REQUEST FOR AN INCIDENTAL HARASSMENT AUTHORIZATION UNDER THE MARINE MAMMAL PROTECTION ACT FOR PILE REMOVAL AND REPLACEMENT NAVAL BASE KITSAP BREMERTON, CONSTRUCTION YEAR 2, October 1, 2014 through March 1, 2015

Submitted to:

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

Prepared by:

Naval Base Kitsap

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LIST OF ACRONYMS AND ABBREVIATIONS

μPa ... microPascal
BMP ... best management practices
Caltrans ... California Department of Transportation
CFR ... Code of Federal Regulations
CV ... coefficient of variation
dB ... decibel
dB(A) ... A-weighted decibel
DON ... Department of the Navy
DPS ... distinct population segment
ESA ... Endangered Species Act
FR ... Federal Register
FY ... fiscal year
IHA ... Incidental Harassment Authorization
Hz ... Hertz
kHz ... kilohertz
m ... meter
MMPA ... Marine Mammal Protection Act
N/A ... not applicable
NAS ... naval air station
NAVBASE ... naval base
NMFS ... National Marine Fisheries Service
NOAA ... National Oceanic and Atmospheric Administration
Pa ... Pascal
PSAMP ... Puget Sound Ambient Monitoring Program
rms ... root mean square
SPL ... sound pressure level
TL ... transmission loss
U.S. ... United States
U.S.C. ... United States Code
USFWS ... U.S. Fish and Wildlife Service
WDFW ... Washington Department of Fish and Wildlife
WSDOT ... Washington State Department of Transportation
ZOI ... zone of influence

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

Naval Base (NAVBASE) Kitsap is a U.S. Navy (Navy) base located on the Kitsap Peninsula in Washington State. The Mission of NAVBASE Kitsap is to serve as the home base for the Navy's fleet throughout Puget Sound and to provide base operating services, including support for both surface ships and submarines home ported at Bremerton and Bangor.

The proposed project is a pier maintenance project occurring at NAVBASE Kitsap Bremerton. NAVBASE Kitsap Bremerton is capable of overhauling and repairing all types and sizes of ships while also serving as the homeport for a nuclear aircraft carrier and other Navy vessels. Other significant capabilities include alteration, construction, deactivation, and dry-docking of all types of naval vessels. As part of the Navy's mission, maintaining facilities and readiness is a priority.

The project will occur in marine waters supporting several marine mammal species. Under the Marine Mammal Protection Act (MMPA) of 1972, as amended (16 United States Code [U.S.C.] Section [§] 1371(a)(5)(D)), the Navy is requesting an Incidental Harassment Authorization (IHA), for pile removal and driving activities that are expected to result in the incidental taking of marine mammals by Level B harassment only. The 14 specific items required for this application, as set out by 50 CFR 216.104, Submission of requests, are provided for in chapters 1–14 of this application.

A map of the region of activity is provided in Figure 1-1 and a description of the activities for which the Navy is requesting incidental take authorization is provided in the following sections.

1.2 Proposed Action

The Navy is proposing to remove 400 deteriorating fender piles at Pier 6 and replace them with 330 new fender piles as begun in December 2013. Fender piles are driven into the sea bed around the perimeter of the pier to protect against damage from incoming vessels. Existing deteriorated fender piles are primarily creosote treated timber that will be replaced with pre-stressed concrete piles. Table 1-1 provides pile size, material, numbers and installation method of the piles to be installed or removed at NAVBASE Kitsap Bremerton.

There will be minimal change to the footprint of Pier 6 as replacement fender piles would be installed in approximately the same location as removed piles. This application is for the second of three IHA needed to accomplish this work.

1.3 Construction Methods and Descriptions

This section describes the typical methods of pile removal and installation that will be used to accomplish the work included as part of this proposed action.

Figure 1-1. NAVBASE Kitsap Bremerton and other Navy Region Northwest Installations

TABLE 1-1. NUMBER, TYPE AND SIZE PILES AT PIER 6

Pile Type	Size	No. Removed	Removal Method	No. Installed	Installation Method
Creosote treated timber fender	12”	380	Vibratory Extraction*	0	N/A
Steel pipe fender	12”	20	Vibratory Extraction	0	N/A
Pre-stressed concrete fender	18”x18”	0	N/A	240	Impact Driving
Pre-stressed concrete reaction	24”x24”	0	N/A	90	Impact Driving
Total:		***400***		***330***	

****As contingency, a direct pull or clamshell may be used to remove broken fender piles that cannot be removed with a vibratory hammer***

1.3.1 Pile Removal

Vibratory extraction is a common method for removing all pile types. This starts with suspending a vibratory driver on a barge-mounted crane adjacent to the pile. The pile is then loosened from the sediments by activating the driver, a large mechanical device weighing from 5–16 tons, and slowly lifting up on the driver with the aid of a crane. Once the pile is released from the sediments, the crane raises the driver and pulls the pile from the sediment. The driver is shut off once the end of the pile reaches the mud line. Still in the clutches of the driver, the pile is pulled from the water, placed on a barge, and released from the driver. Vibratory extraction is expected to take approximately 5–30 minutes per pile. Sediments attached to the outside of the pile are suspended in the water column until they settle back to the seafloor. The amount of time for these sediments to settle ranges from several seconds to a few hours depending on the sediment type, currents, and weather conditions.

In some cases, complete 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 direct pull or clamshell may be used to attempt to entirely remove the broken pile. A direct pull involves wrapping broken piles with a cable and pulling them directly from the sediment with a crane. Clamshell removal involves using a set of steel jaws suspended from a crane to grasp pile stubs that have broken below the water line. If the entire pile cannot be removed, the pile would be cut at the mud line to prevent disturbing sediments. Direct pull and clamshell removal do not produce noise that could impact marine mammals.

1.3.2 Pile Installation

Concrete replacement piles will be up to 24-inches in diameter and will be installed with an impact hammer to the appropriate tip elevation. 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. The pile is essentially hammered into the substrate from the downward force of the strikes. Once the pile is properly positioned, pile installation can typically take 15–60 minutes depending on conditions (i.e., bedrock, loose soils, etc.) to reach the required tip elevation.

1.4 Work Accomplished Under First-Year IHA

During the first in-water work season, only two concrete piles were installed by the contractor. Piles were installed on the east side of Pier 6 using a single impact hammer rig. A soft start was used to begin pile driving for each pile. Marine mammal monitoring was conducted during pile driving. The Year 1 IHA Marine Mammal Monitoring Report is included as Appendix D to this application.

1.5 Best Management Practices, Mitigation and Minimization Measures

The Proposed Action includes best management practices (BMPs) for construction and other measures that will be implemented to minimize or avoid potential environmental impacts. Chapter 11 presents the measures to be implemented to reduce or avoid environmental impacts from the implementation of the proposed action.

General BMPs are routinely used by the Navy to avoid and minimize potential environmental impacts. Additional minimization measures have been added to protect ESA-listed species. These additional measures include limiting in-water work to the designated work window, and marine mammal monitoring as described in Chapter 11 of this application.

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. A signed contract represents a legal agreement between the contractor and the Navy. Failure to follow the prescribed BMP mitigation and minimization measures constitutes a contract violation.

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

Pile removal and replacement for Pier 6 will last for three years beginning on December 1, 2013 and will require 3 IHAs. This application is for Year 2. Timing restrictions (or "fish windows") will be followed to avoid conducting activities when endangered fish are most likely to be present. Timing restrictions are typically imposed by the United States Army Corps of Engineers, the United States Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) and with coordination with the Washington Department of Fish and Wildlife.

The approved Army Corps window for in-water work at NAVBASE Kitsap Bremerton is June 15 to March 1 to avoid the juvenile salmon migration period in Sinclair Inlet. The initial IHA covered the in-water work period from December 1, 2013 through March 1, 2014. This application is requested to cover the period from October 1, 2014 through March 1, 2015.

2.2 Duration

For Year 2 it is estimated that 60 total days of pile driving will be required. See table 2-1 for a year by year breakdown of vibratory and impact pile driving days. Based on the revised project schedule, initial estimate of 200 days as a worst-case number for pile removal and installation over the course of the entire project has been revised down to 102 total days, assuming a production rate of approximately 16 piles per day during pile removal and approximately 4 piles per day during installation. This is a conservative estimate; the actual production rate is expected to be higher resulting in fewer total days. This will depend on the actual geography of the work, equipment, equipment failure, and other construction variables. All pile removal and replacement will occur during daylight hours. It is expected that this project will require a third IHA to complete pile replacement at Pier 6. The Year 3 IHA will be requested for the work window of June 15, 2015 through March 1, 2016.

TABLE 2-1. ESTIMATED PILE DRIVING DAYS[1]

Removal/Installed	Year 1 Pile Driving Days	Year 2 Pile Driving Days	Year 3 Pile Driving Days	Total Pile Driving Days
Vibratory Pile Removal	0	15	10	25
Impact Pile Driving	2	45	30	77
Total Days:	***2***	***60***	***40***	***102***

[1]*Estimated pile driving days are based on a production rate of approximately 16 piles per day during removal and 4 piles per day during installation*

2.3 Geographic Region of Activity

NAVBASE Kitsap Bremerton is located on the north side of Sinclair Inlet within the City of Bremerton in Kitsap County (Figure 2-1). 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.

Sinclair Inlet is part of the estuarine system of interconnected waterways and basins known as Puget Sound. 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 (see Figure 1-1 and 2-1). 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.

Sinclair Inlet connects to the main basin of Puget Sound through Port Washington Narrows and then Agate Pass to the north or Rich Passage to the East. Sinclair Inlet is an estuary of Puget Sound located 16 miles by ferry from the Seattle waterfront, and extending 3.5 miles southwesterly from its connection with the Port Washington Narrows, just east of NAVBASE Kitsap Bremerton. Sinclair Inlet has been significantly modified by development activities. Fill associated with transportation, commercial, and residential development of the NAVBASE Kitsap, the City of Bremerton, and the local ports of Bremerton and Port Orchard has resulted in significant changes to the shoreline. The area surrounding Pier 6 is industrialized, armored and adjacent to railroads and highways. Sinclair Inlet is also the receiving body for the Westside Wastewater Treat Plant (WWTP) located just west of NAVBASE Kitsap Bremerton. Sinclair Inlet is relatively shallow and does not flush fully despite the freshwater stream inputs.

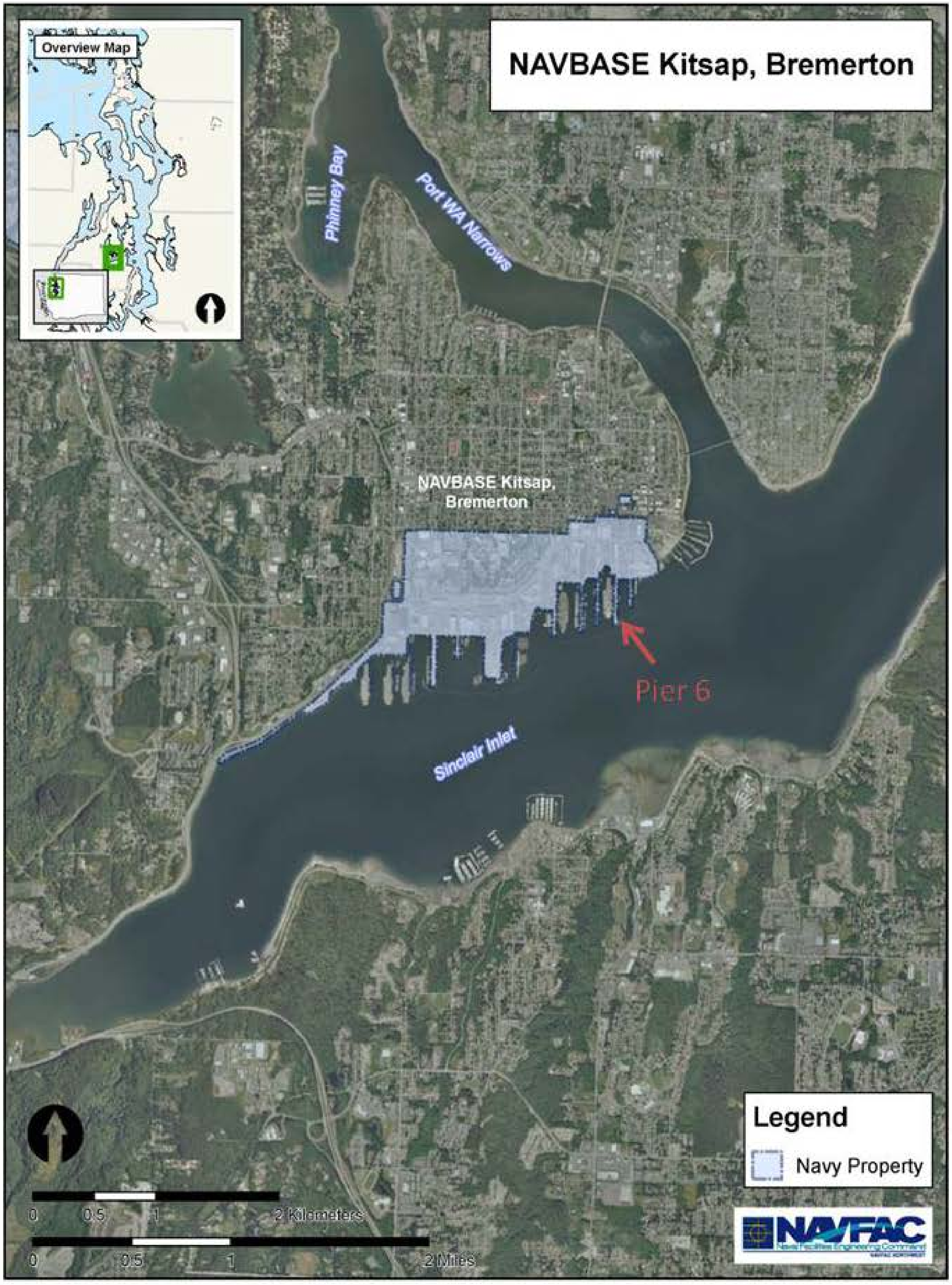

Figure 2-1. Naval Base Kitsap Bremerton

3 Marine Mammal Species and Numbers

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

3.1 Species

Historically, six marine mammal species have been documented in the waters near NAVBASE Kitsap, Bremerton. Five of the species have a reasonable potential to occur in the project vicinity: these are the harbor seal (*Phoca vitulina*), the California sea lion (*Zalophus californianus*), the Steller sea lion (*Eumetopias jubatus*), the transient killer whale (*Orcinus orca*), and the gray whale (*Eschrichtius robustus*). The sixth species, the Southern Resident stock of killer whales, is unlikely to be present.

Harbor seals are common year-round in the waters of Sinclair Inlet and haulout on log breakwaters at various marinas in Port Orchard (across from NAVBASE Kitsap Bremerton). California sea lions haulout seasonally on the port security barrier (floating fence) at NAVBASE Kitsap Bremerton. Steller sea lions had never been documented at NAVBASE Kitsap Bremerton until November 2012, when a solitary animal was observed hauled out on the port security barrier during a vessel survey (personal communication Lance, 2012). In November 2012, near Manchester (located further east in Rich Passage which connects to Sinclair Inlet) there was a sighting of Steller and California sea lions hauled out on a large temporary floating dock (U.S. Navy 2012).

Two types of killer whales, the West Coast transient stock and the Southern Resident stock have historically occurred in the vicinity of Sinclair Inlet, but the Southern Resident presence is extremely rare. The last confirmed sighting was in 1997 in Dyes Inlet (Dyes Inlet connects to Sinclair Inlet northeast of NAVBASE Kitsap Bremerton). There was a more recent confirmed Southern Resident occurrence (7 years ago) along the Washington State Ferries route within Rich Passage between Bremerton and Seattle in December of 2007, but these were not reported to have headed west into Sinclair or Dyes Inlet (Orca Network, 2014). Therefore, due to their rare occurrence in this part of Puget Sound, the Southern Resident killer whale were not carried forward in the analysis and only the transient killer whale is included in the analysis. There are confirmed sightings of gray whales in Sinclair Inlet, although their occurrence is infrequent.

Table 3-1 lists the marine mammal species most likely to occur in the vicinity of the project, their status, and a qualitative likelihood of encountering one of these species in the project vicinity. Section 4 contains detailed information on the species status and management and distribution.

Seven other marine mammal species are rare to extralimital in Sinclair Inlet and the surrounding waters and are unlikely to be exposed to the project activities due to their lack of historic presence. These include: the humpback whale (*Megaptera novaeangliae*), the minke whale (*Balaenoptera acutorostrata*), Pacific white-sided dolphins (*Lagenorhynchus obliquidens*), the harbor porpoise (*Phocoena phocoena*), the Dall's porpoise (*Phocoenoides dalli*), and northern elephant seals (*Mirounga angustirostris*). A review of the sighting reports since 2005 available on Orca Network (Orca Network, 2014) and discussion with the local Navy biologist (Beckley, 2013) indicates that there have been no documented sightings of these species in the waters near NAVBASE Kitsap Bremerton or within Sinclair Inlet in recent history. Humpback whales, minke whales and harbor porpoises have been sighted in central and south Puget Sound but have not been documented transiting west through Rich Passage into Sinclair Inlet (Orca Network, 2014). In addition, a small number of Risso's dolphins (*Grampus griseus*) have been documented in Puget Sound in the last few years, but none were near Sinclair Inlet. This species is a coastal species and considered extralimital to Puget Sound. Therefore, exposure of these species is considered unlikely and take is not requested for these species.

3.2 Numbers

3.2.1 Harbor Seal

Aerial surveys of harbor seals in Washington inland waters were conducted during the pupping season in 1999. At this point, 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, 14,612 (CV=0.15) harbor seals were estimated in the Washington Inland Waters stock (Carretta et al. 2012). Unfortunately, because the most recent abundance estimate is greater than 8 years old, this data is considered out of date; however, this is the best estimate of abundance currently available.

