These values provide a worst case assumption that on all eight days of pile driving all animals would be in the water each day during pile driving (Table 6-18). The Navy does not request any Level A takes of California sea lions at NAVSTA Everett.

6.13.10 Northern Elephant Seal

Northern elephant seals are considered rare visitors to Puget Sound. However, solidary juvenile elephant seals have been known to sporadically haul out to molt in Puget Sound during spring and summer months.

No elephant seal haulouts occur in Puget Sound although individual elephant seals have been detected hauling out for 2 to 4 weeks to molt, usually during the spring and summer. Haulout locations are unpredictable (Norberg, 2012 personal communication), but only one record is known for a MPR Program installation (Section 4.10). Because there are occasional sightings in Puget Sound, the Navy reasons that over the one-year span of each requested authorization, exposure of up to one northern elephant seal to Level B harassment levels could occur from underwater or airborne sound incidental to pile driving at any of the project sites. Therefore, a total of two elephant seals exposures to Level B harassment are requested for the period of July 2024-July 2025 and four for the second MPR IHA for the period of July 2025-July 2026. Any exposure of northern elephant seals to pile driving noise will be minimized to short-term behavioral harassment. Because elephant seals are rare in the project area, and unlikely to occur within or approach the Level A harassment zone, no Level A exposure is anticipated. However, shut-down will occur as described below for harbor seals.

6.13.11 Harbor Seal

Harbor seals are expected to occur year-round at all installations, with the greatest numbers expected at installations with nearby haulout sites, as discussed below. This species hauls out regularly in large numbers within NAVSTA Everett year-round with a dip in numbers in winter months, and in smaller numbers at NAVBASE Kitsap Bangor. Harbor seals are most likely to be exposed to Level A noise where they regularly haul out in close proximity to MPR project sites (i.e., at NAVBASE Kitsap Bangor and NAVSTA Everett). Pile driving will shut down whenever a seal is detected by monitors closely approaching the Level A injury zone. Harbor seals can regularly dive 5-10 minutes and up to 20 minutes; therefore, they may not be seen until they surface within the Level A zone. Due to the high number of harbor seals in the area and diving abilities, additional Level A exposures are included. Harbor seal haulouts are farther away from the other installations, as discussed below; however, since harbor seals are widespread throughout Puget Sound, exposure to Level B noise may occur within the ZOIs at any MPR installation. For most projects, exposure of harbor seals to pile driving noise will be minimized to short-term behavioral harassment (Level B).

Abundance data at haulouts are available at NAVBASE Kitsap Bangor and NAVSTA Everett (Navy, 2023), as discussed below for these locations. Therefore, formula (3) was used with site-specific abundance data to calculate potential exposures of harbor seals at NAVBASE Kitsap Bangor, NAVSTA Kitsap Everett, and NAVBASE Kitsap Manchester. No haulouts are located near the other installations and there are no site-specific abundance data; therefore formula (2) was used with density data to calculate potential exposures at other installations. Estimates of harbor seal exposure at each installation are provided below.

July 2024-July 2025

NAVBASE Kitsap Bremerton

Pile driving would occur at both Pier C and Pier 5. While no haulouts for harbor seals exist on NAVBASE Kitsap Bremerton or within the ZOI, haulouts are present year round in the nearby waters of Sinclair Inlet (Jeffries et al., 2000; Navy, 2023). These haulouts are outside of, but adjacent to, the Level B ZOIs so exposure is likely if animals move to or from these haulouts during vibratory pile driving activities. However, marine mammal surveys were conducted in the vicinity of NAVBASE Kitsap Bremerton during the construction of the Manette Bridge just north of the ZOI in the Port Washington Narrows (Washington State Department of Transportation, 2011, 2012).

The Navy requests Level B takes for exposure of up to 62 harbor seals at NAVBASE Kitsap Bremerton for the duration of the one-year MPR IHA (Table 6-16) The Navy estimates that one harbor seal may enter the Level A harassment zone per day and therefore and requests 40 Level A takes (Table 6-17).

NAVBASE Kitsap Manchester

No harbor seal haulouts have been identified at NAVBASE Kitsap Manchester however seals regularly haulout at Orchard Rocks with a mean number of harbor seals of 10 seals. There will be an estimated 37 days of impact pile driving; therefore, the Navy requests Level B takes for exposure of up to 370 harbor seals, using the nearshore survey data (Navy 2023) and the at sea density data (Navy, 2019) for NAVBASE Kitsap Manchester for the duration of the one-year MPR IHA (Table 6-16). This estimate is based on the NWTT Marine mammal Density report (Navy, 202-19) and likely overestimates exposures to harbor seals as most harbor seals generally in the nearshore and do not move far from the coast (Baird, 2001, Thorson unpublished tagging data). The Navy estimates that one harbor seal per day may enter the Level A harassment zone and therefore, requests 37 takes by Level A harassment (Table 6-17).

July 2025-July 2026

NAVBASE Kitsap Bangor

The closest major haulouts to NAVBASE Kitsap Bangor that are regularly used by harbor seals are the mouth of the Dosewallips River located approximately 8.2 mi away. No harbor seal haulout have been seen on the shoreline opposite Bangor (the east-side of the Toandos Peninsula) during 2015 and 2016 beach seine surveys. A small haulout occurs at NAVBASE Kitsap Bangor under Marginal Wharf and small numbers of harbor seals are known to routinely haul out around the Carderock pier (Figure 1-2). Boat-based surveys and monitoring indicate that harbor seals regularly swim in the waters at NAVBASE Kitsap Bangor (Appendix C). Hauled-out adults, mother/pup pairs, and neonates have been documented occasionally but quantitative data are limited. Incidental surveys in August and September 2016 recorded as many as 28 harbor seals hauled out under Marginal Wharf or swimming in adjacent waters. Assuming a few other individuals may be present elsewhere on the Bangor waterfront, the Navy estimates that 15 harbor seals may be present near the installation each year during summer and early fall months. Based on haulout survey data from NAVSTA Everett (Appendix C), the number of harbor seals present at Bangor is likely to be lower in late fall and winter months.

Based on a maximum daily estimate of 16 harbor seals and 36 days of in-water pile driving, the Navy requests takes for Level B exposure of up to 576 harbor seals at NAVBASE Kitsap Bangor for the duration of the one-year MPR IHA (Table 6 18). The requested takes are highly conservative because the amount of time required to install or extract existing piles will likely be much less than 36 days. Based on previous documented harbor seal behavior during pile driving at Bangor, when several harbor seal pups regularly approached the bubble curtain to feed on fish (Navy, 2020; NMFS, 2020), the Navy estimates one harbor seal may enter the Level A harassment zone; therefore, 20 Level A takes are requested (Table 6-19).

<u>NAVBASE Kitsap Bremerton</u>

While no haulouts for harbor seals exist on NAVBASE Kitsap Bremerton or within the ZOI, haulouts are present year round in the nearby waters of Sinclair Inlet (Jeffries et al., 2000; Navy, 2023). These haulouts are outside of, but adjacent to, the Level B ZOIs so exposure is likely if animals move to or from these haulouts during vibratory pile driving activities. However, marine mammal surveys were conducted in the vicinity of NAVBASE Kitsap Bremerton during the construction of the Manette Bridge just north of the ZOI in the Port Washington Narrows (Washington State Department of Transportation, 2011, 2012). Marine mammal monitoring for this project occurred over multiple years and aligns with the in-water work windows in Puget Sound. Based on 24 days of pile driving expected, the Navy requests Level B takes for exposure of up to 48 harbor seals at NAVBASE Kitsap Bremerton for the duration of the one-year MPR IHA (Table 6-18). The Navy does not request any Level A takes of harbor seals at NAVBASE Bremerton.