3.2.2 California Sea Lion

The current population estimate for the U.S. stock of California sea lions is 296,750 (Carretta et al. 2012). To get this estimate, pups were counted during the breeding season, 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 (Carretta et al. 2012). Approximately 3,000 to 5,000 animals are estimated to move into Washington and British Columbia waters typically starting in September and departing in May for breeding rookeries in California and Mexico (Jeffries et al. 2000). Peak counts of more than 1,000 animals have been made in Puget Sound (Jeffries et al. 2000).

3.2.3 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 ranges from 58,334 to 72,223 (Allen and Angliss 2012).

3.2.4 Killer Whale [Transient]

A minimum abundance estimate for the West Coast Transient stock is 243 animals based on photographic data (DFO 2009, as cited in Allen and Angliss, 2012). This estimate is considered conservative and does not include whales from southeastern Alaska and California that are provisionally classified as part of the stock (Allen and Angliss, 2012). Allen and Angliss provide a minimum population estimate for the stock of 354 individuals including animals in Canadian waters. They note this number is conservative and there are no overall estimates of population size.

3.2.5 Gray Whale

A recent abundance estimates for the Eastern North Pacific gray whale stock is approximately 19,000 (Laake et al. 2009). For stock assessment purposes, NMFS currently uses an abundance of 19,126 animals (CV=0.071 (Allen and Angliss 2012)). 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 (Allen and Angliss 2012).

TABLE 3-1. MARINE MAMMAL SPECIES POTENTIALLY PRESENT IN PROJECT AREA

Species	Stock(s) Abundance Estimate[1]	ESA Status	MMPA Status	Frequency of Occurrence[2]
Harbor Seal *WA Inland Waters Stock*	14,612	-	Non-depleted	Likely
California Sea Lion *U.S. Stock*	296,750	-	Non-depleted	Seasonal (unlikely in July)
Steller Sea Lion *Eastern U.S. Stock/DPS*	58,334-72,223	-	Non-depleted	Seasonal; (unlikely June-September)
Killer Whale *West Coast Transient Stock*	354	-	Non-depleted	Infrequent
Gray Whale *Eastern North Pacific Stock*	19,126	-	-	Infrequent

[1]NMFS marine mammal stock assessment reports at: http://www.nmfs.noaa.gov/pr/sars/species.htm

[2] Extralimital -There may be a small number of sighting or stranding records, but the area is outside the species range of normal occurrence.
Rare -Few confirmed sightings, or the distribution of the species is near enough to the area that the species could occur there.
Infrequent – Confirmed, but irregular sightings.
Likely -Confirmed and regular sightings of the species in the area year-round.
Seasonal - Confirmed and regular sightings of the species in the area on a seasonal basis.

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.

Marine mammal species managed by NMFS that potentially occur in the Puget Sound belong to three taxonomic groups: mysticetes (baleen whales), odontocetes (toothed whales, porpoises and dolphins), and pinnipeds (seals and sea lions). (Mysticetes and odontocetes are known collectively as cetaceans.) In the study area, one of these species (the Steller sea lion) was federally listed under the ESA, before being delisted in December 2013. Informal consultation with NMFS under the ESA was completed on December 20, 2012. Harbor seals and California sea lions are the most common in the study area. This section includes information on each species' stock status management, abundance, and distribution (including seasonal information if available). Some of these sections contain direct excerpts from the most current stock assessment reports developed by NMFS.

4.1 Harbor Seal

4.1.1 Status and Management

Harbor seals are not listed as depleted under the MMPA and they are not listed under the ESA. For management purposes, differences in mean pupping dates, movement patterns, pollutant loads, and fishery interactions have led to the recognition of three separate harbor seal stocks along the west coast of the continental United States:

1. Inland Waters of Washington State—including Hood Canal, Puget Sound, and the Strait of Juan de Fuca out to Cape Flattery
2. Outer Coast of Oregon and Washington
3. California (Carretta et al. 2012).

Harbor seals occurring in the Study Area belong to the Washington Inland stock. Based on radiotelemetry results, interchange between inland and coastal stock is unlikely (Jeffries et al. 2003).

4.1.2 Distribution

Harbor seals are rarely found more than 12 miles (20 km) from shore and frequently occupy bays, estuaries, and inlets (Baird 2001). Individual harbor seals have been observed several miles upstream in coastal rivers (Baird 2001). An ideal harbor seal habitat includes haulout sites, shelter during the breeding periods, and sufficient food (Bjørge 2002). Haulouts can include intertidal and subtidal rock outcrops, sandbars, sandy beaches, peat banks in salt marshes, and manmade structures such as log booms, docks, and recreational floats (Jeffries et al. 2000). Harbor seals are not thought to make extensive pelagic migrations; however long distance movement of tagged animals in Alaska (108 miles [174 km]), along the U.S. west coast (up to 342 miles [550 km]), and in Washington inland waters (greater than 137 miles [220 km]) have been recorded (Peterson et al. 2012). Harbor seals display 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. The number of hauled out harbor seals range from a few to between 100 - 500 individuals (Jeffries et al. 2000).

Pupping seasons vary by geographic region, with pups born in the Strait of Juan de Fuca, San Juan Islands, Admiralty Inlet, and the eastern bays of Puget Sound from June through August; Puget Sound south of Admiralty Inlet from late June through September; and Hood Canal from August through October (NOAA and WDFW 2009).

Harbor seals are expected to occur in Sinclair Inlet and NAVBASE Kitsap Bremerton at all times of the year. No permanent haulout has been identified at NAVBASE Kitsap Bremerton. The nearest known haulouts are along the south side of Sinclair inlet on log breakwaters at several marinas in Port Orchard approximately 1 mile from Pier 6.

4.2 California Sea Lion

4.2.1 Status and Management

California sea lions are not listed as depleted under the MMPA and they are not listed under the ESA. Individuals that may occur in the study area belong to the U.S. stock, the geographic boundary of which begins at the U.S./Mexico border and extends northward into Canada.

4.2.2 Distribution

During the summer, California sea lions breed on islands from the Gulf of California to the Channel Islands and seldom travel more than about 31 miles (50 km) from the islands. The primary rookeries are located on the California Channel Islands of San Miguel, San Nicolas, Santa Barbara, and San Clemente. Their distribution shifts to the northwest in fall and to the southeast during winter and spring—probably in response to changes in prey availability. In the nonbreeding season, adult and sub adult males migrate northward along the coast to central and northern California, Oregon, Washington, and Vancouver Island. They are occasionally sighted hundreds of miles offshore. Generally, only male California sea lions migrate into northwest waters with females remaining in waters near their breeding rookeries off the coasts of California and Mexico. Females and juveniles tend to stay closer to the rookeries. In Washington, haulout sites are located on man-made structures such as docks, jetties, navigation buoys, and offshore rocks and islands (Jeffries et al. 2000).

Regular haulout sites used by adult and sub adult California sea lions have been identified in Washington inland waters (Jeffries et al. 2000; Jeffries, 2012) (Figure 4-2). The Navy conducts surveys of sea lions at its installations within Puget Sound. At NAVBASE Kitsap Bremerton, Navy personnel perform marine mammal counts along the floating fence, or Port Security Barrier, that surrounds a majority of the base (Figure 4-1). Between February, 2010 and July, 2014 the maximum number of California sea lions along and hauled out on the Port Security Barrier was 219 individuals counted on October 30, 2013. Zero sea lions were counted on June 22, 2011, July 23, 2013, and July 16, 2014 (U.S. Navy 2014b). In addition, 50 to 70 California sea lions were observed on floats near Manchester Fuel Depot (approximately 6.5 miles from NAVBASE Kitsap Bremerton) in November 2012 by Navy biologists. Three smaller haulouts are identified in the main basin of Puget Sound (north of Seattle, Seattle, and Tacoma) and California sea lions are found on navigational buoys from south Puget Sound north into Admiralty Inlet (Jeffries et al. 2000; Jeffries, 2012) (Figure 4-2).

Occurrence in Puget Sound is typically between September and June with peak abundance between September and May. During summer months (June, July, and August) 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.

California sea lions on the Port Security Barrier are expected to be exposed to noise from project activities at NAVBASE Kitsap Bremerton. Exposure would occur primarily from September through the end of the in-water work window in early March.

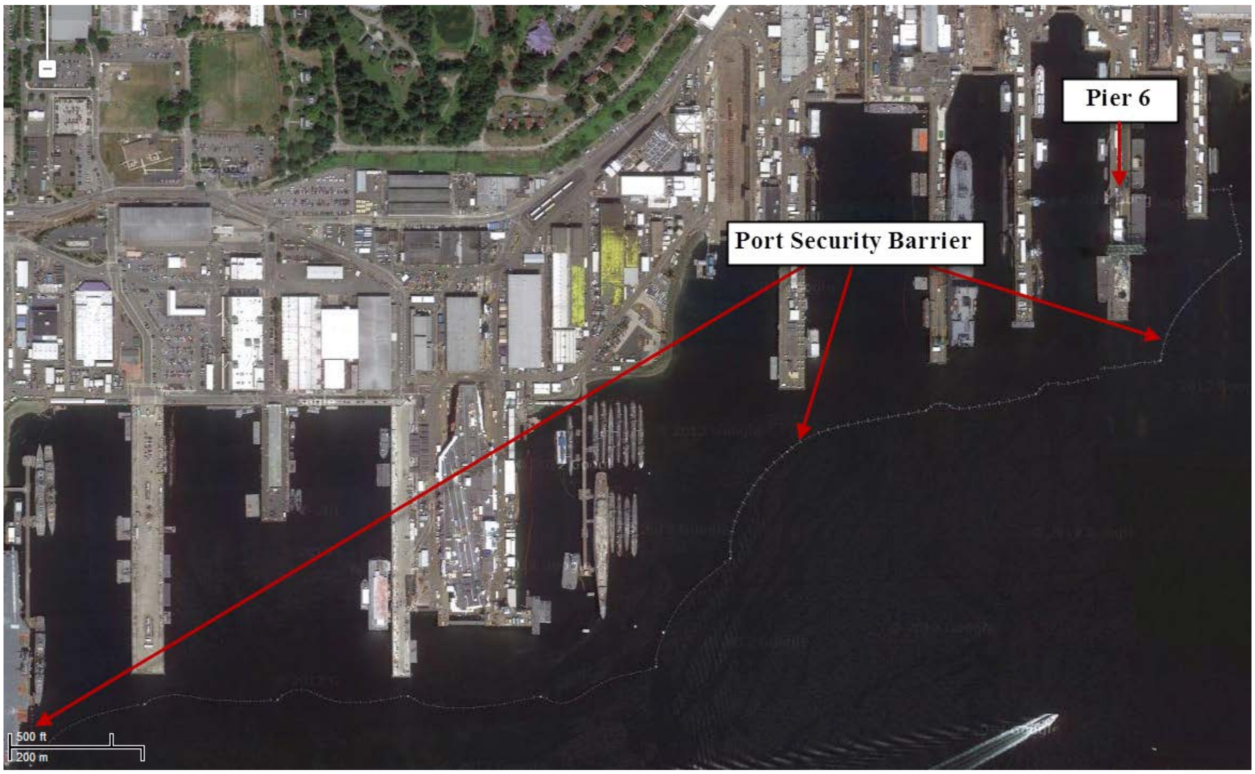

Figure 4-1. Port Security Barrier location in Relation to Pier 6

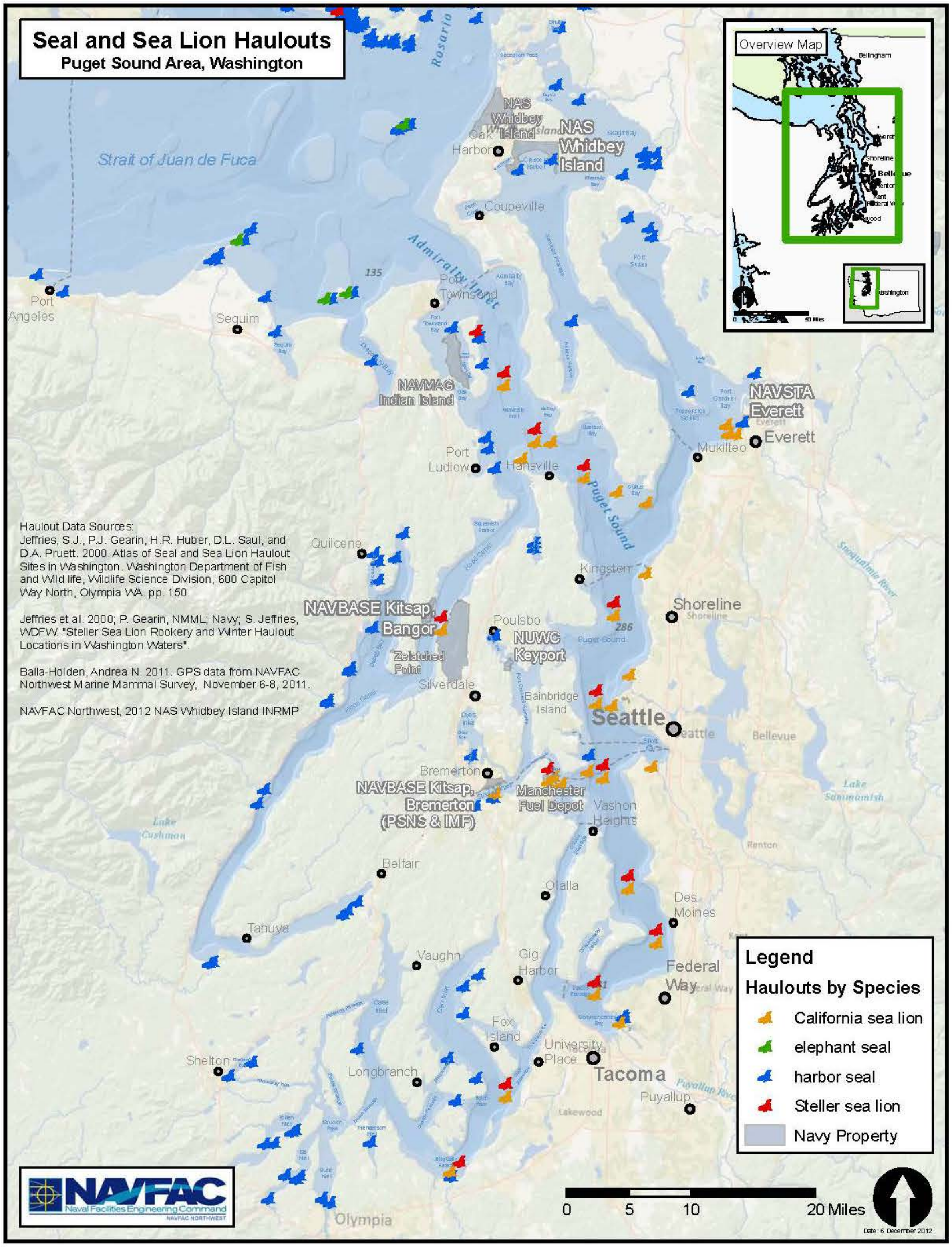

Figure 4-2. Pinniped Haulouts in the Vicinity of the Project

4.3 Steller Sea Lion

4.3.1 Status and Management

Steller sea lions are protected under the MMPA, and the eastern U.S. stock had been listed as threatened under the ESA before being delisted on December 4, 2013. Individuals that may occur in the study area are of the Eastern Distinct Populations Segment (DPS) (Allen and Angliss 2012). The Eastern stock is stable or increasing throughout the northern portion of its range (Southeast Alaska and British Columbia) in the central portion of its range (Oregon through northern California) (NMFS 2012a). In April 2012, NMFS proposed the Steller sea lion be removed from listing under the ESA based on its annual rate of increase (77 FR 23209). 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.

4.3.2 Distribution

Steller sea lions are found along the coasts of Washington, Oregon, and northern California where they occur at rookeries and numerous haulout locations along the coastline (Jeffries et al. 2000; Scordino 2006; NMFS 2012b). Breeding rookeries are located along the Oregon and British Columbia coasts, no breeding rookeries are found in Washington (Jeffries et al. 2000). 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). 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 the Oregon and British Columbia rookeries (approximately late May to early June) (Jeffries et al. 2000). In the Puget Sound, Jeffries (personal communication, August 2012) identified five winter haulout sites used by adult and sub adult Steller sea lions (see Figure 4-2). Numbers of animals observed at all of these sites combined were less than 200 individuals.

By June, most Steller sea lions have left inland waters and returned to their rookeries to mate; however, occasionally sub-adult (immature or pre-breeding animals) or nonbreeding adults remain in Puget Sound over the summer (Gearin, 2008). A haulout with approximately 30 to 50 individuals (Jeffries, 2012) occurs approximately 6.5 miles from the project site near the Manchester Fuel Depot's finger pier. The haulout near Manchester is physically separated by various land masses and waterways from NAVBASE Kitsap Bremerton (Figure 4-2) and therefore is not within a direct line of site of the pile driving activities and construction sounds do not reach these animals. Steller sea lions opportunistically haulout on various navigational buoys from south Puget Sound north into Admiralty Inlet (Jeffries, 2012). Usually one or two animals can be found on any given buoy. The nearest navigational buoy used by Steller sea lions is approximately 8 miles from the project site. Three other haulouts occur in Puget Sound; NAVBASE Kitsap, Bangor in Hood Canal, Marrowstone Island in Admiralty Inlet, and in the southern portion of Puget Sound. These last three haulouts are all located more than 30 miles from the project site. However, one Steller sea lion was observed hauled out on the floating security barrier at NAVBASE Kitsap Bremerton in November 2012 (Lance, 2012). No permanent haulout has been identified at NAVBASE Kitsap Bremerton and Steller sea lion presence at NAVBASE Kitsap Bremerton is considered to be rare and seasonal.

4.4 Killer Whale [Transient]

4.4.1 Status and Management

Among the genetically distinct assemblages of killer whales in the northeastern Pacific, the West Coast Transient stock occurs from California to southeastern Alaska. Killer whales belonging to the West Coast Transient stock are protected under the MMPA, but not listed under the ESA.

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, 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 haul-outs 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 appear to be unpredictable.

The number of West Coast Transient killer whales in Washington inland waters at any one time was considered to likely 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., in review). Many of the West Coast Transients in Washington inland waters have been catalogued by photo identification. However, unlike the Southern Resident stock, re-sighting uniquely identified individuals is less frequent. Sinclair Inlet, where NAVBASE Kitsap Bremerton is located, is a shallow bay located approximately 8 miles from the main open waters of the Puget Sound where killer whales most often travel.

West Coast Transient killer whales most often travel in small pods of up to four individuals (Baird and Dill, 1996). Houghton (2012) 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 Houghton, the most commonly observed group size in Puget Sound (defined as from Admiralty Inlet through South Puget Sound and up to Skagit Bay) in this time period is 6 whales (mode=6, mean=6.88) (Houghton 2012). Occasionally larger groups may occur. Houghton et al. (in review) note that a group of up to 27 animals was observed in Puget Sound in 2010.

Transient killer whales occasionally occur throughout the study area and ZOI. From December 2002 to July 2014, there were two reports of transient killer whales moving through the area around NAVBASE Kitsap Bremerton. Both of these reports occurred in May (2004 & 2012), which is outside of the proposed work window for this project (Orca Network, 2014). The group size in these two sightings ranged from 5 to 12 (Orca Network, 2014).

4.5 Gray Whale

4.5.1 Status and Management

Gray whales are protected under the MMPA. The Eastern North Pacific stock occurs in the waters of the west coast of the United States. This stock was delisted from the ESA in 1994 and in 1999 a status review recommended the continuation of this stock's classification as non-threatened. Additionally, some individuals of the Western North Pacific stock have been identified in waters several hundred miles from the project area in the Pacific Ocean, off Vancouver Island, Washington, and off Oregon since 2004 (MMI 2011, Weller et al. 2011, as cited in WDFW 2012).

4.5.2 Distribution

This species makes the longest annual migration of any mammal—between 9,321 and 12,427 miles (15,000 to 20,000 km) roundtrip (Jefferson et al. 2008; Jones and 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. In the fall, whales start the southward migration from November to late December and mainly follow the coast to Mexico. The trip averages 2 months. 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 (Jones and Swartz 2009).

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, according to Calambokidis et al. (2002), 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. They typically arrive and depart from these feeding grounds concurrently with the migration to and from the wintering grounds (Calambokidis et al. 2002).

Gray whales have been observed in some, but not all Washington Inland waters in all months of the year (Calambokidis et al. 2010; Orca Network 2013) with most individuals occurring from March through June (Calambokidis et al. -2010). Most whales sighted are part of a small regularly occurring group of 6 to 10 gray whales that use mudflats in the Whidbey Island and the Camano Island area as a springtime feeding area from late March through May (Calambokidis et al. 2009; WDFW 2012). Regular feeding areas are located in Port Susan north of Everett and along northwestern and eastern Whidbey Island, including Crescent Harbor where NAS Whidbey Island Seaplane Base is located (Orca Network 2014). Gray whales feed on benthic invertebrates, including dense aggregations of ghost shrimp and tubeworms (Weitkamp et al. 1992, Richardson 1997). These locations are far outside the ZOI for this project and would not be affected by construction noise.

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 (WDFW 2012) and susceptible to stranding. Sinclair Inlet, where NAVBASE Kitsap Bremerton is located, is approximately 8 miles west of the main open waters of Puget Sound where gray whales occur with more frequency. From December 2002 to July 2014, there were four reports of gray whales in the area around NAVBASE Kitsap Bremerton that occurred during the in-water work window months (Orca Network, 2014). Three sightings occurred during the winter of 2008 and 2009 (January, 2008; November, 2008; December 2009) and one stranding occurred in January 2013. The necropsy of the juvenile, male gray whale indicated that it was in poor nutritional health among other issues (Cascadia Research 2013).

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.

The Navy is requesting an IHA for the incidental taking (by behavioral disruption) of marine mammals, incidental to Year 2 of proposed pile removal and replacement activities at Pier 6 for the work period starting in October 2014. This taking would occur as a result of noise generated during in-water pile driving activities. The term “take,” as defined in Section 3 (16 U.S.C. § 1362 (13)) of the Marine Mammal Protection Act (MMPA), means “to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal.” “Harassment” was further defined in the 1994 amendments to the MMPA, which provided two levels of harassment: Level A—potential injury and Level B—potential behavioral disruption.

This authorization request considers pile removal and replacement activities outlined in Chapter 1 that are expected to occur in Sinclair Inlet and have the potential to result in the MMPA defined take of marine mammals. This analysis attempts to quantify the number of marine mammals that will be exposed to levels of sound that may result in a take. This is accomplished by mathematically estimating the number of marine mammals that may be exposed to levels of sound that will result in take as defined by behavioral or injury criteria from the pile extraction and driving. Based on this approach, behavioral disruption (Level B harassment) may result from both underwater and airborne sounds produced during pile removal and installation.

The Navy does not anticipate Level A harassment. The reasons for this are two-fold. First, vibratory pile driving used for pile extraction has a relatively low source level (less than190 dB). Second, pile driving will be either delayed or halted if a marine mammal approaches a predetermined area around Pier 6, the shutdown zone. In addition, the results from the Navy’s modeling approach likely overestimate Level B exposures because most of the assumptions made throughout the species quantification and sound attenuation modeling process give deference to the species. Some examples include: the highest density within the in-water work window for each marine mammal species, or local sighting information is applied over the entire project timeframe regardless of seasonal distribution of species; the maximum number of pile driving days is assumed, and source levels, in most cases, are assumed to be greater than actual source levels. In addition, as detailed in Chapter 11, the Navy makes concerted efforts to reduce its impact as well as take minimization measures.

The take estimates for all marine mammal species combined are as follows: no Level A exposures and 3,420 Level B exposures from underwater sounds (2,700 California sea lions, 60 Steller sea lions and 660 harbor seals). No additional exposures are anticipated from airborne sounds. Chapter 6 contains detailed results of modeled potential exposures to impulsive and non-impulsive sources from pile repair and replacement activities within the project study area.

6 Numbers and Species Taken

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

The methods for estimating the number and types of exposure are described in the sections below. This begins with a presentation of the threshold criteria. Then the method for quantifying exposures of marine mammals to sources of energy exceeding those threshold values is discussed. Exposure of each species was determined by:

- The potential of each species to be impacted by the acoustic sources as determined by the hearing sensitivity and acoustic criterion for each species.
- The potential presence of each species and their density at each project area.
- The area of impact as estimated by taking into account the source levels, propagation loss, and thresholds at which each acoustic criterion are met.
- Potential exposures were calculated by multiplying the density of each marine mammal species potentially present by the total area potentially impacted each day by the estimated number of days of pile driving.

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 just 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.

The following sections provide information on the fundamentals of underwater noise and noise sources as they relate to the proposed action.

6.2 Fundamentals of Underwater Noise

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air or water. Sound is generally characterized by several factors, including frequency and intensity. Frequency describes the sound’s pitch and is measured in hertz (Hz), while intensity describes the sound’s loudness. Due to the wide range of pressure and intensity encountered during measurements of sound, a logarithmic scale is used. In acoustics, the word “level” denotes a sound measurement in decibels. A decibel (dB) expresses the logarithmic strength of a signal relative to a reference. Because the decibel is a logarithmic measure, each increase of 20 dB reflects a ten-fold increase in signal amplitude (whether expressed in terms of pressure or particle motion), i.e., 20 dB means ten times the amplitude, 40 dB means one hundred times the amplitude, 60 dB means one thousand times the amplitude, and so on. Because the decibel is a relative measure, any value expressed in decibels is meaningless without an accompanying reference. In describing underwater sound pressure, the reference amplitude is usually 1 microPascal (μPa) or 10^{-6} Pascal (Pa), and is expressed as “dB re 1μPa.” For in-air sound pressure, the reference amplitude is usually 20 μPa and is expressed as “dB re 20 μPa.” All underwater sound levels throughout the remainder of this application are presented in dB re 1 μPa unless otherwise noted.

The method commonly used to quantify airborne sounds consists of evaluating all frequencies of a sound according to a weighting system that reflects human hearing. This is called A-weighting, and the decibel level measured is called the A-weighted sound level (dB(A)). A similar filtering method that reflects hearing of marine mammals has not yet been developed. Therefore, underwater sound levels are not weighted and measurements are taken throughout the entire frequency range of interest. In the case of marine construction work, the frequency range of interest is 10 to 10,000 Hz (Washington Department of Transportation (WSDOT) 2010).

Table 6-1 summarizes commonly used terms to describe underwater sounds. Two common descriptors are the instantaneous peak sound pressure level (SPL) and the root mean square (rms) SPL (dB rms). The peak pressure is the instantaneous maximum or minimum overpressure observed during each pulse or sound event and is presented in Pa or dB referenced to a pressure of 1 microPascal (dB re 1 μPa). The rms level is the square root of the energy divided by a defined time period. For all intents and purposes this is a time-averaged sound level.

6.3 Description of Noise Sources

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

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

Pulsed sounds (e.g., explosions, gunshots, sonic booms, seismic airgun pulses, and impact pile driving) are brief, broadband, atonal transients (Harris 1991) and occur either as isolated events or repeated in some succession (Southall et al. 2007). Pulsed sounds are all characterized by a relatively rapid rise from ambient pressure to a maximal pressure value followed by a decay period that may include a period of diminishing, oscillating pressures (Southall et al. 2007). Pulsed sounds generally have a greater capacity to induce physical injury compared with sounds that lack these features (Southall et al. 2007).

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

TABLE 6-1. DEFINITIONS OF ACOUSTICAL TERMS

Term	Definition
Decibel (dB)	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for water is 1 microPascal (µPa) and for air is 20 µPa (approximate threshold of human audibility).
Sound Pressure Level	Sound pressure is the force per unit area, usually expressed in microPascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure. Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	Frequency is expressed in terms of oscillations, or cycles, per second. Cycles per second are commonly referred to as hertz (Hz). Typical human hearing ranges from 20 Hz to 20,000 Hz.
Peak Sound Pressure (unweighted), dB re 1 µPa	Peak sound pressure level is based on the largest absolute value of the instantaneous sound pressure over the frequency range from 20 Hz to 20,000 Hz. This pressure is expressed in this application as dB re 1 µPa.
Root Mean Square (rms), dB re 1 µPa	The rms level is the square root of the energy divided by a defined time period. For pulses, the rms has been defined as the average of the squared pressures over the time that comprises that portion of waveform containing 90 percent of the sound energy for one impact pile driving impulse. For nonpulsed energy or continuous sound, rms energy represents the average of the squared pressures over the measurement period and is not limited by the 90 percent energy criterion.
Sound Exposure Level, dB re 1 μPa^2 sec	Sound exposure level is a measure of energy. Specifically, it is the dB level of the time integral of the squared-instantaneous sound pressure, normalized to a 1-second period. It can be an extremely useful metric for assessing cumulative exposure because it enables sounds of differing duration to be compared in terms of total energy.
Waveforms, µPa over time	A graphical plot illustrating the time history of positive and negative sound pressure of individual pile strikes shown as a plot of µPa over time (i.e., seconds).
Frequency Spectra, dB over frequency range	A graphical plot illustrating the frequency content over a given frequency range. Bandwidth is generally defined as linear (narrowband) or logarithmic (broadband) and is stated in frequency (Hz).
A-Weighting Sound Level, dB(A)	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the low and high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective human reactions to noise.
Ambient Noise Level	The background sound level, which is a composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.

TABLE 6-2. REPRESENTATIVE NOISE LEVELS OF ANTHROPOGENIC SOURCES

Noise Source	Frequency Range (Hz)	Underwater Noise Level (dB re 1 µPa)	Reference
Small vessels	250–1,000	151 dB rms at 1 m	Richardson et al. 1995
Tug docking gravel barge	200–1,000	149 dB rms at 100 m	Blackwell and Greene 2002
Vibratory driving of 72-inch steel pipe pile	10–1,500	180 dB rms at 10 m	Illingworth and Rodkin 2007
Impact driving of 36-inch steel pipe pile	10–1,500	195 dB rms at 10 m	WSDOT 2007
Impact driving of 66-inch cast-in-steel-shells piles	100–1,500	195 dB rms at 10 m	Reviewed in Hastings and Popper 2005

6.4 Vocalization and Hearing of Marine Mammals

All marine mammals that have been studied produce and use sounds to forage, orient, detect and respond to predators, and socially interact with others. 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 and 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 standardized testing procedures with appropriate controls, and are considered to be a more accurate representation of a subject's hearing abilities. Audiograms of marine mammals are particularly difficult to obtain compared to other animals because they are often 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 physiological structures, vocal characteristics, 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. For both behavioral and electrophysiological audiometry, 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.

Direct measurement of hearing sensitivity exists for approximately 25 of the nearly 130 species of marine mammals. Table 6-3 provides a summary of sound production and hearing capabilities for marine mammal species in the study area. For purposes of this analysis, marine mammals are arranged into the following functional hearing groups based on their generalized hearing sensitivities: mid-frequency cetaceans, low-frequency cetaceans, and pinnipeds.

TABLE 6-3. HEARING AND VOCALIZATION RANGES FOR MARINE MAMMAL FUNCTIONAL HEARING GROUPS AND SPECIES POTENTIALLY WITHIN THE STUDY AREA

Functional Hearing Group[1]	Functional Hearing Group – Estimated Auditory Bandwith	Species Represented in Project Area	Vocalization Dominant Frequencies (citation)	Best Hearing Sensitivity Range (citation)
Mid-Frequency Cetaceans	150 Hz to 160 kHz[1]	Killer Whale	1.5 to 6 kHz (pulses; Richardson et al. 1995, 35 to 50 kHz (echolocation; Au et al. 2004)	18 to 42 kHz (Szymanski et al. 1999)
Low-Frequency Cetaceans	7 Hz to 22 kHz[1]	Gray Whale	120 Hz to 4 kHz (song; Payne and Payne 1985; 25 Hz to 1.9 kHz (pulses and grunts; Thompson et al. 1986)	No published data
Pinnipeds	In-water: 75 Hz to 75 kHz[1] In-air: 75 Hz to 30 kHz[1]	Harbor Seal	In-water: 250 Hz to 4 kHz (males; Hanggi and Schusterman 1994) In-air: 100 Hz to 1 kHz (males; Richardson et al. 1995)	In-water: 1 to 50 kHz (Southall et al. 2007) In-air: 6 to 16 kHz (Richardson et al. 1995; Wolski et al. 2003)
		Steller Sea Lion	In-air: 150 Hz to 1 kHz (females; Campbell et al. 2002)	In-water: 1-16 kHz (male; Kastelein et al. 2005) 16 to 25 kHz (female; Kastelein et al. 2005) In-air: 2 to 16 kHz (Schusterman 1974; Mulsow & Reichmuch 2008; Mulsow & Reichmuth 2010)
		California Sea Lion	In-water: 500 Hz to 4 kHz (Schusterman et al. 1967) In-air: 250 to 5 kHz	In-water: 1 - 28 kHz (Schusterman et al. 1972) In-air: 4 to 16 kHz (Mulsow et al. 2011a,b)

1. Source: Southall et al. (2007). Pinniped data are primarily from phocid species (true seals).

Hz = Hertz, kHz = kilohertz

6.5 Sound Exposure Criteria and Thresholds

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

Since 1997, NMFS has used generic sound exposure thresholds to determine when an activity in the ocean that produces sound might result in impacts to a marine mammal such that a take by harassment might occur (NMFS 2005). 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. Current NMFS practice regarding exposure of marine mammals to high underwater level sounds is that cetaceans and pinnipeds exposed to impulsive sounds ≥180 and

190 dB rms, respectively, are considered to have been taken by Level A (i.e., injurious) harassment. Level A injury thresholds have not been established for continuous sounds such as vibratory pile driving, but the Navy has applied the threshold values for impulsive sounds to vibratory sound in this analysis (Table 6-4).

Behavioral harassment (Level B) is considered to have occurred when marine mammals are exposed to underwater sounds ≥160 dB rms for impulse sounds (e.g., impact pile driving) and 120 dB rms for continuous noise (e.g., vibratory pile driving), but below injurious thresholds. Level A (injury) and Level B (disturbance) thresholds are provided in Table 6-4.

As described above for underwater sound injury and harassment thresholds, 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 well underwater (Richardson et al. 1995); thus, noise would primarily be a problem for hauled-out pinnipeds near the project locations. The 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 (unweighted) and for all other pinnipeds is 100 dB rms (unweighted).

TABLE 6-4. INJURY AND DISTURBANCE THRESHOLDS FOR UNDERWATER AND AIRBORNE SOUNDS

Marine Mammals	Airborne Marine Construction Criteria (Impact and Vibratory Pile Driving) (re 20 µPa)[1]	Underwater Vibratory Pile Driving Criteria (nonpulsed/continuous sounds) (re 1µPa)		Underwater Impact Pile Driving Criteria (pulsed sounds) (re 1µPa)	
	Disturbance Guideline Threshold (Haul-out)[2]	Level A Injury Threshold	Level B Disturbance Threshold	Level A Injury Threshold	Level B Disturbance Threshold
Cetaceans (whales, dolphins, porpoises)	Not applicable	180 dB rms	120 dB rms	180 dB rms	160 dB rms
Pinnipeds (seals, sea lions, walrus, except harbor seal)	100 dB rms (unweighted)	190 dB rms	120 dB rms	190 dB rms	160 dB rms
Harbor seal	90 dB rms (unweighted)	190 dB rms	120 dB rms	190 dB rms	160 dB rms

1. Airborne disturbance thresholds do not specify pile driver type.

2. Sound level at which pinniped haul-out disturbance has been documented. Not an official threshold, but used as a guideline.