<u>NAVSTA Everett</u>

Harbor seals haul out year-round on floats, riprap, docks, and oil booms within NAVSTA Everett. Surveys from 2019 through June 2022 indicate a maximum of 758 seals hauled in September 2019. Since eight days of pile driving are proposed at NAVSTA Everett (Table 6-12), the Navy determined abundance of harbor seals based on the average monthly maximum counts during the in-water work window (Appendix C), respectively, for an average maximum count of 266 individuals hauled out on oil booms, rip rap, docks, log rafts, and the boat ramp. The Navy assumes that any harbor seal that hauls out at Everett could swim into the behavioral harassment zone each day during pile driving. Only four 12-in steel piles are to be removed and installed at Everett over the course of eight days. Therefore, the Navy requests takes for Level B exposure of up to 2,128 harbor seals at NAVBASE Kitsap Everett for the duration of the one-year MPR IHA (Table 6-18). The requested takes are highly conservative because the amount of time required to extract existing piles will likely be much less than eight days and if both vibratory and impact pile driving of a pile occur on the same day. The Navy does not request any Level A takes of harbor seals at NAVSTA Everett (Table 6-19).

7 IMPACTS TO MARINE MAMMAL SPECIES OR STOCKS

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

7.1 Potential Effects of Pile Driving on Marine Mammals

7.1.1 Potential Effects Resulting from Underwater Noise

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

Potential impacts to marine species can be caused by 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 sounds on marine mammals. Potential effects from impulsive sound sources can range from Level B effects such as brief behavioral disturbance, tactile perception, and physical discomfort, to Level A impacts, which may include slight injury of the internal organs and the auditory system, and to possible death of the animal (Yelverton et al., 1973; O'Keefe & Young, 1984; Ketten, 1995; Navy, 2001).

7.1.1.1 Physiological Responses

Direct tissue responses to impact/impulsive sound stimulation may range from mechanical vibration or compression with no resulting injury to tissue trauma (injury). Because the ears are the most sensitive organ to pressure, they are the organs most sensitive to injury (Ketten, 2000). Sound-related trauma can be lethal or sub-lethal. Lethal impacts are those that result in immediate death or serious debilitation in or near an intense source (Ketten, 1995). Sub-lethal damage to the ear from a pressure wave can rupture the tympanum, fracture the ossicles, and damage the cochlea; cause hemorrhage, and cause leakage of cerebrospinal fluid into the middle ear (Ketten, 2004). Sub-lethal impacts also include hearing loss, which is caused by exposure to perceptible sounds. Moderate injury implies partial hearing loss. Permanent hearing loss (also called permanent threshold shift) can occur when the hair cells of the ear are damaged by a very loud event, as well as by prolonged exposure to noise. Instances of temporary threshold shifts and/or auditory fatigue are well documented in marine mammal literature as being one of the primary avenues of acoustic impact. Temporary loss of hearing sensitivity has been documented in controlled settings using captive marine mammals exposed to strong sound exposure levels at various frequencies (Ridgway et al., 1997; Kastak et al., 1999; Finneran et al., 2005). While injuries to other sensitive organs are possible, they are less likely since pile driving impacts are almost entirely acoustically mediated, versus explosive sounds which also include a shock wave that can result in damage. Based on the mitigation measures outlined in Chapter 11 and the conservative modeling assumptions discussed in Chapter 6, Level A harassment is not expected to any individuals, except potentially California sea lions and harbor seals during impact pile driving. However, based on the continued presence of California sea lions and harbor seals near Navy installations through multiple years of construction, no effect to the harbor seal population is expected. Therefore, auditory effects could be experienced by individual California sea lions and harbor seals, 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 can be highly variable. For each potential behavioral change, the magnitude of the change ultimately determines the severity of the response. A number of factors may influence an animal's response to noise, including its previous experience, its auditory sensitivity, its biological and social status (including age and sex), and its behavioral state and activity at the time of exposure. Habituation occurs when an animal's response to a stimulus wanes with repeated exposure, usually in the absence of unpleasant associated events (Wartzok et al., 2004). Animals are most likely to habituate to sounds that are predictable and unvarying. The opposite process is sensitization—when an unpleasant experience leads to subsequent responses, often in the form of avoidance, at a lower level of exposure. Behavioral state or differences in individual tolerance levels may affect the type of response as well. For example, animals that are resting may show greater behavioral change in response to disturbing noise levels than animals that are highly motivated to remain in an area for feeding (Richardson et al., 1995; National Research Council, 2003; Wartzok et al., 2004). Indicators of disturbance may include sudden changes in the animal's behavior or avoidance of the affected area. A marine mammal may show signs that it is startled by the noise and/or it may swim away from the sound source and avoid the area. Increased swimming speed, increased surfacing time, and cessation of foraging in the affected area would indicate disturbance or discomfort. Pinnipeds may increase their haulout time, possibly to avoid in-water disturbance.

Controlled experiments with captive marine mammals showed pronounced behavioral reactions, including avoidance of loud sound sources (Ridgway et al., 1997; Finneran et al., 2003). Observed responses of wild marine mammals to loud pulsed sound sources (typically seismic guns or acoustic harassment devices and including pile driving) have been varied, but often consist of avoidance behavior or other behavioral changes suggesting discomfort (Morton and Symonds 2002; also see reviews in Gordon et al., 2004; Wartzok et al., 2004; and Nowacek et al., 2007). Some studies of acoustic harassment and acoustic deterrence devices have found habituation in resident populations of seals and harbor porpoises (see review in Southall et al., 2007). Blackwell et al. (2004) found that ringed seals exposed to underwater pile driving sounds in the 153–160 dB RMS range tolerated this noise level and did not seem unwilling to dive. One individual was as close as 63 m from the pile driving. Responses of two pinniped species to impact pile driving at the San Francisco-Oakland Bay Bridge East Span Seismic Safety Project were mixed (California Department of Transportation, 2001; Thorson & Reyff, 2006; Thorson, 2010). Harbor seals were observed in the water at distances of approximately 400–500 m from the pile driving activity and exhibited no alarm responses, although several showed alert reactions, and none of the seals appeared to remain in the area. One of these harbor seals was even seen to swim to within 150 m of the pile driving barge during pile driving. Several sea lions, however, were observed at distances of 500–1,000 m swimming rapidly and porpoising away from pile driving activities. Observations at other construction sites (for example, the Navy's Point Loma fuel pier project) indicated that sea lions typically did not respond behaviorally to pile driving (Navy, 2014, 2016d). The reasons for these differences are not known, and probably reflect the context of construction activities and the previous experiences of the animals.

Observations of marine mammals on NAVBASE Kitsap Bangor during the Test Pile Program 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. Relatively few observations of cetacean behaviors were obtained during pile driving, and all were outside the Waterfront Restricted Area (WRA). Most harbor porpoises were observed swimming or traveling through the project area and no obvious behavioral changes were associated with pile driving.

During the 3 years of EHW-2 construction monitoring, only California sea lions and harbor seals were detected within the shutdown and behavioral disturbance zones (Primary Surveys) and outside the WRA (Outside Boat Surveys). The sample size for California sea lions was too small during pile driving to identify any trends in responses to construction (Hart Crowser, 2013, 2014, 2015). Harbor seals engaged in a variety of behaviors during pile driving, including swimming, diving, sinking, and looking. They were equally likely to swim, dive, or sink as their ultimate behavior if they were inside the 464-m behavioral disturbance zone and most likely to dive if they were outside the WRA. However, observation effort within the WRA was more intense than effort outside WRA (as explained in Appendix C). Harbor porpoises were only observed outside the WRA, where the predominant behavior during construction (vibratory pile driving) was swimming or traveling through the project area. During pre-construction monitoring, PSOs also reported harbor porpoise foraging. PSOs did not detect adverse reactions to Test Pile Program or EHW-2 construction activities consistent with distress, injury, or high speed withdrawal from the area, nor did they report obvious changes in less acute behaviors. During the installation of piles for the Service Pier Extension in 2020, three identified weaned harbor seal pups regularly approached the bubble curtain during steel pile driving (Navy, 2020; NMFS, 2020). Although it could not be confirmed, it is likely that the seal pups were feeding on fish that may have been disoriented by the bubble curtain.

Marine mammal monitoring at the Port of Anchorage marine terminal redevelopment project found no response by marine mammals swimming within the threshold distances to noise impacts from construction activities including pile driving (both impact hammer and vibratory driving) (Integrated Concepts and Research Corporation, 2009). Most marine mammals observed during the two lengthy construction seasons were beluga whales while harbor seals, harbor porpoises, and Steller sea lions were observed in smaller numbers. Background noise levels at this port are typically at 125 dB.