6.5.1 Limitations of Existing Noise Criteria

The application of the 120 dB rms threshold can sometimes be problematic because this threshold level can be either at or below the ambient noise level of certain locations. As a result, this threshold level is subject to ongoing discussion (NMFS 2009). The National Marine Fisheries Service is developing new thresholds to improve and replace the current generic exposure level thresholds, but the criteria have not been finalized (Southall et al. 2007). The 120 dB rms threshold level for continuous 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 continuous sound threshold should not be confused with the 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 continuous sounds from vibratory pile driving as low as the 120 dB threshold. Southall et al. (2007) reviewed studies documenting behavioral responses of harbor seals and northern elephant seals to continuous sounds under various conditions. He concluded that exposures between 90 dB and 140 dB rms re 1μPa generally do not induce strong behavioral responses, albeit this was from a limited number of studies.

6.5.2 Auditory Masking

Natural and artificial sounds can disrupt behavior by auditory masking. This masking interferes with a marine mammal's ability to hear other relevant sounds, such as communication and echolocation signals (Wartzok et al. 2003). Masking occurs when both the signal and masking sound have similar frequencies and either overlap or occur very close to each other in time. Noise can only mask a signal if it is within a certain "critical bandwidth" around the signal's frequency and its energy level is similar or higher than the signal (Holt 2008). What is meant by an energy level that is "similar" is a strong function of the frequency of the signal/noise. (Wartzok et al. 2003). For example, in delphinid subjects, relevant 1 kHz signals needed to be 17 to 20 dB louder than masking noise in order to be detected; 100 kHz signals need to be 40 dB greater (Richardson et al. 1995).

If a masking sound is manmade, it can be potentially harassing (as defined by the MMPA) if it disrupts hearing-dependent behavior such as communications or echolocation. The most intense underwater sounds in the proposed action are those produced by impact pile driving. Given that the energy distribution of pile driving covers a broad frequency spectrum, with greatest amplitude typically from 50 to 1,000 Hz (WSDOT 2011a, b); pile driving sound will be primarily within the lower audible range of the pinniped and cetacean species that may occur in the project area. Some overlap of frequencies used for social signals by the marine mammal species with pile driving frequencies may occur; especially affecting the pinnipeds which use and are more sensitive to lower frequencies than the cetaceans that may occur in the project area (see chapter 4).

Any masking event that could possibly rise to Level B harassment under the MMPA will occur concurrently within the zones of behavioral harassment estimated for vibratory and impact pile driving (see Section 6.6.2, Underwater Noise from Pile Driving) which are taken into account in the exposure analysis (see Section, 6.8, Estimating Harassment Exposures). Therefore, masking effects are not considered as separately contributing to exposure estimates in this application.

6.5.3 Ambient Noise

Underwater Noise

Underwater ambient noise in Puget Sound is comprised of sounds produced by a number of natural and anthropogenic sources and varies both geographically and temporally. Natural noise 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 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 noise between 20 Hz and 100 kHz (Urick 1983).

Human-generated noise is a significant contributor to the ambient acoustic environment at NAVBASE Kitsap Bremerton (Table 6-5). Normal port activities include vessel traffic from aircraft carriers, large ships, submarines, 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, the adjacent Washington State Ferry Terminal, and noise from recreational boat engines. Ship and small boat noise comes from propellers and other on-board rotating equipment.

TABLE 6-5. INSTALLATION ACTIVITY LEVELS AND NOISE SOURCES

Installation	Activity Level	Noise Sources
NAVBASE Kitsap Bremerton	Very high	Shipyard; high traffic and homeport for large ships

At NAVBASE Kitsap Bremerton, depending on the wavelength, anthropogenic noise can often dominate the ambient soundscape. In areas with less anthropogenic activity, ambient noise is likely to be dominated by noise from natural sources.

Underwater ambient noise has been recorded and measured only at NAVBASE Kitsap Bangor during previous Navy activities. In 2009, the average broadband (100 Hz–20 kHz) noise level near Marginal Wharf on NAVBASE Kitsap Bangor was 114 dB re 1µPa rms (Slater 2009). Below 300 Hz, noise from industrial activity dominated the spectrum, with a maximum level of 110 dB re 1µPa rms in the 125 Hz band. From 300 Hz to 5 kHz, average received levels ranged between 83 and 99 dB re 1µPa rms. Wind-driven wave noise dominated the background noise between 5 and 10 kHz; above 10 kHz, the sound levels were relatively even at all frequencies.

Similar noise levels were recorded near the NAVBASE Kitsap Bangor project area in 2011. Average noise levels at the Explosives Handling Wharf during the recent Test Pile program ranged from 112.4 dB rms at mid depth to 114.3 dB rms at deep depth. 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 noise are to be expected based on land shadowing and other environmental factors, but for analysis purposes, the average noise level at this installation was assumed to be 114 dB re 1 µPa rms.

Ambient noise 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 re 1 µPa rms; Veirs and Veirs 2006; Carlson et al. 2005). Nearshore measurements near ferry terminals in Puget Sound resulted in median noise levels (where the cumulative distribution function (CDF) equals 0.5) between 104 and 130 dB re 1 µPa rms (WSDOT 2012). It is reasonable to assume that ambient noise associated with NAVBASE Kitsap Bremerton will be higher than NAVBASE Kitsap Bangor due to the higher activity levels, presence of larger vessels, and additional industrial workload. Under normal weather, workload, and traffic (boat and vehicle) conditions, ambient noise at NAVBASE Kitsap Bremerton is assumed to be below 120 dB re 1 µPa rms.

Airborne Noise

Airborne noise at NAVBASE Kitsap Bremerton is produced by common industrial equipment, including trucks, cranes, compressors, generators, pumps, and other equipment that might typically be employed along industrial waterfronts. Noise is highly variable based on the types and operational states of equipment at the recording location (ex: each wharf may have a different noise environment). For NAVBASE Kitsap Bangor, airborne noise measurements were taken during a two-day period in October 2010 within the waterfront industrial area near the project site. During this period, daytime noise levels ranged from 60 dBA 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.

These higher day-time noise levels are produced by a combination of sound sources including heavy trucks, forklifts, cranes, marine vessels, mechanized tools and equipment, and other sound-generating industrial/military activities. Measured levels were comparable to estimated noise levels from literature. Presuming multiple sources of noise may be present at one time, maximum combined levels may be as high as 99 dBA. This estimates that two similar sources occurring together will increase noise levels by 3 dB (double) over the level of a single piece of equipment by itself (WSDOT 2007). Existing maximum baseline noise conditions at the waterfront during a typical work week are expected to be approximately 99 dBA due to typical truck, forklift, crane, and other industrial activities. Noise levels will vary by time and location, but average ambient noise levels are expected to range from a low of 55 dBA to 99 dBA.

6.6 Modeling Noise Impact from Pile Driving

6.6.1 Underwater Sound Propagation

Pile driving will generate underwater noise that potentially could result in disturbance to marine mammals swimming near the project area. Transmission loss (TL) is the decrease in acoustic intensity as an acoustic pressure wave propagates out from a source. Transmission loss 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 the pile driving activity to various expected sound pressure levels in the study area.

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

Where *TL* is the transmission loss in dB, R_1 is the distance of the modeled SPL from the driven pile, and R_2 is the distance from the driven pile of the initial measurement.

This model is a compromise between the spherical spreading law that assumes noise moves in all directions from a source and the cylindrical spreading law that assumes the sound moves radially outward but the sea floor and ocean surface prevents spreading upward or downward. In this model, there is a 4.5 dB reduction in level for each doubling of distance from the source. In the spherical model this loss would be 6 dB and in the cylindrical model this loss would be 3 dB.

The choice of TL model is based on how underwater noise propagates away from a noise source and is dependent on a variety of factors, most notably by the water boundaries: bathymetry and presence or absence of reflective or absorptive conditions at the sea surface and the nature of the sediment on the sea floor.

The TL model described above was used to calculate the expected noise level resulting from both impact and vibratory pile driving. From this, sound level contours were used to establish a zone of influence (ZOI) or area affected by the noise criteria. Maps showing the extent of a representative ZOI for the study area can be found in Appendix B. At Pier 6, a pile furthest from the shore was chosen to illustrate the maximum reach of the ZOI that would be produced from noise generated by pile driving at the structure (see next section).

6.6.2 Underwater Noise from Pile Driving

The intensity of pile driving sounds is greatly influenced by factors such as the type of piles, hammers, and the physical environment in which the activity takes place. In order to determine reasonable sound pressure levels from pile driving at NAVBASE Kitsap Bremerton, studies with similar properties to the proposed action were evaluated. Studies which met the following parameters were considered:

- Pile materials: wood, concrete, and steel pipe piles
- Pile driver type: vibratory and impact

Tables 6-6 and 6-7 present representative sound pressure levels from pile driving activities (impact hammer and vibratory driver, respectively) that have occurred in recent years.

Due to the similarity of these actions and the Navy's proposed action, they represent reasonable sound pressure levels that can be anticipated. The sound source level that was produced from the most similar measured source level was used. If a source level for a particular pile was not available the next highest source level was used to produce a conservative estimate of areas above threshold values.

TABLE 6-6. REPRESENTATIVE SOUND PRESSURE LEVEL FROM CONCRETE PILE DRIVING STUDIES USING IMPACT HAMMERS

Project	Location	Pile Type	Hammer Type	Water Depth	Distance	Measured Sound Levels (rms)
Berth 22, Port of Oakland[1]	CA	Concrete pile/24-inch	Impact	15m	10 m/33 feet	176 dB re 1 µPa

[1]Compendium of Pile Driving Data report to the California Department of Transportation—Illingworth and Rodkin, Inc. (2007)

TABLE 6-7. REPRESENTATIVE SOUND PRESSURE LEVELS FROM PILE DRIVING STUDIES USING VIBRATORY HAMMERS

Project	Location	Pile Type	Hammer Type	Water Depth	Distance	Measured Sound Levels (rms)
Mad River Slough Pipeline[1]	CA	Steel Pipe/ 13-inch	Vibratory	~5 m	10 m/33 feet	155 dB re 1 µPa
Timber Pile Removal[2]	WA	Wood/12-inch	Vibratory	~10 m	15.8 m/52 feet	150 dB re 1 µPa

[1]Compendium of Pile Driving Data report to the California Department of Transportation—Illingworth & Rodkin, Inc. (2007)
[2]WSDOT 2011.

All calculated distances to underwater marine mammal noise thresholds are provided in Table 6-8 and ZOI areas are provided in Table 6-9. For the 20 steel piles to be removed, an increased radial distance was calculated. The ZOI areas only include the area encompassed to the extent of the shoreline. Figures illustrating the extent and area of each ZOI for a pile representing the worst-case extent of noise propagation (furthest from the shore) at each installation are presented in Appendix B.

TABLE 6-8. CALCULATED RADIAL DISTANCE(S) TO UNDERWATER MARINE MAMMAL PILE DRIVING NOISE THRESHOLDS

Pile Driving Site	Injury Pinnipeds (190 dB RMS)	Injury Cetaceans (180 dB RMS)	Behavioral harassment Cetaceans and Pinnipeds (160 dB RMS)	Behavioral harassment Cetaceans and Pinnipeds (120 dB RMS)
NAVBASE Kitsap Bremerton – Pier 6	1.2 m (impulsive) 0 m (continuous)	5.4 m (impulsive) 0 m (continuous)	117 m	1585 m (2,154 m for steel piles)

TABLE 6-9. CALCULATED AREA(S) ENCOMPASSED BY UNDERWATER MARINE MAMMAL PILE DRIVING NOISE THRESHOLDS

Pile Driving Site	Injury Pinnipeds (190 dB RMS)	Injury Cetaceans (180 dB RMS)	Behavioral harassment Cetaceans and Pinnipeds (160 dB RMS)	Behavioral harassment Cetaceans and Pinnipeds (120 dB RMS)
NAVBASE Kitsap Bremerton – Pier 6	4 sq m (impulsive) < 1 sq m (continuous)	92 sq m (impulsive) 15 sq m (continuous)	0.04 sq km	5.04 sq km (7.5 sq km for steel piles)

6.6.3 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 appropriate airborne noise thresholds 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 is not directionally inhibited; therefore, it follows the spherical spreading law discussed above. This means that there is a 6 dB decrease in sound pressure level over water ("hard-site" condition) per doubling of distance (WSDOT 2010). The transmission loss equation assuming spherical spreading is given by:

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

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. This model was used to estimate the distance to the 100 dB and 90 dB rms re 20 µPa (unweighted) airborne thresholds.

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. In order to determine reasonable airborne source sound pressure levels, the source level measurements listed in Table 6-10 were used.

TABLE 6-10. AIRBORNE SOUND PRESSURE LEVELS FROM SIMILAR IN-SITU MONITORED CONSTRUCTION ACTIVITIES

Project and Location	Pile Size and Type	Installation Method	Water Depth	Measured Sound Pressure Levels
Test Pile Program, NAVBASE Kitsap Bangor, WA	24-inch steel pile	Impact	-	89dB re 20 µPa at 15 meters (50 feet)
Wahkiakum County Ferry Terminal, WA	18-inch steel pile	Vibratory	-	87.5 dB rms re 20 µPa at 15 meters (50 feet)
Sources: Illingworth & Rodkin, Inc., 2012; Laughlin 2010				

No unweighted in-air sound level data is available for concrete piles; Data from similarly sized (24-inch) steel piles was used to represent the 18 or 24-inch concrete piles that will be impact driven during the course of the project. Steel piles generally produce louder source levels during installation than concrete piles; therefore, the steel data would likely overestimate the impacts associated with concrete pile installation. Unweighted in-air measurements of impact driving of a 24-inch steel pile collected during the Test Pile Program was 89 dB re 20 µPa (rms) at 50 ft. (Illingworth & Rodkin, Inc. 2012)).

No unweighted in-air sound level data is available for 12-inch timber and 12-inch steel piles using a vibratory hammer. Airborne data is available for slightly larger (18-inch) steel piles. Unweighted in-air measurements of vibratory driving of 18-inch steel piles collected during the Wahkiakum County Ferry Terminal project averaged 87.5 dB re 20 µPa (rms) at 50 ft. (Laughlin 2010). This data is representative of the vibratory sounds that are likely to be produced with the smaller 12-inch piles. Steel piles generally produce louder source levels than timber piles; therefore, the steel data will likely overestimate the impacts associated with timber pile removal.

These are conservative estimates as actual pile types differ from this. Pile driving at Bremerton is expected to have lower source level measurements and smaller threshold distances. The distances to the airborne harassment thresholds were calculated with the airborne transmission loss formula presented in section 6.6.3. All calculated distances to marine mammal airborne noise thresholds, as well as the areas encompassed by these threshold distances (also referred to as the ZOIs), are shown in Table 6-11. See Appendix B for figures of the affected area encompassed by the estimated airborne ZOI.

TABLE 6-11. CALCULATED MAXIMUM DISTANCES IN AIR TO MARINE MAMMAL NOISE THRESHOLDS AND AREAS ENCOMPASSED BY NOISE THRESHOLDS DUE TO PILE DRIVING

Installation Method	Description	Harbor seal (90 dB rms)	Pinnipeds (seals, sea lions, except harbor seal) (100 dB rms)
Impact	Distance to Threshold	13 meters	5 meters
	Area Encompassed by Threshold	169 sq m	25 sq m
Vibratory	Distance to Threshold	11 meters	4 meters
	Area Encompassed by Threshold	121 sq m	16 sq m

6.7 Marine Mammal Species Quantitatively Assessed

The Navy's Marine Species Density Database (NMSDD) is the overarching database for marine mammal densities within Navy operational areas, including NAVBASE Kitsap Bremerton. The Navy has been updating densities in the Northwest region and incorporating them into the NMSDD to support operations and other regional projects. The NMSDD was used to calculate marine mammal densities as presented in Appendix A. The actual density data is in Table A-1 in Appendix A as well.

The NMSDD uses data from local marine mammal data sets (e.g., Orca Network, state and federal agencies), opinions from state and federal agencies, and survey data from Navy biologists and other agencies. The NMSDD is meant to be a living database, that is continually updated as new information and surveys become available. These densities, in tandem with local observational data, have been used to support pile driving projects throughout the Puget Sound. The Northwest region's NMSDD densities were recently (2012) finalized; the technical report documenting the processes and background data for the densities for the NW region within the NMSDD was published in January, 2014 (U.S. Navy 2014a). There are currently no density estimates for any Puget Sound population of marine mammals outside of this database. The NMSDD often lists a species density by season. As pile replacement at Pier 6 will occur over multiple seasons (fall to winter), the highest seasonal density by species was carried forward for take analysis.

Incidental take for this project is estimated for each species by using the NMSDD densities within the ZOI during pile removal or driving; and by augmenting these numbers by looking at site specific data and local surveys. This augmentation of presence and numbers is determined by past observations and general abundance at NAVBASE Kitsap Bremerton during the same seasons as the construction window and ensures a more realistic take estimate. For example, the floating port security barrier near the project site is a known pinniped haulout site. Therefore, take estimates are based on increasing the NMSDD densities to ensure a more accurate estimate. Additionally, all of the pinniped derived abundances assumed that pinnipeds would be both in the water 100 percent of the time during pile driving activities for underwater calculations and out of water 100 percent of the time for the airborne calculations. This very conservative approach insures that these take estimates are based on a worst case scenario, that the full potential for sound exposure is taken into account.

It is anticipated that all other the marine mammals (not including harbor seals and California sea lions) that enter the ZOI will be exposed to pile driving noise only briefly as they are transiting the area. Harbor seals and California sea lions forage and haulout in or near the Bremerton ZOI and could be exposed multiple times during a project.

6.8 Estimated Duration of Pile Driving

As mentioned previously in Section 2.0, Dates, Duration, and Location of Activity, an average of 4 piles will be driven a day amounting to an estimated 102 days of pile driving over three years. During Year 2, it is estimated that the duration would be 60 days of pile driving and is the number being used for this application. The estimated number of days includes 15 days of vibratory pile extraction and 45 days of impact hammering. However, in terms of actual on the ground work, both types of driving may occur on the same day, though not at the same time, and the total combined work is expected to take 60 days. The actual number of days for Year 1 was much less.