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

Marine mammals encountering pile driving operations over a project's construction timeframe would likely avoid affected areas in which they experience noise-related discomfort, limiting their ability to forage or rest there. As described in the section above, individual responses to pile driving noise are expected to be variable. Some individuals may occupy a project area during pile driving without apparent discomfort, but others may be displaced with undetermined effects. Avoidance of the affected area during pile driving operations would reduce the likelihood of injury impacts, but would also reduce access to foraging areas. Noise-related disturbance may also inhibit some marine mammals from transiting the area. Given the duration of some projects in the MPR Program 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 response. Since pile driving will only occur during daylight hours, marine mammals transiting a project area or foraging or resting in a project area at night will not be affected. Effects of pile driving activities will be experienced by individual marine mammals, but will not cause population-level impacts or affect the continued survival of the species.

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

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

Based on the frequency overlap between noise produced by both vibratory and impact pile driving (10 Hz to 1.5 kHz), animals that remain in a project area during steel pile driving may be vulnerable to masking for the duration of pile driving (typically 2 hours or less intermittently over the course of a day depending on the site and project). Energy levels of vibratory pile driving are less than half that of impact pile driving; therefore, the potential for masking noise would be limited to a small radius around a pile.

The potential for masking differs between species, depending on the overlap between pile driving noise and the animals' hearing and vocalization frequencies. In this respect, harbor porpoises, which use HF sound, are probably less vulnerable to masking from pile driving than pinnipeds. In addition, cetaceans that may be subject to masking are transitory within the vicinity of the Proposed Action area. The animals most likely to be at risk for vocalization masking would be pinnipeds (harbor seals and sea lions). Animals will often compensate for increasing noise levels by increasing the signal level, repetition rate, duration, or changing the frequency, of their vocalizations, a phenomenon termed the "Lombard effect" (Hotchkin & Parks, 2013; Erbe et al., 2016). Possible behavioral reactions to vocalization masking include changes to vocal behavior (including cessation of calling), habitat abandonment (long or short term), and modifications to the acoustic structure of vocalizations (which may help signalers compensate for masking) (Brumm & Slabbekoorn, 2005; Brumm & Zollinger, 2011). The extent to which the animals' behaviors would mitigate the potential for masking is uncertain, and, accordingly, the Navy has estimated that masking as well as compensatory behavioral responses are likely within the zones of behavioral harassment estimated for vibratory and impact pile driving and DTH drilling (Section **Error! Reference source not found.**), and therefore, taken into account in the exposure analysis.

7.1.2 Potential Effects Resulting from Airborne Noise

Airborne noise resulting from pile driving has the potential to cause behavioral harassment, depending on their distance from pile driving activities. Airborne pile driving noises are expected to have very little impact to cetaceans because noise from atmospheric sources does not transmit well through the air-water interface (Richardson et al., 1995), consequently, cetaceans are not expected to be exposed to airborne sounds that will result in harassment as defined under the MMPA. Airborne noise will primarily be an issue for pinnipeds that are swimming or hauled out within the range of impact as defined by the acoustic criteria discussed in Chapter 6. Most likely, airborne sound will cause behavioral responses similar to those discussed above in relation to underwater noise. For instance, anthropogenic sound could cause hauled-out pinnipeds to exhibit changes in their normal behavior, such as reduction in vocalizations, or cause them to temporarily abandon their usual or preferred locations and move farther from the noise source. Pinnipeds swimming in the vicinity of pile driving may avoid or withdraw from the area, or may show increased alertness or alarm (e.g., heading out of the water, and looking around). However, studies of ringed seals by Blackwell et al. (2004) and Moulton et al. (2005) indicate a tolerance or lack of response to unweighted airborne sounds as high as 112 peak decibels and 96 dB RMS, which suggests that habituation occurred.

California sea lions and harbor seals were present during impact installation and vibratory extraction of piles at NAVBASE Kitsap Bremerton in February 2014 and November 2014 to February 2015 (Northwest Environmental Consulting, 2014, 2015). In February 2014, California sea lions were observed basking on the PSB within the underwater behavioral disturbance zone (117 m from the driven pile) and no behavioral harassment takes were documented because they did not enter the water. California sea lions and harbor seals were observed in the water during vibratory hammer activity. PSOs detected 160 individuals during vibratory pile extraction within the 1,600-m vibratory disturbance zone, resulting in exposure to noise levels above the Level B threshold. PSOs detected 125 individuals during impact pile driving within the 117-m impact disturbance zone, resulting in exposure to noise levels above the Level B threshold. There were no shutdowns of pile driving activity because pinnipeds never entered the injury zones. No visible behaviors indicating a reaction to noise disturbance were observed. Behaviors observed included hauling-out (resting), foraging, milling, and traveling.

Based on these observations, marine mammals in the impact zones may exhibit temporary behavioral reactions to airborne pile driving noise. These exposures may have a temporary effect on individual or groups of animals, but this level of exposure is very unlikely to result in population-level impacts.

7.2 Conclusions Regarding Impacts to Species or Stocks

Individual marine mammals may be exposed to sound pressure levels during pile driving operations at each of the installations, which may result in Level B behavioral harassment and, for harbor seals, some Level A harassment. Any marine mammals that are exposed (harassed) may change their normal behavior patterns (i.e., swimming speed, foraging habits, etc.) or be temporarily displaced from the area of construction. Any exposures to Level B harassment will likely have only a minor effect on individuals and no effect on the population. For harbor seals, exposure to Level A harassment during steel impact driving could result in a change in hearing thresholds permanently. To avoid permanent impacts to harbor seal hearing, a shut-down zone will be implemented that will encompass as much of the Level A zone as practicable. The sound generated from vibratory pile driving will not result in injury to marine mammals because the areas where injury could potentially occur are small, will be fully monitored, and pile driving will be shut-down if marine mammals are approaching these zones. Mitigation is expected to avoid most potential adverse underwater impacts to marine mammals from impact pile driving. Nevertheless, some exposure is unavoidable. The expected level of unavoidable exposure (defined as acoustic harassment) is presented in Chapter 6. This level of effect is not anticipated to have any adverse impact to population recruitment, survival, or recovery.

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8 IMPACTS TO SUBSISTENCE USE

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

8.1 Subsistence Harvests by Northwest Treaty Indian Tribes

NMFS is considering a request by the Makah Indian Tribe to resume limited hunting of Eastern Pacific gray whales for ceremonial and subsistence purposes. This request stems from the 1855 Treaty of Neah Bay, which expressly secures the Tribe's right to hunt whales and seals. To authorize Makah gray whale hunting, NMFS must waive the Marine Mammal Protection Act (MMPA) take moratorium, issue requisite MMPA regulations and permits, and comply with provisions governing aboriginal subsistence whaling under the Whaling Convention Act (WCA). In October of 2022, NMFS prepared a Supplemental Draft Environmental Impact Statement that builds on NMFS' previous consideration of the request in its 2015 Draft Environmental Impact Statement (NMFS 2022). The preferred Alternative put forth in the Supplemental Draft Environmental Impact Statement combines various elements from alternatives previously analyzed in the DEIS and the Administrative Law Judge's recommended decision. Under this alternative, the waiver of the MMPA take moratorium would be valid for 10 years and subject to numerous provisions contained in NMFS' proposed regulations to govern a Makah Tribe gray whale hunt (84 FR 13604). Two management goals shaped many of the provisions in the preferred alternative: (1) limiting the likelihood that tribal hunters would strike or otherwise harm a WNP gray whale and (2) ensuring that the hunting does not reduce PCFG abundance below recent stable levels (NMFS 2022). The current preferred alternative would establish a take limit of up to 20 gray whales harvested, and 25 struck or struck and lost, over a 10 year period (NMFS 2022). The proposed hunt area includes waters north and west of Tatoosh Island off of Cape Flattery out to the edge of the EEZ, and is bound to the south by a line near the 48th parallel (NMFS 2015).

Several Pacific Northwest treaty Indian tribes have promulgated tribal regulations allowing tribal members to exercise treaty rights for subsistence harvest of sea lions (Carretta et al. 2007), but there are no known active ceremonial and/or subsistence hunts for pinnipeds in Puget Sound. Subsistence harvests of the Oregon-Washington Coastal and Washington Inland Waters stocks of harbor seal by Northwestern Treaty Indian Tribes may occur, but no data on recent takes are available (Carretta et al., 2021).

Potential impacts resulting from the proposed project will be limited to individuals of marine mammal species located in the marine waters near NAVBASE Kitsap-Bremerton and will be primarily limited to Level B harassment. For all species, no population impacts will result from the proposed project. Therefore, no impacts to the availability of species or stocks for subsistence use are expected.

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

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

Impacts to habitat will be temporary and include increased human activity and noise levels, localized, minor impacts to water quality, and changes in prey availability near the individual project sites. Impacts will not result in permanent impacts to habitats used directly by marine mammals.

9.1 Effects from Human Activity and Noise

Existing human activity and underwater noise levels, primarily due to industrial activity and vessel traffic, could increase above baseline temporarily during pile repair and replacement activities.

Marine mammals in proposed project and surrounding areas encounter vessel traffic associated with both Navy and non-navy activities. At Navy installations, vessels are used in day-to-day activities including security along the waterfront. Several studies have linked vessels with behavioral changes in killer whales in Pacific Northwest inland waters (Kruse, 1991; Kriete, 2002; Bain et al., 2006; Williams et al., 2006, 2009), although it is not well understood whether the presence and activity of the vessels, the vessel noise produced, or a combination of these factors produces the changes. The probability and significance of vessel and marine mammal interactions is dependent upon several factors including numbers, types, and speeds of vessels; the regularity, duration, and spatial extent of activities; and the presence/absence and density of marine mammals. The existing facilities at these Navy installations also constitute a regular point source of ambient airborne and underwater noise that marine mammals in the vicinity are regularly exposed to.

Behavioral changes in response to vessel presence include avoidance reactions, alarm/startle responses, temporary abandonment of haulouts by pinnipeds, and other behavioral and stress-related changes (such as altered swimming speed, direction of travel, resting behavior, vocalizations, diving activity, and respiration rate) (Watkins, 1986; Würsig et al., 1998; Terhune & Verboom, 1999; Ng & Leung, 2003; Foote et al., 2004; Mocklin, 2005; Bejder et al., 2006; Nowacek et al., 2007). Some dolphin species approach vessels and are observed bow riding or jumping in the wake of vessels (Norris & Prescott, 1961; Shane et al 1986; Würsig et al., 1998; Ritter, 2002). In other cases neutral behavior (i.e., no obvious avoidance or attraction) has been reported (review in Nowacek et al., 2007). Little is known about the biological importance of changes in marine mammal behavior under prolonged or repeated exposure to high levels of vessel traffic, such as increased energetic expenditure or chronic stress, which can produce adverse hormonal or nervous system effects (Reeder & Kramer, 2005).

During MPR Program construction activities, additional vessels may operate in project areas, but will operate at low speeds within the relatively limited construction zone and access routes during the in-water construction period. The presence of vessels will be temporary and occur at current Navy facilities that have some level of existing vessel traffic. Therefore, effects are expected to be limited to short-term behavioral changes and are not expected to rise to the level of take or harassment as defined under the MMPA.

Additional noise could be generated by barge-mounted equipment, such as cranes and generators, but this noise will typically not exceed existing underwater noise levels resulting from existing routine waterfront operations. While the increase may change the quality of the habitat, is not expected to exceed the Level A or B harassment thresholds and impacts to marine mammals from these noise sources is expected to be negligible.

9.2 Impacts on Water Quality

Temporary and localized reduction in water quality will occur as a result of in-water construction activities. Most of this effect will occur during the installation and removal of piles when bottom sediments are disturbed. Effects to turbidity and sedimentation are expected to be short-term, minor, and localized. Turbidity will return to normal levels within minutes to hours after pile extraction or installation. Turbidity and sedimentation levels are not anticipated to result in increases that are significant for marine mammals or their forage base. During pile repair and replacement activities, suspension of anoxic sediment compounds could result in temporary, minor, localized reduced dissolved oxygen in the water column. However, if decreases occur, they would be minimal and localized and are not anticipated to result in levels that are significant for marine mammals or their forage base.

9.3 Impacts on Prey Base (Fish)

Pile repair and replacement will impact marine habitats used by fish. Marine habitats used by fish species that occur in the MPR Program area include nearshore intertidal and subtidal habitats, including piles used for structure and cover. The greatest impact to prey species during pile repair and replacement will result from behavioral disturbance due to pile driving noise. Secondary impacts include benthic habitat displacement, re-suspension of sediments, and injury from underwater noise. The prey base for the most common marine mammal species (harbor seal and California sea lion) in the project area includes a wide variety of fish such as Pacific hake, Pacific herring, and salmonids. Steller sea lions in the vicinity of the project area probably consume pelagic and bottom fish. Dall’s porpoise and harbor porpoise likely feed on schooling forage fish, such as Pacific herring, smelts, and squid. Transient killer whales in the Puget Sound prey on pinnipeds. Southern Resident killer whales occur in Puget Sound and consume fish—primarily salmon.

9.3.1 Underwater Noise Impacts on Fish

The greatest impact to marine fish during construction will occur during impact pile driving because pile driving will exceed the established underwater noise behavior guidance and injury thresholds for fish. However, most piles will be installed with a vibratory driver or they will be concrete, which have lower amplitude sound levels and are not typically associated with fish kills.

During pile driving, the associated underwater noise levels will have the potential to cause injury and could result in behavioral responses, including project area avoidance. To reduce potential effects to salmonids, including juvenile ESA-listed salmonids, the projects will adhere to the in-water work window applicable at each installation for pile extraction and installation. At all installations a bubble curtain, or other noise attenuating device, will be deployed to reduce the underwater noise levels and associated impacts to underwater organisms during impact pile driving of steel piles. To further minimize the underwater noise impacts during steel pile driving, vibratory pile drivers will be used to the maximum extent practicable to drive piles. An impact hammer will be primarily used to verify load-bearing capacity or where piles cannot be advanced further with a vibratory driver due to hard substrate conditions.

Fish within the areas where noise exceeds the behavioral guidance (150 dB RMS re 1 μPa) may display a startle response during initial stages of pile driving and will potentially avoid the immediate project vicinity during pile driving and other construction activities. However, field observation investigations of juvenile salmonid behavior near pile driving projects (Feist, 1991; Feist et al., 1992), found little evidence that normally nearshore out-migrating salmonids move farther offshore to avoid the general project area. In fact, some studies indicate that construction site behavioral responses, including site avoidance, may be as strongly tied to visual stimuli as to underwater sound (Feist, 1991; Feist et al., 1992;

Ruggerone et al., 2008). Therefore, it is possible that salmonids, and likely other species, may alter their normal behaviors including startle response and avoidance of the immediate project site.

Thus, prey availability for marine mammal predators within an undetermined portion of the areas near the affected installations could be reduced temporarily in localized areas during pile driving. However, with the minimization measures that will be implemented, the effect to the overall marine mammal fish forage base will be minimized. Therefore, adverse effects to the marine mammal prey base will be insignificant and will not rise to the level of MMPA take.

9.3.2 Impacts on Fish Habitats/Abundance

Pile repair and replacement activities will adversely affect some habitat conditions for marine fish, including forage fish, in the project area. Positioning and anchoring the construction barges and removing/driving piles will locally increase turbidity, disturb benthic habitats, and disturb forage fish in the immediate project vicinities. Additionally, removal of marine vegetation attached to piles will occur. Construction could bury benthic organisms with limited mobility under sediment. Increased turbidity could make it difficult for predators to locate prey. All of these actions will be temporary with sediments settling back soon after the cessation of activities, and will be localized to the immediate project area around piles. Foraging and refuge habitat quality for prey species will be temporarily degraded over localized areas. The effect is expected to be insignificant to the forage base for marine mammals. Impacts to benthic habitats reflect the number of piles being driven at each project site over the course of the MPR Program. All affected areas are expected to recover quickly and no new overwater structures are being built that will permanently degrade or alter habitat.
Impacts to salmonid and forage fish populations, including ESA-listed species, will be minimized by adhering to the in-water work period designated at each installation. These work periods are designated when out-migrating juvenile salmonids are least likely to occur. Some habitat degradation is expected during construction, but the impacts to fish species and their habitats will be temporary and localized. Moreover, the numbers of marine mammals affected by impacts to prey populations will be small; therefore, the impact will be insignificant in the context of marine mammal populations.