6.9 Estimating Harassment Exposures

The method for calculating potential exposures to impact and vibratory pile driving noise for each threshold were estimated using local marine mammal data sets (e.g., Orca Network, state and federal agencies), opinions from state and federal agencies, and data from Navy biologists. All estimates are conservative and include the following assumptions:

- Each species could be present in the project area each day during construction. The potential for a take will be based on a 24 hour timeframe. So the model assumes that there can be one potential take (Level B harassment exposure) per individual, per 24 hours.
- All pilings installed at each site will have an airborne noise disturbance equal to the piling 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 vibratory driving steel piles. The ZOI for an impact hammer will be encompassed by the larger ZOI from the vibratory driver. The ZOIs for each threshold are not spherical and are truncated by land masses which will dissipate sound pressure waves (WSDOT 2010).
- All airborne noise generated by piling installations will be treated as if it were being driven by an impact driver at a location furthest from shore. The result of this is that all airborne noise generated from a particular pile drive is always modeled to have the greatest intensity and furthest reach of all the potential pile driving processes. This effectively expands the ZOIs. Exposures to airborne noise were only calculated for pinnipeds.
- Exposures were based on estimated work days. Numbers of days were based on an average production rate of 4 pilings per day for fender pile replacement.

- In absence of site specific underwater acoustic propagation modeling, the practical spreading loss model was used to determine the ZOI.
- Using the Navy's NMSDD (U.S. Navy 2014a), the calculation for marine mammal exposures is estimated by multiplying animal density (N/A, number of animals per unit area) times the area defined by the ZOI times the number of days for pile driving (days):

$$\text{Exposure estimate} = (N/A * ZOI) * days$$

- Where site specific knowledge or new information is not fully integrated into the NMSDD, or where this information provides a more conservative exposure, an estimate of the number of species in the ZOI was used (N_{est}):

$$\text{Exposure estimate} = N_{est} * days$$

- Total days of pile driving activity is 60.

6.10 Exposure Estimates

The exposure estimates presented in Table 6-12 indicate the number of calculated exposures that might result from the one year period of in-water construction at Pier 6. Reporting will provide details of how many actual animals of each species are exposed with the ZOIs to noise levels considered potential behavioral harassment at each location.

These estimates 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 the study area.

6.10.1 Harbor Seal

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 (Beckley, 2013; WDFW 2000). 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 impact or vibratory pile driving activities.

Bibliographic reference (U.S. Navy 2014b) and Appendix A contains density information for marine mammal species in the project area. Based on this density, the modeling estimates that two to three harbor seals would be exposed to level B harassment within the ZOI on a daily basis. Using this value, modeled level B exposures is estimated at 130 to 195 individuals (depending on a 5 sq km ZOI for vibratory removal of timber piles or a 7 sq km ZOI for the vibratory removal of steel piles) during the entire project.

The most recent marine mammal survey for this area occurred during the construction of the Manette Bridge just north of the ZOI in the Port Washington Narrows. Marine mammal monitoring for this project occurred over multiple years and aligns with the allowed work windows in the Puget Sound. During the first year of construction an average of 3.7 harbor seals were observed daily (WSDOT 2011C) with the counts ranging as high as 59 on October 18, 2011 (WSDOT 2012c). During the most recent year of 586 harbor seals were observed (7/12 through 11/12) (WSDOT 2012b). This averages to 11 harbor seals a day, though some animals were likely counted multiple times.

For the proposed project at NAVBASE Kitsap Bremerton a reasonable, conservative average are eleven harbors seals occurring within the ZOI in one day. This number is conservative estimate when taking into account WSDOT's survey information, incidental sightings, and the potential for the same animal to be observed more than once. The number of days of potential exposure is based on a couple of considerations. There is an estimate of 15 days of vibratory pile driving and 45 days of impact hammering. However, in terms of actual on the ground work, both types of driving may occur on the same day, though not at the same time. The total combined work is expected to take 60 days.

So, substituting in the equation above, with N_{est} = 11 harbor seals and days = 60, the exposure estimate is:

Exposure estimate = 11 (harbor seals/day) × 60 (days) = 660 harbor seals

Exposure estimate = 660 harbor seal exposures

Based on the Navy's analysis, a maximum estimate of 660 harbor seals of the Washington inland waters stock could be exposed to sound levels considered Level B harassment from underwater sound incidental to pile driving at NAVBASE Kitsap Bremerton. This estimate is higher than the exposure estimate of 130 to 195, based on the density data contained in the NMSDD, as it uses recent nearby survey numbers to deliver a more site specific estimate. Exposures would potentially occur to juveniles, subadults, and adults of any sex within the disturbance ZOIs while pile driving is occurring. Animals could be exposed when traveling, resting, and foraging. No Level A takes are anticipated because of the implementation of monitoring and mitigation measures described in Chapter 11. An estimate of zero exposures to sound levels considered Level B harassment from airborne sounds incidental to pile driving was calculated because of the lack of haulouts and the fact that in-water animals are accounted for in the underwater sound analysis.

6.10.2 California Sea Lion

The California sea lion is most common from fall to late spring. The Navy published density information for marine mammal species in the project area (U.S. Navy 2014a). Based on this density, modeling estimates that only one California sea lion will be exposed to level B harassment within the ZOI per day regardless of whether the ZOI is 5 or 7 sq km ZOI. However, an average 45 California sea lions haul out at NAVBASE Kitsap Bremerton on the floating port security barrier (U.S. Navy 2014b). This number is based on 46 surveys conducted from February 2010 through July 2014. Actual values ranged from zero to 219. Since the haulout is adjacent to the Level B ZOIs, exposure is likely. This is especially true when animals move to or from the haulout as well as when traveling, resting, and foraging near the haulout.

Based on the above information, the Navy estimates that an average of 45 California sea lions per day could be exposed to sound levels considered Level B harassment from underwater sound incidental to pile driving at NAVBASE Kitsap Bremerton. This number is significantly higher than the estimate from the NMSDD of one exposure a day as it takes into account the proximity of the project to the floating port security barrier (U.S. Navy 2014a). Since only male California sea lions migrate into the study area (Jeffries et al. 2000), all exposures are expected to be to sub-adult or adult males. All animals hauled out were assumed to enter the water once each day within the ZOI resulting in one exposure per day for each animal. Therefore, to determine the probable number of takes, the average haulout count was multiplied by the anticipated number of days of pile driving for Year 2 (60 days). The number of days includes an estimate of 15 days of vibratory pile driving and 45 days of impact hammering. However, in terms of actual on-the -

ground work, both types of driving may occur on the same day, though not at the same time. The total combined work is expected to take 60 days.

So, substituting in the equation above, with N_{est} = 45 California sea lion haulouts and days = 60, the exposure estimate is:

Exposure estimate = 45 (California sea lion haulouts/day) × 60 (days)
Exposure estimate = 2,700California sea lion exposures

No exposures to sound levels considered Level B harassment from airborne sounds are calculated. However, it is likely California sea lions will be exposed to airborne noise levels at NAVBASE Kitsap Bremerton. A small section of the Port Security barrier floats are near the airborne ZOI, which extends 48 meters from an impact driven pile. Because animals exposed in an airborne ZOI are already accounted within the underwater ZOI, no additional exposures of California sea lions are requested for airborne disturbance.

Therefore, the Navy is requesting authorization for Level B acoustical harassment take of 2,700 California sea lions. It is assumed that this number will include multiple harassments of the same individuals.

6.10.3 Steller Sea Lion

Steller sea lion haulouts are not located within Sinclair Inlet. The nearest documented Steller sea lion haulout occurs approximately 6.5 miles from the project site near the Manchester Fuel Depot's finger pier (Lance, 2012). While California sea lions have been observed by Navy biologists with great regularity hauled out along the floating port security barrier surrounding NAVBASE Kitsap Bremerton (U.S. Navy 2014b), only one Steller sea lion has been observed on the barrier (Lance, 2012). Sinclair Inlet is a muddy inlet without the habitat features and prime haulout areas that Stellar Sea Lions prefer. In addition, it is thought that the floating port security barrier does not regularly attract Steller sea lions as the pontoons are too small to accommodate anything larger than a juvenile Steller sea lion (Beckley 2013).

From this data, and from the on-site Navy biologist's personal notes and observations (Beckley 2013), it is assumed that Steller sea lion occurrence in the waterways in the Bremerton area is rare. These reports are in line with the density data reported in the NMSDD (U.S. Navy 2014a). Using the exposure estimate equation with this data, no Steller sea lion exposure to Level B acoustical harassment from pile driving will occur. Assuming the one siting a single Steller sea lion in 2012 on the port security barrier is not random, the maximum number of Steller sea lions present on any day would be one individual. All animals are assumed to enter the water each day within the ZOI resulting in one exposure per day for each animal.

As with the California sea lion, a haulout count was used as an estimated number of animals in the ZOI. The number of days includes an estimate of 15 days of vibratory pile driving and 45 days of impact hammering. However, in terms of actual on the ground work, both types of driving may occur on the same day, though not at the same time. The total combined work is expected to take 60 days.

So, substituting in the equation above, with N_{est} = 1 Stellar seal lion haulout and days = 60, the exposure estimate is:

Exposure estimate = 1(Stellar sea lion haulout/day) × 60 (days)
Exposure estimate = 60 Stellar sea lions exposures

No exposures to sound levels considered Level B harassment from airborne sounds are calculated. However, it is possible Steller sea lions will be exposed to airborne noise levels at NAVBASE Kitsap Bremerton because a small section of the Port Security barrier floats are near the airborne ZOI, which extends 48 meters from an impact driven pile. Because animals exposed in an airborne ZOI are already accounted within the underwater ZOI, no additional exposures of California sea lions are requested for airborne disturbance.

Therefore, the Navy is requesting authorization for Level B acoustical harassment take of 60 Steller sea lions. It is assumed that this number will include multiple harassments of the same individual.

6.10.4 Killer Whale [Transient]

Transient killer whales occasionally occur throughout the study area and ZOI. They are typically observed in small groups with an average group size in Puget Sound of six individuals. From December 2002 to July 2014, there were two reports of transient killer whales transiting through the area around NAVBASE Kitsap Bremerton. Both of these reports occurred in May (2004 & 2012), which is outside of the proposed work window for this project (Orca Network, 2014). The group size in these two sightings ranged from 5 to 12 (Orca Network, 2014).

Given this data, it is assumed that transient killer whales occurrence in the waterways in the Bremerton area is infrequent. These reports are in line with the density data reported in the NMSDD (U.S. Navy 2014a), from which the modeling estimated no killer whale exposure to Level B acoustical harassment from pile driving.

To ensure no Level B acoustical harassment occurs, the Navy will take the following two steps:

1) The Navy will avoid exposure of killer whales to underwater sounds from pile driving by implementing a shut-down procedure if killer whales are in the ZOI (see mitigation measures in chapter 11 and appendices B and C);
2) Prior to the start of pile driving, the Orca Network and/or Center for Whale Research will be contacted to find out the location of the nearest killer whale sightings. As the appearance of Killer Whales in the narrow south sound waterways is considered rare, their presence becomes a newsworthy event and is quickly reported by many to the Orca Network. Previous and ongoing monitoring of these networks for Navy testing and training activities has proven to be an important tool for monitoring these species throughout the Puget Sound.

Given the rare occurrence of transient killer whales in the ZOI and the above monitoring procedures, exposure of transient killer whales to Level B acoustical harassment from pile driving is unlikely to occur.

6.10.5 Gray Whale

Most gray whales in Puget Sound utilize the feeding areas in northern Puget Sound around Whidbey Island in the spring and summer. A few individuals reside year-round. Individuals or pairs occasionally enter central and southern Puget Sound primarily in March through May. The majority of in-water work will occur when gray whales are less likely to be present.

From December 2002 to July 2014, there were four occurrences of gray whales in the area around NAVBASE Kitsap Bremerton occurring during the in-water work window months. This data came from members of the public reporting to Cascadia Research and the Orca Network (Orca Network, 2014) during the winter of 2008 and 2009 and one stranding (January, 2013) (Cascadia Research Collective, 2013) near the west end of NAVBASE Kitsap Bremerton. Each sighting appeared to be of a lone gray whale attempting to feed in the vicinity of Sinclair Inlet and Port Washington Narrows over a matter of days and then leaving the area. The preliminary report of the January 2013 stranding event indicated that the gray whale was in poor nutritional condition and exhibited signs of severe injuries caused by a killer whale attack. There is an average of six gray whales that die and strand in Washington each year. Three occurred in 2012, only one was in the Puget Sound. These reports are in-line with the NMSDD. Based on this density data, the Navy previously estimated that there will be no gray whale exposure to Level B acoustical harassment from pile driving (U.S. Navy 2014a).

To ensure no Level B acoustical harassment occurs, the Navy will take the following two steps:

1. The Navy will avoid exposure of gray whales to underwater sounds from pile driving by implementing a shut-down procedure if gray whales are in the ZOI (see mitigation measures in chapter 11);
2. Prior to the start of pile driving, the Orca Network and/or Center for Whale Research will be contacted to find out the location of the nearest marine mammal sightings.

Given the rare occurrence of gray killer whales in the ZOI and the above monitoring procedures, exposure of gray whales to Level B acoustical harassment from pile driving will not occur.

TABLE 6-12. TOTAL UNDERWATER LEVEL B EXPOSURE ESTIMATES BY SPECIES AT NAVBASE KITSAP BREMERTON

Species	**Exposure Estimate**
Harbor seal[1]	**660**
California sea lion[2]	**2,700**
Steller sea lion[3]	**60**
Transient killer whale	**0**
Gray whale	**0**
	Total Estimated Exposures 3,420

[1]Modeled Level B exposures were 130 for an area of 5 sq km and 195 for an area of 7 sq km. Exposures were adjusted to reflect actual sighting reports.
[2]Modeled Level B exposures were 65 for both 5 and 7 sq km. Exposures were adjusted to reflect number of animals hauled out.
[3]Modeled Level B exposures were 0 for both 5 and 7 sq km. Exposures were adjusted to reflect number of animals hauled out.

7 Impacts to Marine Mammal Species or Stocks

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

7.1 Potential Effects of Pile Driving on Marine Mammals

7.1.1 Potential Effects Resulting from Underwater Noise

The effects of pile driving on marine mammals depend 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. The farther away from the source, the less intense the exposure should be. The substrate and depth of the habitat affect the sound propagation properties of the environment. Shallow environments are typically more structurally complex, which leads to rapid sound attenuation. In addition, substrates that are soft (i.e., sand) will absorb or attenuate the sound more readily than hard substrates (rock) which may reflect the acoustic wave.

Impacts to marine species are expected to be the result of physiological responses to both the type and strength of the acoustic signature (Viada et al. 2008). Behavioral impacts are also expected, though the type and severity of these effects are more difficult to define due to limited studies addressing the behavioral effects of impulsive sounds on marine mammals. Potential effects from impulsive sound sources can range from brief acoustic effects such as behavioral disturbance, tactile perception, physical discomfort, slight injury of the internal organs, and the auditory system to the death of the animal (Yelverton et al. 1973; O'Keefe and Young 1984; Ketten 1995).

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 tuned to detect to pressures, 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 (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 2000). 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 or PTS) 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. In contrast, explosive sounds are accompanied by a shock wave that can result in damage.

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. 2003). 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. 2003).

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 have shown 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. 2003; Wartzok et al. 2003; 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 meters 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 (Caltrans 2001; Thorson and Reyff 2006; Thorson 2010). Harbor seals were observed in the water at distances of approximately 400–500 meters 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 meters of the pile driving barge during pile driving. Several sea lions, however, were observed at distances of 500–1,000 meters swimming rapidly and porpoising away from pile driving activities. The reasons for these differences are not known, although Kastak and Schusterman (1998) reported that sea lions are more sensitive than harbor seals to underwater noise at low frequencies.

Studies of marine mammal responses to continuous noise, such as vibratory pile installation, are limited. Monitors at the Port of Anchorage marine terminal redevelopment project found no marine mammal responses from animals swimming within noise threshold distances established around construction activities including pile driving (both impact hammer and vibratory driving) (Integrated Concepts and Research Corporation 2009). The most common marine mammals observed during the two lengthy construction seasons were beluga whales. Harbor seals, harbor porpoises, and Steller sea lions were observed in smaller numbers. Background noise levels at this port are typically at 125 dB rms re 1 micropascal.

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. 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.

As described in the section above, individual responses to pile driving noise are expected to be variable. Some individuals may occupy the project area during pile driving without apparent discomfort, but others may be displaced with undetermined long-term effects. Avoidance of the affected area during pile driving operations would reduce the likelihood of injury impacts, but also reduces access whether for foraging or as a transit area. Given the duration of the project there is a potential for displacement of marine mammals from the affected area during the in-water construction season.

Given the above discussion, the discussion in Chapter 6, mitigation affects, and that pile driving will only occur for a few hour a day; negative effects from 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.

7.1.2 Potential Effects Resulting from Airborne Noise

Marine mammals present in the study area could be exposed to airborne sounds associated with pile driving. These have the potential to cause behavioral harassment, depending on the animal's 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.

As discussed in Chapter 6, airborne noise will primarily be an issue for pinnipeds that are swimming or hauled out in the study area within the range of impact. 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, it may 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 will occur.

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 result in in Level B behavioral 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. All of these exposures will likely have only a minor effect on individuals and no effect on the population. The sound generated from vibratory pile driving is nonpulsed (e.g., continuous) and is not known to cause injury to marine mammals. Mitigation efforts are expected to minimize whatever negative impacts such exposure does cause. 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.