No indirect effects are expected to the Southern Resident killer whale’s prey base. The diet of Southern Resident killer whales consists primarily of adult Chinook (Ford et al., 1998, 2010; Hanson et al., 2010) along with several other salmonid species. Minimization efforts, including adhering to in-water work windows and the use of a noise attenuating device for impact driving steel pile, are likely to minimize this potential adverse effect (refer to Chapter 11 for specific mitigation efforts). Therefore, the project’s effect on the Southern Resident killer whale prey base will be insignificant and is not likely to adversely affect the population.

Direct impacts to marine mammal habitat are expected to be limited to the duration of pile installation and removal during the in-water work window each year. Additionally, the Navy will implement compensatory mitigation actions to mitigate for losses to aquatic resources as required under the CWA Section 404. While this nature of this mitigation is not yet determined, this mitigation would be supportive of fish populations and help to offset the permanent impacts associated with the proposed activity. As a result, in-water activities associated with the proposed project are not likely to have a permanent, adverse effect on marine habitat or populations of prey species.

9.4 Likelihood of Habitat Restoration

All impacts to marine mammal habitat are expected to be limited to the duration of pile extraction and installation during the in-water work window each year. In-water activities associated with the Proposed

Action are not likely to have a permanent, adverse effect on any marine habitat or population of fish species.

10 IMPACTS TO MARINE MAMMALS FROM LOSS OR MODIFICATION OF HABITAT

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

The proposed activities are not expected to have any habitat-related effects that could cause significant or long-term consequences for populations of marine mammals because all activities will be temporary and all piles removed or replaced are within the existing footprint of current structures. Pile repair and replacement will affect marine mammal habitats indirectly through temporary, localized impacts on prey abundance and availability. The most important impacts on marine fish species consumed by marine mammals will result from potential injury and behavioral disturbance to fish species during pile driving. Information provided in Chapter 9 indicates there may be temporary impacts, but those impacts will be minimized through avoidance and mitigation measures and limited to the immediate area surrounding the structures being repaired. Impacts will cease upon the completion of pile repair and replacement activities.

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11 MEANS OF EFFECTING THE LEAST PRACTICABLE ADVERSE IMPACTS

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

The Navy will employ the Best Management Practices (BMPs) and minimization measures listed in this section to avoid and minimize impacts to marine mammals, their habitats, and forage species. Best management practices, mitigation and minimization measures are included in construction contract plans and specifications for individual projects and must be agreed upon by the contractor prior to any construction activities.

11.1 General Construction Best Management Practices

The existing general BMPs and minimization measures that will be implemented, as applicable, during the proposed project are presented below. BMPs are intended to avoid and minimize potential environmental impacts.

- All work will adhere to performance requirements of the Clean Water Act, Section 404 permit and Section 401 Water Quality Certification. No in-water work will begin until after issuance of regulatory authorizations.
- The construction contractor will be responsible for preparation of an environmental protection plan. The plan will be submitted to the Navy and implemented prior to the commencement of any construction activities and is a binding component of the overall contract. The plan shall identify construction elements and recognize spill sources at the site. The plan shall outline BMP, responsive actions in the event of a spill or release, and notification and reporting procedures. The plan shall also outline contractor management elements such as personnel responsibilities, project site security, site inspections, and training.
- No petroleum products, fresh cement, lime, fresh concrete, chemicals, or other toxic or harmful materials shall be allowed to enter surface waters.
- Washwater resulting from washdown of equipment or work areas shall be contained for proper disposal and shall not be discharged unless authorized.
- Equipment that enters surface waters shall be maintained to prevent any visible sheen from petroleum products.
- No oil, fuels, or chemicals shall be discharged to surface waters, or onto land where there is a potential for re-entry into surface waters to occur. Fuel hoses, oil drums, oil or fuel transfer valves, fittings, etc. shall be checked regularly for leaks. Materials will be maintained and stored properly to prevent spills.
- No cleaning solvents or chemicals used for tools or equipment cleaning shall be discharged to ground or surface waters.
- Construction materials will not be stored where high tides, wave action, or upland runoff could cause materials to enter surface waters.
- Barge operations will be restricted to tidal elevations adequate to prevent grounding of a barge.

- Where eelgrass is present in the work area, the Navy shall provide the contractor with plan sheets showing eelgrass boundaries. The following restrictions shall apply to areas designated as having eelgrass:
  - No derrick spudding or anchoring will occur.
  - No scouring of sediments or significant sediment contamination will occur within eelgrass beds.

11.2 Pile Repair, Removal, and Installation Best Management Practices

11.2.1 Pile Inspection

Pile cleaning is necessary to be able to inspect the pier for any structural concerns. Cleaning of piles in all of the action areas shall be conducted with the following restrictions:

- Work must be conducted during maximum daily tidal flows during spring, summer, and fall operations. Maximum tidal flows occur 1 hour after high or low slack tide to 1 hour prior to the next high or low slack tide.
- If piles are wood coated with creosote or other wood treatment, use hand tools and methods that do not remove creosote or treated wood fibers.
- Monitor for turbidity. Cease operations if turbidity exceeds 5 nephelometric turbidity units (NTU) above background for background levels 50 NTU or less. If background is greater than 50 NTU, then cease operations if there is a 10 percent increase in turbidity.
- Removed marine growth must be collected and disposed in accordance with installation waste instructions.

11.2.2 Creosote Pile Removal

- A containment boom surrounding the work area will be used during creosote-treated pile removal to contain and collect any floating debris and sheen. In some cases, the boom may be lined with oil-absorbing material to absorb released creosote.
- Oil-absorbent materials will be used in the event of a spill if any oil product is observed in the water.
- All creosote-treated material and associated sediments will be disposed of in an approved Subtitle D Landfill.
- Creosote-treated timber piles will be replaced with noncreosote-treated piles.

11.2.3 General

- Removed piles and associated sediments (if any) shall be contained on a barge. If a barge is not utilized, piles and sediments may be stored in a containment area near the construction site.
- Pilings that break or are already broken below the waterline may be removed by wrapping the piles with a cable or chain and pulling them directly from the sediment with a crane. If this is not possible, pilings will be removed with a clamshell bucket. To minimize disturbance to bottom sediments and splintering of piling, the contractor will use the minimum size bucket required to pull out piling based on pile depth and substrate. The clamshell bucket will be emptied of piling and debris on a contained barge before it is lowered into the water. If the bucket contains only sediment, the bucket will remain closed and be lowered to the mudline and opened to redeposit the sediment. In some cases (depending on access, location, etc.), piles may be cut below the mudline and the resulting hole backfilled with clean sediment.

- Any floating debris generated during installation will be retrieved. Any debris in a containment boom will be removed by the end of the work day or when the boom is removed, whichever occurs first. Retrieved debris will be disposed of at an upland disposal site.
- If steel piles are filled with concrete, the tube used to fill steel piles with concrete will be placed toward the bottom of the pile to prevent splashing and overflow.
- Whenever activities that generate sawdust, drill tailings, or wood chips from treated timbers are conducted, tarps or other containment material will be used to prevent debris from entering the water.
- Ammoniacal copper zinc arsenate-treated wood will be treated using established standards.
- All piles, lumber, and other materials treated with preservatives shall be sufficiently cured to minimize leaching into the water or sediment.
- If excavation around piles to be repaired or replaced is necessary, hand tools or a siphon dredge will be used to excavate around piles to be replaced.
- Vessels shall operate at a speed of 10 knots or less and shall avoid marine mammals if observed to prevent collision. Vessels shall be placed in neutral/idle if a protected species is within 50 feet (15.2 meters) of the vessel, until the animal is at least 50 yards (46 meters) away, at which point the vessel shall then slowly move away.
- Vessel operators shall not encircle or trap marine mammals between multiple vessels or between vessels and the shore.