8 Impact 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

Historically, Pacific Northwest treaty Indian tribes were known to utilize (hunt) several species of marine mammals including, but not limited to: harbor seals, Steller sea lions, northern fur seals, gray whales, and humpback whales (Norberg, 2007). Recently, several Pacific Northwest treaty Indian tribes have promulgated tribal regulations allowing tribal members to exercise treaty rights for subsistence harvest of California sea lions and harbor seals (Carretta et al. 2007). The Makah Indian Tribe (Makah) has specifically passed hunting regulations for gray whales (Norberg, 2007). However, the directed take of marine mammals (not just gray whales) for ceremonial and/or subsistence purposes was enjoined by the Ninth Circuit Court of Appeals in a ruling against the Makah in 2002, 2003, and 2004 (Norberg, 2007; NMFS 2008c). The issues surrounding the Makah gray whale hunt (in addition to the hunt for marine mammals in general) is currently in litigation or not yet clarified in recent court decisions (Wright 2007). These issues also require National Environmental Policy Act and MMPA compliance, which has not yet been completed. Presently, there are no known active ceremonial and/or subsistence hunts for marine mammals in Puget Sound or the San Juan Islands.

8.2 Summary

Potential impacts resulting from the proposed action will be limited to individuals of marine mammal species located in the marine waters near NAVBASE Kitsap Bremerton and will be limited to Level B harassment. Therefore, no impacts to the availability of species or stocks for subsistence use were found.

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 from the project are expected to be temporary and include increased human activity and noise levels, impacts to water quality, and changes in prey availability near the individual project sites. Impacts are not likely to be permanent.

9.1 Effects from Human Activity and Noise

Existing human activity and underwater noise levels, primarily due to industrial activity and small vessel traffic, could increase slightly as the result of the Pier 6 fender pile repair project. However, marine mammals in the study area already 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; Williams et al. 2002; Bain et al. 2006), 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.

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 and Verboom 1999; 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 and 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. It has been hypothesized that there may be increased energetic expenditure or chronic stress to sudden changes in the environment which produce adverse hormonal or nervous system effects (Reeder and Kramer 2005). Although it is not clear the long term effects of the responses when the animal is able to adapt (Reeder and Kramer 2005).

During construction activities, additional vessels may operate in the project area, but will operate at low speeds within the relatively limited construction zone and access routes during the in-water construction period. As mentioned briefly above, these additional vessels will not constitute a sudden change in the environment, but will involve a marginal and temporary increase in the vessel traffic over what is already present. The presence of vessels is 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 Effects on Water Quality

Some degree of 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 from the substrate when bottom sediments are disturbed. Effects to turbidity are expected to be short-term and minimal. Turbidity will return to normal levels within a short time after completion of the proposed action. No direct effects to marine mammals are expected from turbidity impacts.

Removal of the existing timber fender piles at Pier 6 will result in the removal of 380 creosote-treated piles removed from the marine environment. This will result in the potential, temporary and localized sediment re-suspension of some of the contaminants associated with creosote, such as polycyclic aromatic hydrocarbons. However, the actual removal of the creosote-treated timber piles from the marine environment will result in a long-term improvement in water and sediment quality. The net impact is a benefit to marine organisms, especially toothed whales and pinnipeds that are high in the food chain and bioaccumulate these toxins. This is especially a concern for long-lived species that spend their entire life in Puget Sound, such as Southern Resident killer whales (NMFS 2008a).

9.3 Impacts on Potential Prey (Fish)

Pile replacement will impact marine fish habitats. In particular, some nearshore intertidal and subtidal habitats, including piles used for structure and cover will be affected. The greatest impact, however, 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 small 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. Transient killer whales in the Puget Sound prey on pinnipeds, primarily harbor seals.

9.3.1 Underwater Noise Effects 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 thresholds for both behavior and injury for fish.

During pile driving, the associated underwater noise levels will have the potential to cause injury and will result in behavioral responses, including project area avoidance. Sound during impact pile driving will be detected above the average background noise levels at locations near the various installations with a direct acoustic path (e.g., line-of-sight from the driven pile to the receiver location).

Fish within the 150 dB received level range may display a startle response during initial stages of pile driving and will likely avoid the immediate project vicinity during pile driving and other construction activities. However, field observation investigations of Puget Sound salmonid behavior, when occurring near pile driving projects (Feist 1991; Feist et al. 1996), found little evidence that normally nearshore 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. 1996; Ruggerone et al. 2008).

Thus, prey availability for marine mammal predators within an undetermined portion of the areas near the affected installations probably will be reduced. The duration of fish avoidance of this area after pile driving stops is unknown, but a rapid return to normal distribution and behavior is anticipated. Any behavioral avoidance by fish of the disturbed area will still leave significantly large areas of marine mammal foraging habitat in Puget Sound and other nearby areas. Some adverse effects on marine mammal prey are possible, but do not rise to the level of MMPA take.

9.3.2 Effects 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 vicinity. Additionally, removal of marine vegetation attached to piles will occur. Construction will bury benthic organisms with limited mobility under sediment. Increased turbidity will 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 a localized area. The effect is expected to be insignificant to the forage base for marine mammals. Affected area is 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 for 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 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.

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 populations involved.

The proposed activity is not expected to have any habitat-related effects that could cause significant or long-term consequences for individual or populations of marine mammals because all activities will be temporary and all piles removed or replaced are within the existing footprint and part of the existing Pier 6. This project will not alter the footprint of Pier 6. Information provided in chapter 9 indicates there may be temporary impacts, but those impacts will be limited to the immediate area surrounding the structures being repaired. Impacts will cease upon the completion of pile removal and replacement activities.

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 continue to employ the Best Management Practices (BMPs), mitigation 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. A signed contract represents a legal agreement between the contractor and the Navy. Failure to follow the prescribed BMP mitigation and minimization measures constitutes a contract violation. Measures depend on location, timing, and construction methods.

11.1 General Construction Best Management Practices

- The Navy will continue to adhere to performance conditions imposed as part of the Rivers and Harbors Act, Section 10 Permit issued by the Corps of Engineers. No in-water work will be conducted until the Corps authorization process has been completed.
- The construction contractor is responsible for preparation of an environmental protection plan. The plan will be submitted and implemented prior to the commencement of any construction activities and is a binding component of the overall contract. The plan identifies construction elements and recognizes spill sources at the site. The plan outlines BMPs, response actions in the event of a spill or release, and notification and reporting procedures. The plan also outlines 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 will be allowed to enter surface waters.
- Wash water resulting from wash-down of equipment or work areas will be contained for proper disposal and will not be discharged unless authorized.
- Equipment that enters surface waters will be maintained to prevent any visible sheen from petroleum products.
- No oil, fuels, or chemicals will 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. will be checked regularly for leaks and will be maintained and stored properly to prevent spills.
- No cleaning solvents or chemicals used for tools or equipment cleaning will 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.

11.2 Pile Repair, Removal, and Installation Best Management Practices

Creosote Pile Removal

- 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 will be cut into 4 foot lengths to preclude further use as piling and disposed of in a landfill.
- Creosote-treated timber piles will be replaced with noncreosote treated piles.

General

- Removed piles will be contained on a barge. If a barge is not utilized, piles may be stored in a containment area near the construction site.
- If piles break or are damaged, a chain will be used, if practical, to attempt to entirely remove the broken pile. If the entire pile cannot be removed, the pile will be cut at the mud line using a pneumatic underwater chainsaw to prevent disturbing contaminated sediment.
- Any floating debris generated during installation will be retrieved.
- 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.

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 window when ESA-listed salmonids are least likely to be present.
  - NAVBASE Kitsap Bremerton: June 15–March 1. The in-water work period for this project during Year 2 of this project would be from October 1, 2014 through March 1, 2015.
- All in-water construction activities will occur during daylight hours (sunrise to sunset). Sunrise and sunset are to be determined based on the National Oceanic and Atmospheric Administration (NOAA) data which can be found at http://www.srrb.noaa.gov/highlights/sunrise/sunrise.html.

11.4 Additional 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 will conduct briefings between construction supervisors and crews, the marine mammal monitoring team, and Navy staff prior to the start of all pile driving activity in order to explain responsibilities, communication procedures, marine mammal monitoring protocol, and operational procedures.

11.4.2 Soft Start

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

- A soft start procedure will be used at the beginning of each day's in-water pile driving or any time pile driving has ceased for more than 30 minutes.
- For impact pile driving, the following soft-start procedures will be conducted:
    - 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. (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").
- For vibratory pile driving, the contractor will initiate noise from vibratory hammers for 15 seconds at reduced energy followed by a 30-second waiting period. The procedure shall be repeated two additional times.

11.4.3 Visual Monitoring and Shutdown Procedures

A marine mammal monitoring plan is presented in Appendix C and must be approved by NMFS prior to commencement of project activities at NAVBASE Kitsap Bremerton. The plan includes the following:

- For all impact and vibratory pile driving, a shutdown and disturbance zone will be monitored.
    - Monitoring will take place from 15 minutes prior to initiation through 30 minutes post-completion of pile driving.
    - 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 (180 dB isopleth for cetaceans; 190 dB isopleth for pinnipeds). The shutdown zone will always be a minimum of 10 meters (33 feet) to prevent injury from physical interaction of marine mammals with construction equipment (See Appendix B for a map of the shutdown zone).
    - 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 (160 dB re 1 μPa for impact pile driving, 120 dB re 1 μPa for vibratory extraction.
- Visual monitoring will be conducted by qualified, trained marine mammal observers (hereafter "observer"). An observer has 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.

- Trained observers will be placed at the best vantage points practicable (from the construction barges, on shore, or pier side) to monitor for marine mammals and implement shutdown/delay procedures when applicable by calling for the shutdown to the hammer 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.
- Prior to the start of pile driving, the shutdown zone will be monitored for 15 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.
- If a cetacean approaches or enters the disturbance zone during pile driving, work will be halted and delayed until either the animal has voluntarily left and been visually confirmed beyond the disturbance zone or 15 minutes have passed without re-detection of the animal.
- During vibratory pile removal the disturbance zone will be a 1,600 meter arc around the source (2,154 meters for the 20 steel piles). Due to the extreme area of this zone, the contractor will have a mammal observer patrolling the 1,600 meter disturbance zone by boat. This zone is considered a realistic area for visual monitoring for both vibratory extraction of steel and wood piles due to the limited number of steel piles and high number of wood piles.
- If a harbor seal, California sea lion, or Steller sea lion 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 marine mammal approaches or enters a shutdown 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 shutdown zone or 15 minutes have passed without re-detection of the animal.

11.4.4 Data Collection

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

- Date and time that pile removal and/or installation begins and ends
- Construction activities occurring during each observation period
- Weather parameters (e.g. percent cover, visibility)
- Water conditions (e.g. sea state, tidal state [incoming, outgoing, slack, low, and high])
- Species, numbers, and, if possible, sex and age class of marine mammals
- Marine mammal behavior patterns observed, including bearing and direction of travel, and, if possible, the correlation to sound pressure levels
- Distance from pile removal and/or installation activities to marine mammals and distance from the marine mammal to the observation point

- Locations of all marine mammal observations
- Other human activity in the area.

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.

Collected data will be compiled following the end of Year 2 activities covered by this application and submitted to NMFS prior to submitting an application for Year 3. See Appendix D for the Year 1 monitoring report.

Acoustic Monitoring

The Navy will conduct acoustic monitoring during vibratory removal of woodpiles and impact hammer installation of concrete piles relative to background levels. The monitoring will include underwater and airborne sounds measurements from pile removal and installation.

The acoustic monitoring includes:

- Conduct acoustic monitoring on a minimum of 10 concrete piles driven via impact hammer and 10 wood piles removed via vibratory extraction. Note that of the approximate 400 piles to be removed via vibratory hammer, only 20 are steel fender piles. The rest are timber piles. It is expected that acoustic monitoring of vibratory pile removal will occur for timber piles only. However, if during monitoring activities a steel pile is encountered the Navy will perform acoustic monitoring of the extraction of that pile as part of the twenty piles monitored.
- For underwater recordings, a single 3-hydrophone system with the ability to measure SPLs will be placed for collection of source levels at approximately 10 meters from the pile being worked.
- For airborne recordings, reference recordings will be attempted at approximately 50 feet (15.2 meters) from the source via a stationary microphone. However, other distances maybe utilized to obtain better data if the signal cannot be isolated clearly due to other sound sources (e.g. generators, industrial shipyard work).
- Each hydrophone (underwater) and microphone (airborne) will be calibrated prior to the start of the action and will be checked at the beginning of each day of monitoring activity.
- Environmental data will be collected including but not limited to: wind speed and direction, wave height, water depth, precipitation, and type and location of in-water construction activities, as well other factors that could contribute to influencing the airborne and underwater sound levels (e.g. aircraft, boats, etc.);
- The construction contractor will supply the Navy and monitoring personnel with an estimate of the substrate condition, hammer model and size, hammer energy settings and any changes to those settings during the piles being monitored.

For acoustically monitored piles, post-analysis of the sound level signals will include the average, minimum, and maximum RMS value for each pile monitored. If possible acoustic monitoring will provide similar information for the peak metric as well.

11.4.5 Mitigation Effectiveness

All observers utilized for mitigation activities will be experienced 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 in order 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. A reporting plan will be forward to NMFS as described in section 13.

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.

Subsistence use is the traditional exploitation of marine mammals by native peoples for their own consumption. This project does not occur in traditional Arctic subsistence hunting areas. Based on the discussions in chapter 8, proposed activities will produce no adverse effects on the availability of species or stocks for subsistence use. No species in the region of activity are associated with subsistence hunting; therefore no effect will occur to Arctic subsistence hunting.

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 Monitoring Plans

The Navy developed a detailed marine mammal monitoring plan (see Appendix C) to comply with the requirements of the MMPA permit. This monitoring plan has not changed from the project's Year 1 IHA application. See Appendix D for results of the Year 1 IHA monitoring effort. All aspects of the monitoring plan will be fully implemented. Components of the monitoring plan are also described in section 11.4.

13.2 Reporting

- At the completion of in-water work for which there has been active monitoring in accordance with this plan, the Navy will provide a draft monitoring report to NMFS within 45 calendar days. In addition, the Navy will submit a draft monitoring report at least 60 days prior to the issuance of any subsequent IHA for continuation of this project. Final reports will be prepared and submitted to the NMFS within 30 days following receipt of comments on the draft reports from the NMFS. If no comments are received from NMFS, the draft report will be considered to be the final report. At a minimum, the report shall include:
- General data:
    - Date and time of activities.
    - Water conditions (e.g., sea-state, tidal state).
    - Weather conditions (e.g., percent cover, visibility).
- Pre-activity observational survey-specific data:
    - Dates and time survey is initiated and terminated.
    - Description of any observable marine mammal behavior in the immediate area during monitoring.
    - If possible, the correlation to underwater sound levels occurring at the time of the observable behavior.
    - Actions performed to minimize impacts to marine mammals.
- During-activity observational survey-specific data:

    - Description of any observable marine mammal behavior within monitoring zones or in the immediate area surrounding the monitoring zones, including the following:
        - Distance from animal to pile driving sound source
        - Reason why/why not shutdown implemented
        - If a shutdown was implemented, behavioral reactions noted and if they occurred before or after implementation of the shutdown
        - If a shutdown is implemented, the distance from animal to sound source at the time of the shutdown
        - Behavioral reactions noted during soft starts prior to impact driving and if they occurred before or after implementation of the soft start
        - Distance to the animal from the sound source during soft start
- Post-activity observational survey-specific data:
    - Results, which include the detections of marine mammals, species and numbers observed, sighting rates and distances, behavioral reactions within and outside of safety zones.
    - A refined take estimate based on the number of marine mammals observed during the course of construction.

14 Research Efforts

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

To minimize the likelihood that impacts will occur to the species, stocks, and subsistence use of marine mammals, all construction activities will be conducted in accordance with all federal, state, and local regulations and minimization measures in Chapter 11 will be implemented to protect marine mammals. The Navy will coordinate all activities with the relevant federal and state agencies. These include, but are not limited to: the NMFS, USFWS, United States Coast Guard, United States Army Corps of Engineers, and WDFW.

The United States (U.S.) Department of the Navy (Navy) is one of the world's leading organizations in assessing the effects of human activities on the marine environment including marine mammals. 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 activities.

The Navy will share field data and behavioral observations on all marine mammals that occur in the project area with NMFS and other agencies upon request. Results of the monitoring effort will be provided to NMFS in summary reports (section 13.2). The Navy strives to be a world leader in marine species research and has provided more than $100 million over the past five years to universities, research institutions, federal laboratories, private companies, and independent researchers around the world to increase the understanding of marine species physiology and behavior with several projects ongoing in Washington.

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

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

The Navy has sponsored several workshops and ongoing surveys to evaluate the current state of knowledge and potential for future acoustic monitoring of marine mammals. The workshops brought together acoustic experts and marine biologists from the Navy and outside research organizations to present data and information on current acoustic monitoring research efforts and to evaluate the potential for incorporating similar technology and methods into Navy activities.

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. In order to better understand marine mammal presence and habitat use in the Puget Sound Region, the Navy has funded and coordinated four major efforts:

1) **Puget Sound Pinniped Haulout Surveys at Specific Naval Installations:** Biologists located at NAVBASE Kitsap Bremerton, Bangor, and NAVSTA Everett conduct counts of seals and sea lions hauled out on Navy assets (e.g., submarines) and on floating

security fences. In the case of NAVBASE Kitsap Bangor and NAVSTA Everett, counts are conducted daily (excluding weekends) when. For NAVBASE Kitsap Bremerton counts are collected during a monthly water quality sampling program. All animals are identified to species where possible. This information aides in determination of seasonal use of each site and trends in the number of animals. Currently, there are efforts underway to increase the frequency of the surveys at NAVBASE Kitsap Bremerton and expand to additional Navy areas such as Manchester, Whidbey Island, and Indian Island.

2) **Opportunistic Marine Mammal Vessel Surveys in Hood Canal and Dabob Bay:** The Navy conducted an opportunistic marine mammal density survey in Hood Canal and Dabob Bay during September and October 2011 and again in October 2012. In Hood Canal, the surveys followed a double saw-tooth pattern to achieve uniform coverage of the entire Bangor waterfront. Transects generally covered the area from Hazel Point on the south end of the Toandos Peninsula to Thorndyke Bay. Surveys in adjacent Dabob Bay represented a different pattern and generally followed more closely to the shoreline while completing a circular route through the bay. A large exclusion zone surrounding a Navy ship moored temporarily in Dabob Bay made it difficult to perform zigzag transects across the bay; therefore, early attempts at surveys in Dabob did not follow a zigzag pattern, and switching to this survey pattern later in the project would have made density information collected during early "loop pattern" surveys incompatible with later data. Therefore, the loop pattern was followed during all subsequent baseline surveys in the bay. These surveys had a dual purpose of collecting marine mammal and marbled murrelet (bird species) data, and shoreline surveys tended to yield more marbled murrelet sightings.

3) **Aerial Pinniped Haul-out Surveys:** The Navy funded and contracted WDFW to conduct aerial surveys of pinniped haul-outs 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 continue until spring 2014. The survey area does not cover the outer coast of Washington, only the inland waters.

4) **Aerial Cetacean Surveys in Puget Sound (Admiralty Inlet and south):** The Navy has contracted aerial surveys of cetaceans in Puget Sound in order to better understand seasonality and distribution with the goal of improved density values. These surveys began in late 2013, with the survey frequency still being established..

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

15 Preparers

<u>Naval Facilities Engineering Command Atlantic</u>

Taura Huxley-Nelson, Natural Resources Specialist

MPA, Park University
B.S. Natural Resources, Cornell University
Years of Experience: 11

Anurag Kumar, Marine Resource Specialist

M.S. Marine Science, California State University Fresno
B.S. Biology-Ecology, California State University Fresno
Years of Experience: 11

Deanna Rees, Marine/Wildlife Biologist

Graduate Certificate Coastal Studies, NOVA Southeastern University
B.S. Wildlife Resources, University of Idaho
Years of Experience: 16

<u>Naval Facilities Engineering Command Northwest</u>

Andrea Balla-Holden

Fisheries and Marine Mammal Biologist
B.S. Fisheries, University of Washington
Years of Experience: 21

Eric Beckley

Biologist
M.S. Central Washington University
Years of Experience: 7

Warren Drummond

Cartographic Technician
M.C.R.S., Urban Planning, Rutgers, State University of New Jersey, Edward J. Bloustein School of Planning and Public Policy
Master's Certificate, Project Management, George Washington University, School of Business and Public Management
B.A., Geography, University of Oklahoma
Years of experience: 22

Eric Mollerstuen

Environmental Protection Specialist
Western Washington University
Years of Experience: 7

Sharon Rainsberry, Fish Biologist

M.S. Fisheries Science, University of Washington
B.S. Biological Science, California State Polytechnic University
Years of experience: 10

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Appendix A. Density Estimates of Marine Mammals at NAVBASE Kitsap Bremerton

TABLE A-1. MAXIMUM MARINE MAMMAL DENSITIES ESTIMATES FOR NAVBASE KITSAP BREMERTON (#/KM^2)

Species	**Densities (Sinclair Inlet)**
Harbor seal (with haulout factor applied)	**0.4267**
California sea lion	**0.13**
Steller sea lion	**0.037**
Transient killer whale	**0.002373**
Gray whale	**0.00051**

Source: U.S. Navy. (2014a). Pacific Navy Marine Species Density Database Technical Report. 2014. Naval Facilities Engineering Command Pacific, Pearl Harbor, HI.

Appendix B. Zone Of Influence Maps at Naval Base Kitsap Bremerton

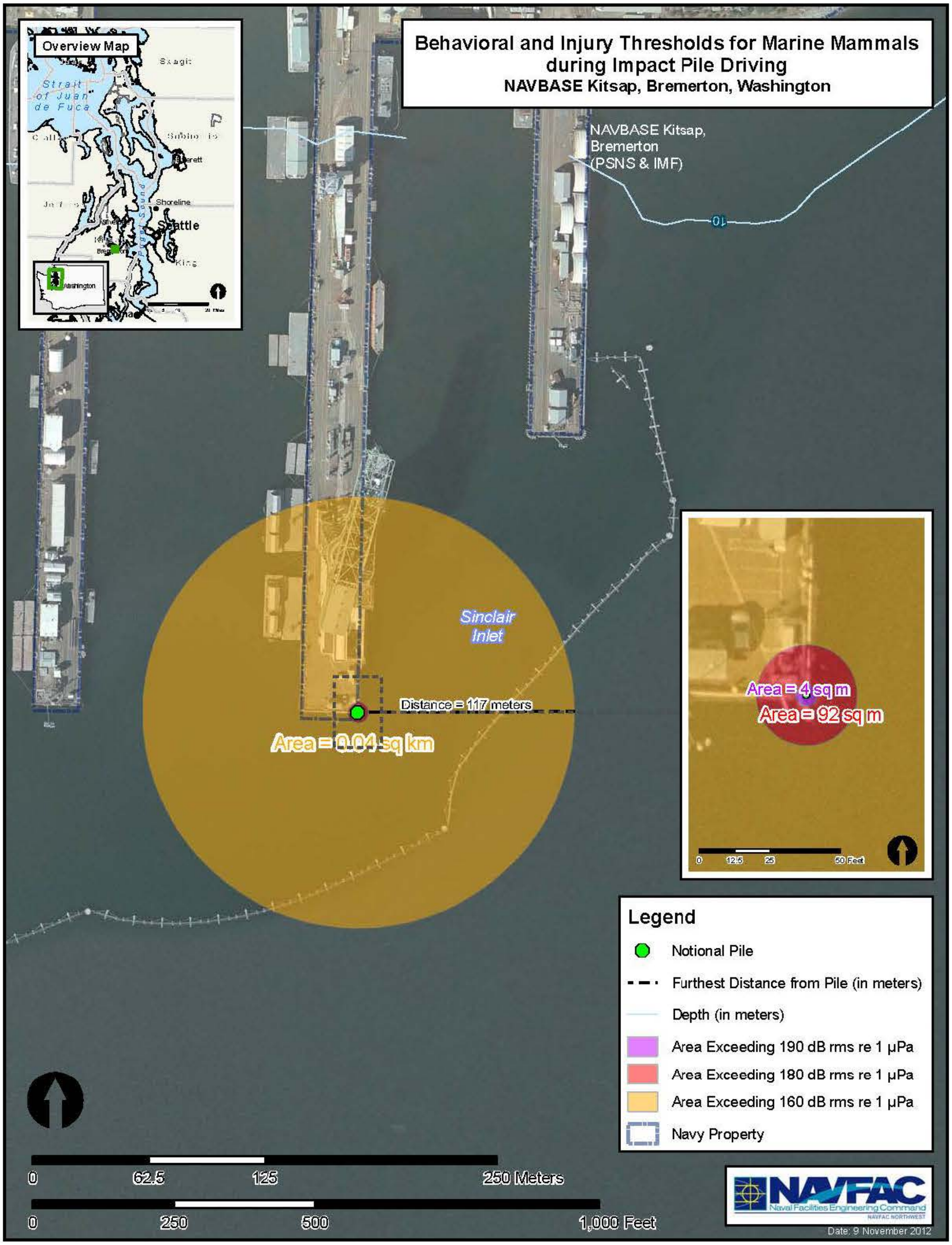


Figure B-1. Areas Exceeding the Behavioral and Injury Thresholds for Marine Mammals during Impact Pile Driving for a Representative Pile at NAVBASE Kitsap Bremerton

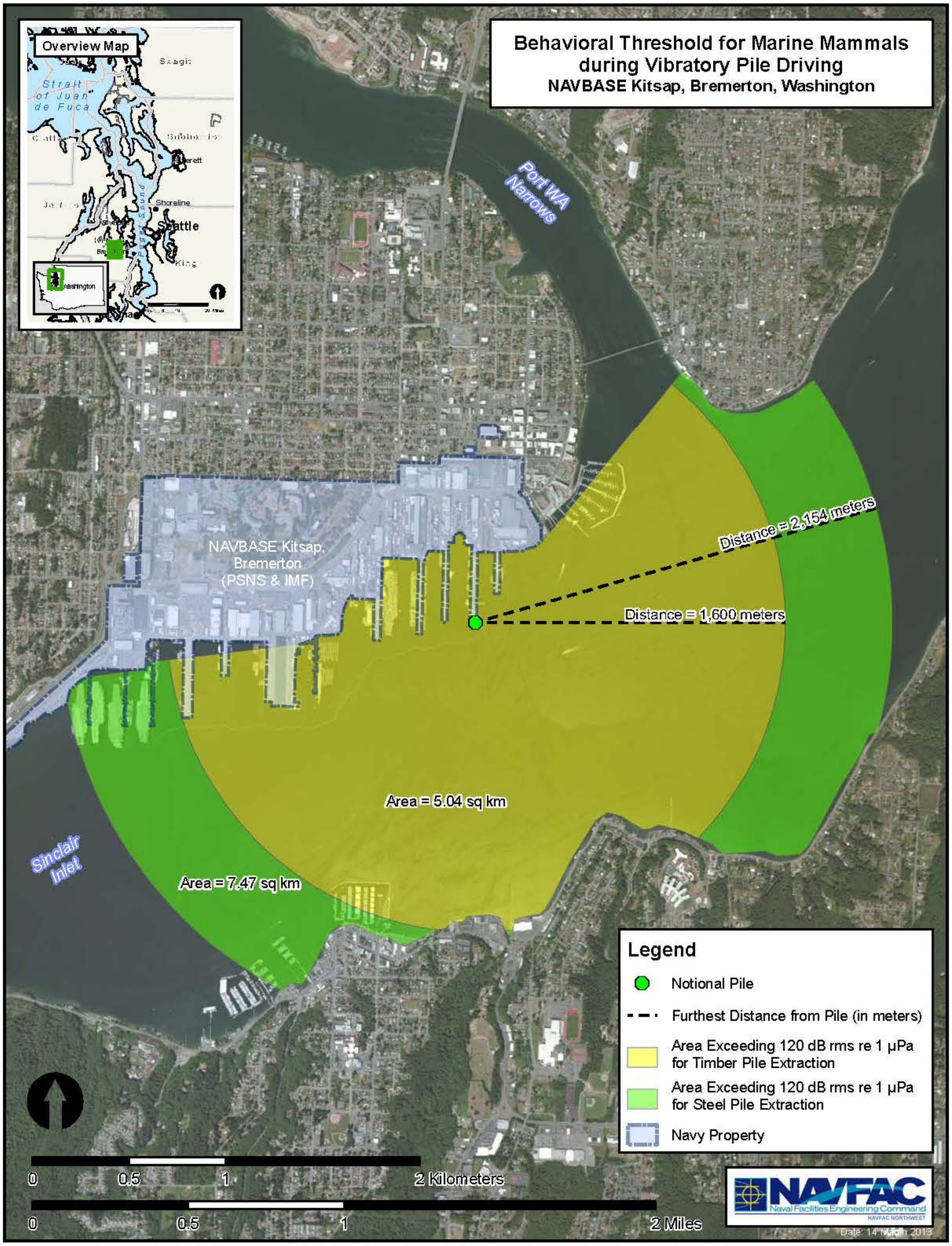


Figure B-2. Behavioral Threshold for Marine Mammals during Vibratory Pile Removal at NAVBASE Kitsap Bremerton

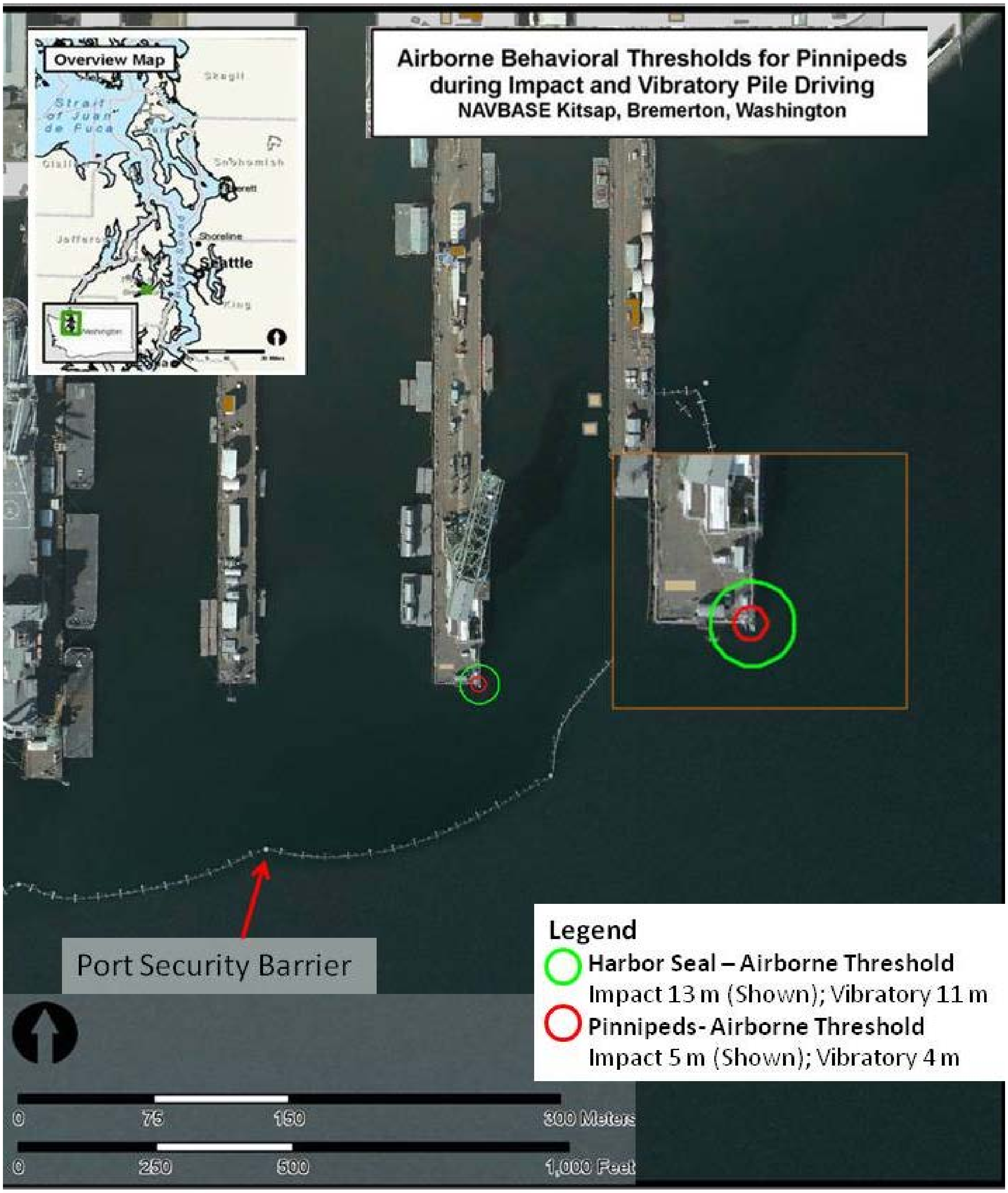


Figure B-3. Airborne Behavioral Thresholds for Pinnipeds during Impact Pile Driving and Vibratory Pile Removal at NAVBASE Kitsap Bremerton

Appendix C. Marine Mammal Monitoring Plan

NAVBASE Kitsap Bremerton
Pier 6 Pile Replacement Project
Marine Mammal Monitoring Plan

June 2014

In accordance with the NAVBASE Kitsap Pier 6 Incidental Harassment Authorization Request, marine mammal monitoring will be implemented during this project. Qualified marine mammal observers will be present on site at all times during pile removal and driving. Marine mammal behavior, overall numbers of individuals observed, frequency of observation, and the time corresponding to the daily tidal cycle will be recorded.

This project includes vibratory removal of 380 creosote treated pilings, 20 steel fender piles and impact pile driving of 330 concrete piling that will occur over three years. For impact pile driving there will be a small acoustic injury zone (SL sounds are greater than 180 dB). For vibratory pile removal and driving, no injury will occur (SL sounds are less than 180 dB), and so will result in a Level B acoustical harassment ZOI only. This zone is calculated to extend to the 120 dB (nonpulse) isopleth for vibratory pile removal. However, land is intersected before this extent is reached directly south, at a maximum of 1,600 meters and to the east at 1,700 meters (Figure 1). For impact driving of concrete piles, the zone of Level B acoustical harassment is much smaller, at 117 meters (Figure 2).

The Navy or their contractor will conduct briefings between the construction supervisors and the crew and marine mammal observer(s) prior to the start of pile-driving activity, marine mammal monitoring protocol and operational procedures.

Prior to the start of pile driving on any day, the Orca Network and/or Center for Whale Research will be contacted and/or data reviewed to find out the location of the nearest marine mammal sightings. The Orca Sightings Network consists of a list of over 600 (and growing) residents, scientists, and government agency personnel in the U.S. and Canada. 'Sightings' information collected by the Orca Network includes detection by hydrophone. With this level of coordination in the region of activity, the Navy will be able to get real-time information on the presence or absence of whales before starting any pile removal or driving.

Monitoring to Estimate Take Levels for California Sea Lions, Steller Sea Lions and Harbor Seals

The Navy proposes the following Marine Mammal Monitoring Plan in order to estimate project Level B acoustical harassment take levels in the ZOI:

- To verify the required monitoring distance, the vibratory Level B acoustical harassment ZOI will be determined by using a range finder or hand-held global positioning system device.
- The vibratory Level B acoustical harassment ZOI will be monitored for the presence of marine mammals 15 minutes before, during, and 30 minutes after any pile removal or driving activity.
- Monitoring will be continuous unless the contractor takes a significant (30 minutes or greater) break-then the 15 minutes before, during, and 30 minutes monitoring sequence will begin again.

- If marine mammals are observed, their location within the ZOI, and their reaction (if any) to pile-driving activities will be documented.
- During vibratory pile removal, four land-based biologists will monitor the area including two at the pier work site, one at the eastern extent of the ZOI in the Manette neighborhood of Bremerton, and one at the southern extent of the ZOI near the Annapolis ferry landing in Port Orchard. Additionally, one boat with a biologist will travel through the monitoring area (Figure 1). This zone is considered a realistic area for visual monitoring for vibratory extraction of both steel and wood piles due to the limited number of steel piles and high number of wood piles.
- During impact hammering, one land-based biologists will monitor the area from the pier work site (Figure 2).
- A shutdown zone of 10 meters will be implemented surrounding each pile for vibratory and impact hammering to ensure no physical impacts occur.
- If a marine mammal approaches or enters a shutdown 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 shutdown zone or 15 minutes have passed without re-detection of the animal.