11.3 Timing Restrictions

To minimize the number of fish exposed to underwater noise and other construction disturbance, in-water work will occur during the following in-water work windows when ESA-listed salmonids are least likely to be present (U.S. Army Corps of Engineers, 2015).

- NAVBASE Kitsap Bangor (waterfront): July 16–January 15[9]
- NAVBASE Kitsap Bremerton, NAVBASE Kitsap Manchester, and NAVSTA Everett: July 16–February 15

All in-water construction activities will occur during daylight hours (sunrise to sunset) except from July 16 to September 15 when impact pile driving will only occur starting 2 hours after sunrise and ending 2 hours before sunset, to protect foraging marbled murrelets during the nesting season (April 15–September 23). The exception is NBK Bremerton which does not have nesting marbled murrelets. Sunrise and sunset are to be determined based on the NOAA data which can be found at http://www.esrl.noaa.gov/gmd/grad/solcalc.

Non in-water construction activities could occur between 7:00 AM and 10:00 PM during any time of the year.

[9] The window required by U.S. Army Corps of Engineers ends March 1, but the Navy observes an end date of January 15 to be protective of ESA-listed Hood Canal summer-run chum juvenile outmigrants.

11.4 Minimization Measures for Marine Mammals

The following mitigation measures will be implemented during pile driving to avoid marine mammal exposure to Level A injurious noise levels generated from impact pile driving and to reduce to the lowest extent practicable exposure to Level B disturbance noise levels.

11.4.1 Coordination

The Navy shall conduct briefings between construction supervisors and crews, the marine mammal monitoring team, and Navy staff prior to the start of all pile driving activity and when new personnel join the work, to explain responsibilities, communication procedures, marine mammal monitoring protocol, and operational procedures.

11.4.2 Acoustic Minimization Measures

- Vibratory installation will be used to the extent possible to drive steel piles to minimize high sound pressure levels associated with impact pile driving.
- At all installations a bubble curtain or other noise attenuation device that achieves an average of at least 8 dB of noise attenuation will be employed during impact installation or proofing of steel piles where water depths are greater than 0.67 m (2 ft) (see Section 2.3.6). A noise attenuation device is not required during vibratory pile driving.
- If a bubble curtain or similar measure is used, it will distribute air bubbles around 100 percent of the piling perimeter for the full depth of the water column. Any other attenuation measure must provide 100 percent coverage in the water column for the full depth of the pile. The lowest bubble ring shall be in contact with the mudline for the full circumference of the ring. The weights attached to the bottom ring shall ensure 100 percent mudline contact. No parts of the ring or other objects shall prevent full mudline contact.
- A performance test of the noise attenuation device shall be conducted prior to initial use for impact pile driving. If a bubble curtain or similar measure is utilized, the performance test shall confirm the calculated pressures and flow rates at each manifold ring. The contractor shall also train personnel in the proper balancing of air flow to the bubblers. The contractor shall submit an inspection/performance report to the Navy for approval within 72 hours following the performance test. Corrections to the noise attenuation device to meet the performance stands shall occur prior to use for impact driving.
- The Navy will conduct hydroacoustic monitoring for a sub-set of impact-driven steel piles for MPR projects that have greater than three piles with a noise attenuation device.
- If USFWS concurs that turning off the noise attenuation will not negatively impact marbled murrelets, baseline sound measurements of steel pile driving will occur prior to the implementation of noise attenuation to evaluate the performance of a noise attenuation device. Impact pile driving without noise attenuation will be limited to the number of piles necessary to obtain an adequate sample size for each project.

11.4.3 Soft Start

The objective of a soft-start is to provide a warning and/or give animals in close proximity to impact pile driving a chance to leave the area prior to impact driver operating at full capacity thereby, exposing fewer animals to loud underwater and airborne sounds.

- A soft-start procedure will be used for impact pile driving at the beginning of each day’s in-water pile driving or any time pile driving has ceased for more than 30 minutes.

- The following soft-start procedures will be conducted:
  - If a bubble curtain is used for impact pile driving, the contractor will start the bubble curtain prior to the initiation of impact pile driving to flush fish from the zone near the pile where SPL are highest.
  - The contractor will provide an initial set of strikes from the impact hammer at reduced energy, followed by a 30-second waiting period, then two subsequent sets, regardless of whether other activities such as vibratory driving have occurred during the interim. The reduced energy of an individual hammer cannot be quantified because they vary by individual drivers. Also, the number of strikes will vary at reduced energy because raising the hammer at less than full power and then releasing it results in the hammer "bouncing" as it strikes the pile resulting in multiple "strikes".

11.4.4 Visual Monitoring and Shutdown Procedures

A marine mammal monitoring plan will be approved by NMFS prior to commencement of project activities at each installation-specific location. At a minimum the plans will include the following:
For all impact and vibratory pile driving, a shutdown and disturbance zone will be monitored.

- The Navy shall conduct briefings between construction supervisors and crews, the marine mammal monitoring team, and Navy staff prior to the start of all pile installation and removal activity and when new personnel join the work, to explain responsibilities, communication procedures, marine mammal monitoring protocol, and operational procedures.
- All disturbance and shutdown zones will initially be based on the distances from the source predicted for each threshold level.
- Visual monitoring will be conducted by qualified, trained, NMFS-approved PSOs[10]. An observer for MPR projects will be a biologist with prior training and experience conducting marine mammal monitoring or surveys, and who has the ability to identify marine mammal species and describe relevant behaviors that may occur in proximity to in-water construction activities.
- PSOs will be placed at the best vantage point(s) practicable (e.g., from a small boat, construction barges, on shore, or any other suitable location) to monitor for marine mammals and implement shutdown/delay procedures when applicable by calling for the shutdown to the pile driver operator.
- If the shutdown zone is obscured by fog or poor lighting conditions, pile driving will not be initiated until the entire shutdown zone is visible.

[10] NMFS's requirements for PSO qualifications (as of 2023) are as follows: (1) Independent observers (i.e., not construction personnel) are required and must not have any other assigned tasks during monitoring periods; (2) At least one observer must have prior experience performing the duties of a PSO during construction activity pursuant to a NMFS-issued incidental take authorization; (3) Other observers may substitute other relevant experience, education (degree in biological science or a related field), or training for prior experience performing the duties of a PSO during construction activity pursuant to a NMFS-issued incidental take authorization; (4) Where a team of three or more observers are required, a lead observer or monitoring coordinator must be designated. The lead observer must have prior experience performing the duties of a PSO during construction activity pursuant to a NMFS-issued incidental take authorization; and (5) Observers must be approved by NMFS prior to beginning any activity subject to the IHA.

- Monitoring will take place from 30 minutes prior to initiation through 30 minutes post-completion of pile driving. Prior to the start of pile driving, including resuming in-water work after a pause of over 30 minutes, the shutdown zone will be monitored for 30 minutes to ensure that the shutdown zone is clear of marine mammals. Pile driving will only commence once observers have declared the shutdown zone clear of marine mammals.
- The shutdown zone will include all areas where the underwater sound pressure levels are anticipated to equal or exceed the Level A (injury) criteria for marine mammals except for certain areas for harbor seals. The shutdown zone will always be a minimum of 10 m (33 ft) to prevent injury from physical interaction of marine mammals with construction equipment. Shutdown will be implemented in accordance with procedures stated in final approved monitoring plans.
- The disturbance zone will include all areas where the underwater or airborne sound pressure levels are anticipated to equal or exceed the Level B (disturbance) criteria for marine mammals during impact pile driving. However, due to the large area of this zone and limited visibility due to structures such as PSB's within the zone at some project locations, this zone may be reduced to a practicable monitoring area in final approved monitoring plans.
- In accordance with the Plans, pile driving will cease if whales are seen approaching or entering the shutdown (injury) zone or visually monitorable portion of the Level B Harassment zone during impact or vibratory pile driving. Work will be halted and delayed until either the animal has voluntarily left and been visually confirmed beyond the injury zone or visual portion of the disturbance zone or 15 minutes have passed without re-detection of the animal.
- If a pinniped approaches or enters a shutdown zone during pile impact or vibratory driving, work will be halted and delayed until either the animal has voluntarily left and been visually confirmed beyond the shutdown zone or 15 minutes have passed without re-detection of the animal.
- If a marine mammal species for which incidental take is not authorized, or a species for which incidental take has been authorized but the authorized number of takes has been met, is observed entering or within the disturbance zone, work will be halted and delayed until either the animal has voluntarily left and been visually confirmed beyond the shutdown zone or 15 minutes have passed without re-detection of the animal.
- If a pinniped or harbor porpoise is observed in the disturbance zone, but not approaching or entering the shutdown zone, a "take" will be recorded and the work will be allowed to proceed without cessation. Marine mammal behavior will be monitored and documented.
- If a pinniped is observed in the injury zone, work will be stopped and a "take" will be recorded.
- Navy biologists and the lead PSO will have access to the Orca Network text or call in notification systems. Orca Network receives sighting information from Citizen Scientists, vessel captains, and researchers throughout the Puget Sound area. They primarily report on killer whales, humpback whales, and gray whales. The lead PSO will contact the Orca Network and monitor social media prior to the start of pile driving each day to determine the location of ESA-listed SRKWs and humpback whales, and other whales (i.e., gray or minke whales). If any whale species are near or approaching the shutdown zone, pile driving will be delayed until the whale or whales have moved away.

11.4.5 Data Collection

NMFS requires that at a minimum, the following information be collected on the sighting forms:

- Dates and times that marine mammal monitoring begins and ends
- Construction activities occurring during each observation period, including:

  - The number and type of piles that were driven and the method (e.g., impact, vibratory)
  - Total duration of driving time for each pile (vibratory driving) and number of strikes for each pile (impact driving)
- PSO locations during marine mammal monitoring
- Environmental conditions during monitoring periods (at beginning and end of observer shift and whenever conditions change significantly), including Beaufort sea state and any other relevant weather conditions such as cloud cover, fog, sun glare, and overall visibility to the horizon, and estimated observable distance
- Upon observation of a marine mammal, the following information:
  - Name of PSO who sighted the animal(s), PSO location, and activity occurring at time of sighting;
  - Time of sighting;
  - Identification of the animal(s), PSO confidence in identification, and the composition of the group if there is a mix of species;
  - Estimated number of animals, including estimated age and/or sex classes of animal(s);
  - Distance and location of each observed animal relative to the pile being driven;
  - Animal's closest point of approach and estimated time spent within the harassment zone; and
  - Description of behavioral observations (e.g., feeding, traveling), including an assessment of behavioral responses thought to have resulted from the activity (e.g, no response, ceasing feeding, changing direction, flushing, breaching).
- Total number of marine mammals detected within the harassment zone(s), by species

Detailed information about implementation of any mitigation (e.g., shutdowns and delayed), a description of specific actions that ensued, and resulting changes in behavior of animal(s), if any The Navy will note in behavioral observations, to the extent practicable, if an animal has remained in the area during construction activities. Therefore, it may be possible to identify if the same animal or a different individuals are being taken.

For hydroacoustic monitoring of impact-driven steel piles, the Navy will collect the following information, at minimum:

- The type and size of pile being driven, substrate type, method of driving (including hammer model and energy setting(s)), total pile driving duration, and water depth at the pile
- Whether a sound attenuation device is used and, if so, a detailed description of the device and the duration of its use per pile
- The number of strikes and strike rate, depth of substrate to penetrate, pulse duration, and mean, median, and maximum sound levels (dB re: 1 µPa), root mean square sound pressure level (SPL_{rms}), peak sound pressure level (SPL_{peak}), cumulative sound exposure level (SEL_{cum}), and single strike exposure sound level (SEL_{s-s})
- One-third octave band spectrum and power spectral density plot for each pile monitored
- Environmental data including, but not limited to:
  - Wind speed and direction;
  - Air temperature;

- Humidity;
- Surface water temperature;
- Water depth;
- Wave height;
- Weather conditions; and
- Any other factors that could contribute to influencing the airborne and underwater sound levels (e.g., nearby boat activity)

11.4.6 Mitigation Effectiveness

Bubble curtains and similar sound attenuation systems have a long track record of effectiveness when properly deployed. As described in Section 6.7.2, the Navy assumes that the sound attenuation system used for impact driving of steel pipe piles will provide 8 dB of attenuation. All observers utilized for mitigation activities will be experienced biologists with training in marine mammal detection and behavior. Due to their specialized training, the Navy expects that visual mitigation will be highly effective. The observers will be positioned in locations, which provide the best vantage point(s) for monitoring. This will probably be an elevated position to provide a better range of viewing angles. In addition, the small radius of the shutdown zone makes the likelihood of detecting a marine mammal in this zone extremely high.

12 EFFECTS ON ARCTIC SUBSISTENCE HUNTING AND PLAN OF COOPERATION

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

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

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

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

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

Not applicable. The proposed action will take place in Puget Sound, and no activities will take place in or near a traditional Arctic subsistence hunting area. Therefore, there are no relevant subsistence uses of marine mammals implicated by this action.

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13 MONITORING AND REPORTING EFFORTS

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

13.1 Coordination

During each in-water work period covered by the IHA, the Navy will update NMFS on the progress of projects in the MPR Program (bimonthly [September 15, November 15, and January 15]).

13.2 Monitoring Plans

To reduce impacts to marine mammals to the lowest extent practicable, a marine mammal monitoring plan for each project will be approved by NMFS prior to the start of construction. Draft monitoring plans will be submitted in March prior to the start of the in-water work period. Final monitoring plans will be prepared and submitted to NMFS within 30 days following receipt of comments on the draft plans from NMFS.

An example of monitoring plan used for the Test Pile Study in 2023 is located in Appendix C.

Components of the monitoring plans are described in Section 11.4.

13.3 Reporting

Report(s) will be submitted to NMFS within 90 work days of the completion of any required monitoring. The reports will detail the monitoring protocol, summarize the data recorded during monitoring, and estimate the number of marine mammals that may have been harassed. Final reports will be prepared and submitted to the NMFS within 30 days following receipt of comments on the draft reports from the NMFS.

In addition, a final draft report summarizing all marine mammal visual monitoring, acoustic monitoring, and construction activities will be submitted to NMFS 90 calendar days after completion of the in-water work period each year. A final annual report will be prepared and submitted to the NMFS within 30 days following receipt of comments on the draft report from NMFS.

The Marine Mammal Monitoring Plans will contain detailed reporting measures.

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14 RESEARCH EFFORTS

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

The U.S. Navy is one of the world's leading organizations in assessing the effects of human activities in the marine environment including marine mammals. Over the last decades, 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, 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.

The Office of Naval Research'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 Population Consequences of Acoustic Disturbance; and (4) models and databases for environmental compliance.

To manage some of the Navy's marine mammal research programmatic elements, the Navy developed the Living Marine Resources (LMR) Research and Development Program (http://www.lmr.navy.mil/) in 2011. 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 LMR resulting from naval activities, emphasizing those consequences that are most likely to be biologically significant.

The following Puget Sound marine mammal monitoring activities and contracted studies are being conducted by the Navy outside of and in addition to the Navy's commitments to the NMFS under existing permits. To better understand marine mammal presence and habitat use in the Puget Sound Region, the Navy has funded and coordinated four major efforts:

- **Puget Sound Pinniped Haulout Surveys at Specific Naval Installations:** Biologists conduct counts of seals and sea lions at NAVBASE Kitsap Bremerton, Bangor, Manchester, and NAVSTA Everett. Counts are conducted several times per month, depending on the installation. All animals are identified to species where possible. This information aids in determination of seasonal use of each site and trends in the number of animals.
- **Marine Mammal Vessel Surveys in Hood Canal and Dabob Bay:** The Navy conducted a marine mammal density survey in Hood Canal and Dabob Bay during September and October 2011 and again in October 2012 (HDR, 2012).
- **Aerial Pinniped Haulout Surveys:** The Navy funded and contracted WDFW to conduct aerial surveys of pinniped haulouts in all of Puget Sound and the Strait of Juan de Fuca out to Cape Flattery. NMFS NWR funded the San Juan Islands Region. Collectively this information will be used to revise and update the 2000 Atlas of Seal and Seal Lion Haulouts in Washington State. The surveys began in 2013 and continued until spring 2014. Surveys included flyovers at NAVBASE Kitsap Bremerton and Manchester. The survey area did not cover the outer coast of Washington, only the inland waters.
- **Aerial Cetacean Surveys in Puget Sound (Admiralty Inlet and south):** The Navy has contracted aerial surveys of cetaceans in Puget Sound to better understand seasonality and distribution with the goal of improved density values. These surveys began in late 2013, and reports have been published (Smultea et al., 2015; Jefferson et al., 2016).

Overall, the Navy will continue to research and contribute to university/external research to improve the state of the science regarding marine species biology and acoustic effects. These efforts include monitoring programs, data sharing with NMFS from research and development efforts, and current research as previously described.

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Appendix A

Pile Driving Activities and Level B Harassment Exposure Estimates for Pile Driving

Table 1. Exposure Calculation Table NBK Bremerton 2024-2025 Pier C

Pile Type Removal	Timber 13-in	Harbor Porpoise		Steller Sea Lion		California Sea Lion		Harbor Seal	
		Density or Abundance	Level B Exposures	Density or Abundance	Level B Exposures	Density or Abundance	Level B Exposures	Density or Abundance	Level B Exposures
Number of Piles to Remove	25								
Removal Method	Vibratory, pull, or cut								
Number of Days	5								
Zone of Influence	16 km^2								
Pile Type Installation	Concrete octagonal 24-in								
Number of Piles to Install	25								
Installation Method	Impact								
Number of Days	7								
Zone of Influence	0.02 km^2								
Calculated Exposures Removal		0.53/km^2	**42**	0.0478/km^2	**4**	98/day	**490**	2/day	**10**
Calculated Exposures Installation		0.53/km^2	**0**	0.0478/km^2	**0**	98/day	**686**	2/day	**14**
Total Exposures			**42**		**4**		**1,176**		**24**

Table 2. Exposure Calculation Table NBK Bremerton 2024-2025 Pier 5

Pile Type Removal	Timber 13-in	Harbor Porpoise		Steller Sea Lion		California Sea Lion		Harbor Seal	
		Density or Abundance	Level B Exposures	Density or Abundance	Level B Exposures	Density or Abundance	Level B Exposures	Density or Abundance	Level B Exposures
Number of Piles to Remove	53								
Removal Method	Vibratory, pull or cut								
Number of Days	6								
Zone of Influence	16 km^2								
Pile Type Installation	Concrete Square 18-in								
Number of Piles to Install	65								
Installation Method	Vibratory								
Number of Days	13								
Zone of Influence	16 km^2								
Calculated Exposures Removal		0.53/km^2	**51**	0.0478/km^2	**5**	98/day	**588**	2/day	**12**
Calculated Exposures Installation									
Installation Method	Impact[1]								
Number of Days	13								
Zone of Influence	0.007 km^2								

Calculated Exposures Installation		0.53/km^2	**0**	0.0478/km^2	**0**	98/day	**1,274**	2/day	**26**
Total Exposures			**51**		**5**		**1,862**		**38**

[1]Installation may be either vibratory or impact driving.

Table 3. Exposure Calculation Table NBK Manchester 2024-2025 Down the Hole Drilling

Pile Type Removal	Steel 26-in	Harbor Porpoise		Steller Sea Lion		California Sea Lion		Harbor Seal	
		Density or Abundance	Level B Exposures	Density or Abundance	Level B Exposures	Density or Abundance	Level B Exposures	Density or Abundance	Level B Exposures
Number of Piles to Remove	72								
Removal Method	Pull or cut (no exposure zone								
Number of Days	24								
Zone of Influence	0								
Pile Type Installation	Concrete 24-in								
Number of Piles to Install	74								
Installation Method	DTH Drilling								
Number of Days	37								
Zone of Influence	75.8 km^2								
Calculated Exposures Removal	N/A (No Vibratory)								
Calculated Exposures Installation		0.25/km^2	**701**	6/day	**222**	24/day	**888**	10/day	**370**
Total Exposures			**701**		**222**		**888**		**370**

Table 4. Exposure Calculation Table NBK Bangor Marginal Wharf 2025-2026

Pile Type Removal	Steel 36-in	**Harbor Porpoise**		**Steller Sea Lion**		**California Sea Lion**		**Harbor Seal**	
		Density or Abundance	**Level B Exposures**	**Density or Abundance**	**Level B Exposures**	**Density or Abundance**	**Level B Exposures**	**Density or Abundance**	**Level B Exposures**
Number of Piles to Remove	78								
Removal Method	Vibratory or pull								
Number of Days	16								
Zone of Influence	31 km^2								
Pile Type Installation	Steel 36-in								
Number of Piles to Install	78								
Installation Method	Vibratory								
Number of Days	20								
Zone of Influence	31 km^2								
Calculated Exposures Removal		0.812	**402**	7.25/day	**116**	25/day	**400**	16/day	**256**
Calculated Exposures Installation		0.812	**503**	7.25/day	**145**	25/day	**500**	16/day	**320**
Installation Method	Impact								
Zone of Influence	0.92 km^2								
Calculated Exposures Installation		0.812	**N/A**	7.25/day	**N/A**	25/day	**N/A**	16/day	**N/A**

Total Exposures			905		261		900		576

Note: The Level B Behavioral Harassment Zone is attenuated by the shorelines on either side of the narrow Hood Canal.

Table 5. Exposure Calculation Table NBK Bremerton Pier F 2025-2026

Pile Type Removal	Steel 24-in	Harbor Porpoise		Steller Sea Lion		California Sea Lion		Harbor Seal	
		Density or Abundance	Level B Exposures	Density or Abundance	Level B Exposures	Density or Abundance	Level B Exposures	Density or Abundance	Level B Exposures
Number of Piles to Remove	48								
Removal Method	Vibratory or pull								
Number of Days	12								
Zone of Influence	16 km^2								
Pile Type Installation	Steel 24-in								
Number of Piles to Install	48								
Installation Method	Vibratory								
Number of Days	12								
Zone of Influence	16 km^2								
Calculated Exposures Removal		0.53/km^2	**102**	0.0478/km^2	**9**	98/day	**1,176**	2/day	**24**
Calculated Exposures Installation		0.53/km^2	**102**	0.0478/km^2	**9**	98/day	**1,176**	2/day	**24**
Total Exposures			**204**		**18**		**2,352**		**48**

Table 6. Exposure Calculation Table Naval Station Everett Pier A 2025-2026

Pile Type Removal	Steel 12-in	**Harbor Porpoise**		**Steller Sea Lion**		**California Sea Lion**		**Harbor Seal**	
		Density or Abundance	**Level B Exposures**	**Density or Abundance**	**Level B Exposures**	**Density or Abundance**	**Level B Exposures**	**Density or Abundance**	**Level B Exposures**
Number of Piles to Remove	4								
Removal Method	Vibratory or pull								
Number of Days	4								
Zone of Influence	8 km^2								
Pile Type Installation	Steel 12-in								
Number of Piles to Install	4								
Installation Method	Vibratory								
Number of Days	4								
Zone of Influence	8 km^2								
Calculated Exposures Removal		0.75/km^2	**24**	1/day	**4**	48/day	**192**	266/day	**1,064**
Calculated Exposures Installation		0.75/km^2	**24**	1/day	**4**	48/day	**192**	266/day	**1,064**
Installation Method	Impact								
Zone of Influence	0.055 km^2								
Calculated Exposures Installation		0.75/km^2	**N/A**	2/day	**N/A**	48/day	**N/A**	266/day	**N/A**

Total Exposures			**48**		**8**		**384**		**2,128**

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Appendix B

Proxy Sound Source Levels and Potential Bubble Curtain Attenuation for Acoustic Modeling of Nearshore Marine Pile Driving at Navy Installations in Puget Sound

(Attached)

Appendix C

Marine Mammal Monitoring Plan

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