Monitoring to Comply with Killer Whales and Grey Whales

The Navy proposes the following Marine Mammal Monitoring Plan in order to ensure no takes to killer whales, grey whales, and Steller sea lions in the ZOI:

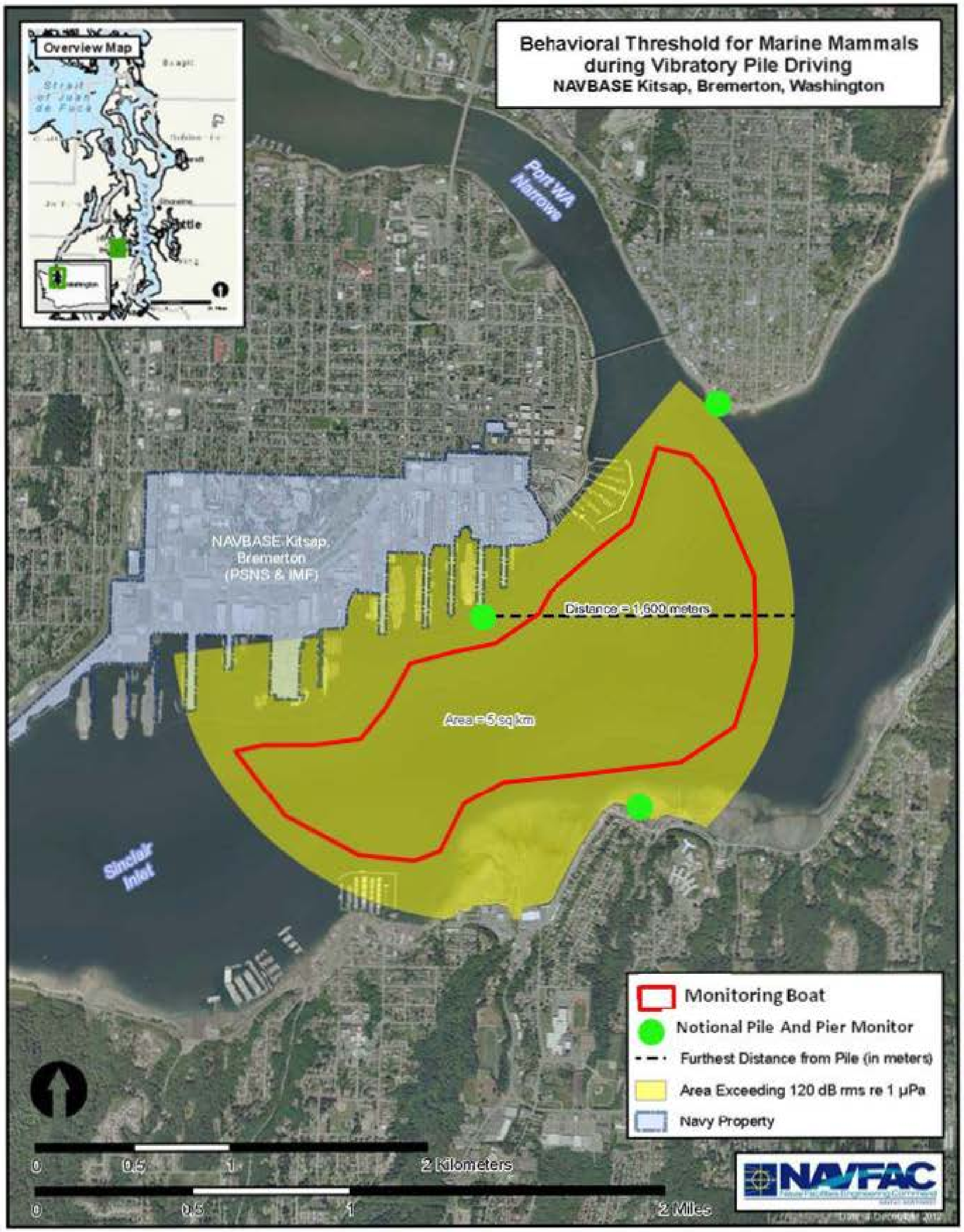
- During vibratory pile removal, four land-based biologists will monitor the area including two at the pier work site, one at the eastern extent of the ZOI in the Manette neighborhood of Bremerton, and one at the southern extent of the ZOI near the Annapolis ferry landing in Port Orchard. Additionally, one boat with a biologist will travel through the monitoring area (Figure 1) completing an entire loop approximately every 30 minutes. If any killer whales or grey whales (or any cetacean) are observed, pile removal will not begin. This zone is considered a realistic area for visual monitoring for vibratory extraction of both steel and wood piles due to the limited number of steel piles and high number of wood piles.
- During impact hammering, one land-based biologist will monitor the area from the pier work site. If any killer whales or grey whales are observed, pile removal will not begin.
- If any killer whales or grey whales approaches or enters the disturbance zone during pile driving, work will be halted and delayed until either the animal has voluntarily left and been visually confirmed beyond the disturbance zone or 15 minutes have passed without re-detection of the animal.

Minimum Qualifications for Marine Mammal Observers

Qualifications for marine mammal observers include:

- Visual acuity in both eyes (correction is permissible) sufficient for discernment of moving targets at the water’s surface with ability to estimate target size and distance. Use of binoculars may be necessary to correctly identify the target.
- Advanced education in biological science, wildlife management, mammalogy or related fields (Bachelor’s degree or higher is preferred), but not required.
- Experience or training in the field identification of marine mammals (cetaceans and pinnipeds).

- Sufficient training, orientation or experience with the construction operation to provide for personal safety during observations.
- Ability to communicate orally, by radio or in person, with project personnel to provide real time information on marine mammals observed in the area as necessary.
- Experience and ability to conduct field observations and collect data according to assigned protocols (this may include academic experience).
- Writing skills sufficient to prepare a report of observations that would include such information as the number and type of marine mammals observed; the behavior of marine mammals in the project area during construction, dates and times when observations were conducted; dates and times when in water construction activities were conducted; dates and times when marine mammals were present at or within the defined shut-down safety or Level B acoustical harassment ZOI; dates and times when in water construction activities were suspended to avoid injury from impact pile driving; etc.



Behavioral Threshold for Marine Mammals
during Vibratory Pile Driving
NAVBASE Kitsap, Bremerton, Washington
Overview Map
Port WA Narrows
NAVBASE Kitsap, Bremerton (PSNS & IMF)
Distance = 1,600 meters
Area = 5 sq km
Sinclair Inlet
Monitoring Boat
Notional Pile And Pier Monitor
Furthest Distance from Pile (in meters)
Area Exceeding 120 dB rms re 1 μPa
Navy Property
0 0.5 1 2 Kilometers
0 0.5 1 2 Miles
NAVFAC

Figure 1.

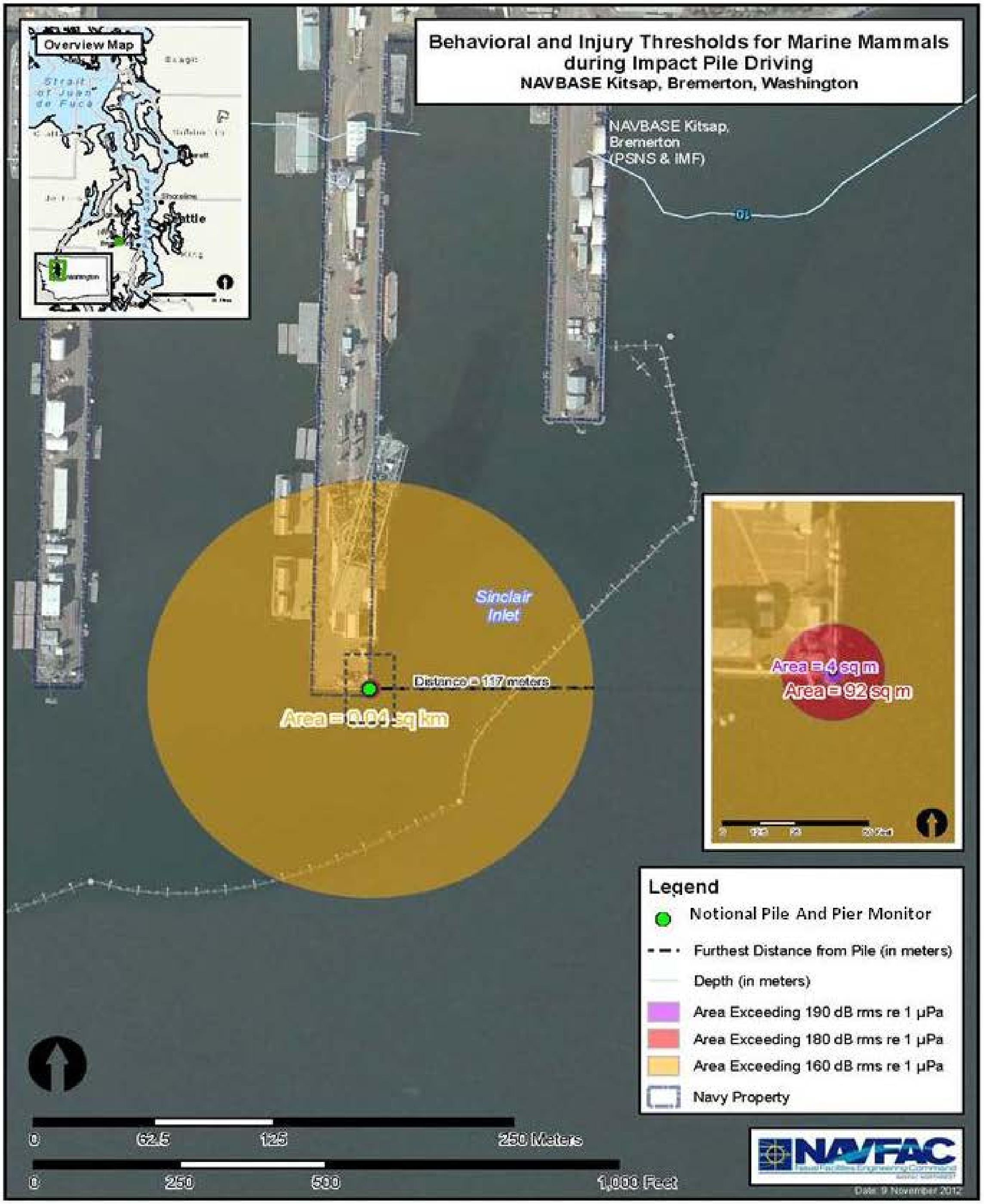

Behavioral and Injury Thresholds for Marine Mammals
during Impact Pile Driving
NAVBASE Kitsap, Bremerton, Washington
Overview Map
Seattle
NAVBASE Kitsap,
Bremerton
(PSNS & IMF)
Sinclair
Inlet
Distance = 117 meters
Area = 0.04 sq km
Area = 4 sq m
Area = 92 sq m
Legend
Notional Pile And Pier Monitor
Furthest Distance from Pile (in meters)
Depth (in meters)
Area Exceeding 190 dB rms re 1 µPa
Area Exceeding 180 dB rms re 1 µPa
Area Exceeding 160 dB rms re 1 µPa
Navy Property
0
62.5
125
250 Meters
0
250
500
1,000 Feet
NAVFAC
Date: 9 November 2012

Figure 2.

Appendix D. Year 1 IHA Marine Mammal Monitoring Report

Replace Fendering System, Pier 6, PSNS & IMF

Marine Mammal Monitoring

Prepared for

Watts Constructors, LLC

6625 Wagner Way, Suite 360

Gig Harbor, WA 98335

Prepared by

Northwest
Environmental Consulting, LLC

Northwest Environmental Consulting, LLC
3639 Palatine Avenue North
Seattle, WA 98103
206-234-2520

MARCH 2014

INTRODUCTION

The Biological Evaluation for N44255-10-D-5021/0006 ~ Replace Fendering System, Pier 6, PSNS & IMF, Bremerton, Washington Project requires that a Marine Mammal Monitoring Plan be followed during all pile driving activity. The plan requires a summary report that contains a brief summary of the marine mammal observations including dates, times, conditions, details of marine mammals observed in the vicinity of the project, animal behavior patterns, and details of any work stoppages resulting from marine mammal presence or weather conditions precluding adequate sighting. The plan also requires that the report contain all field data sheets and logs.

Northwest Environmental conducted marine mammal monitoring at Pier 6 at the Bremerton Naval Shipyard in February 2014 during test impact pile driving activities. This report summarizes efforts, observations, and mitigation activities that were followed during installation of the pilings.

Site Conditions

Pile driving took place at Pier 6 in the Bremerton Navy Shipyard. Pier 6 is about 370 meters long and oriented north to south. The shoreline along the north side of the pier is a seawall and contains poor marine mammal habitat. Some mammal species might use the shoreline for foraging.

Two piles were driven on the east side of Pier 6. The first was about 50 meters from the south end of Pier 6 and the second was 100 meters from the south end of the Pier 6. A range finder was used to help estimate the 10-meter shutdown zone and the 117-meter disturbance zone. Another shipyard pier was located about 90 meters to the east and second pier was located approximately 115 meters to the west. The navy marine security fence was located roughly 85 meters from the south end of Pier 6 and the distance was highly variable along the southern perimeter of the disturbance zone. The security fence started along the edge of the pier to the east and continued to the south for about 230 meters and extended west out of the observation zone. The security fence was within 80 to 130 m from the two test pile locations to the southeast. No photos of the site were taken.

The monitor typically took up a position within 30 meters of the pile being set up or driven, so that the 10 m shutdown zone was completely visible, and the monitor would move occasionally to ensure visibility throughout the 117 m monitoring zone to the east, since the view in that direction was otherwise obstructed by the work barge and crane derrick. Several attempts at observation were made in the western portion of the monitoring zone, west of Pier 6, however this area was mostly obscured by industrial equipment and security exclusion zones, and there were no mammals observed to the west of Pier 6. Once the monitor had scouted for commonly used areas, the monitor focused on positions where the shut-down zone could be observed entirely and where mammals were consistently present (i.e., Navy security fence and the eastern, southeastern, and southern portion of monitoring zone).

Monitoring Effort

Monitoring took place in February 2014 during the installation of piles from February 18th to February 20th for a total of 3 days of monitoring. The monitor followed protocol and was on site to complete the 15-minute pre-watch and post-watch scan before the pile driver was operated. Hammer usage was recorded from about the start time to finish time, intermittent hammering was not recorded, unless there was a break in the monitoring.

Table 1 is a summary of dates and times pile driving and monitoring took place. Pile driving was not continuous on the dates worked.

Table 1 – Pile Driving Dates and Time

Date	Obs.	Start time	End Time
18-Feb*	GJ	-	-
19-Feb	GJ	12:50	16:54
20-Feb	GJ	8:19	10:34

* Monitor on site but no pile driving occurred

Summary of observations

California sea lions were the only marine mammal observed during observations. No Stellar sea lions, southern resident killer whales, or humpback whales were observed. Table 2 – Observation Summary summarizes the number of times each species was sighted, and the number of sightings within the 10 meter (33 feet) shutdown zone and the 117 meter (384 feet) disturbance zone as well as the number of times mitigation was employed. A soft start was used to begin pile driving for each pile. A single observation may include multiple sightings.

Table 2 – Observation Summary During Impact Pile Driving

Species	Total No. of Observations Recorded	Total No. of Individuals Recorded	Individuals in Shutdown Zone	Number of Individuals in Disturbance Zone	No. of times Mitigation Delays Occurred
California Sea Lion	6	31	0	24*	0
Total	**6**	**31**	**0**	**24**	**0**

* All individuals were basking on buoys and not observed in the water during pile driving.

All California Sea Lion sightings in the disturbance zone were basking on the marine security fence buoys and were not in the water during pile driving. Therefore, the individuals were not subjected to disturbance from pile driving activities. Copies of field data sheets can be found in Appendix A – Data Sheets.

Behaviors Observed

Behaviors for California sea lions mainly included basking when hauled out on the security fence buoys. A few individuals were seen climbing onto the buoys, but were not observed entering or exiting the disturbance zone.

Appendix A – Data Sheets

Marine Mammal Observation Form
Northwest Environmental Consulting

Observer: Glenn Johnson **Date:** 2/18/2014 **Monitoring Location:** Pier 6, Bremerton **Page** 1 **of** 1

Use separate line for each sighting or recording

Activity	Sighting (1.0 or 1.1 for resight)	Time of Sighting or activity	End of Sighting or activity	Species	Behavior	Number of Animals	Gender of Animal	No. adult, sub-adult, pups	Direction of Travel	(meters) Distance to sighting	(meters) Distance from activity	Notes (record environmental condtions including cloud cover, visibility, beaufort state, and tides at start of shift and note significant changes) record if animals are tagged or marked, react to construction activity, or other observations including other activities in area. Use multiple lines if needed.
PRE	1.0	1049	1350	CSL	Basking on Fence	13	See below	All adult	not traveling	85-170	80-160	100% Cloud cover, Visibility = 1 Km - 2 Km, B.S.S. ≈ 2, Ebb Tide. 1330 = Low Tide.
PRE	1.1	1050	1350	CSL	Basking + resting	4	♂ = 3 ♀ = 1	Adults	not traveling	85-110	80-115	Part of same sighting above, This entry for all animals within disturbance zone of 117m.
PRE	1.2	1050	1350	CSL	Basking resting	9	♂ = 5 ♀ = 4	Adults	not moving	125-190	125-190	This entry for all stationary animals outside 117m disturbance zone.
POST		1350	- left site									At aprox 1220 The pile was dropped in to place, no hammering/impact driving today.

Activity: **P ON** Pile Driver On **PRE** Pre Watch **POST** Post Watch **M-SD** Mitigation Shutdown - note time when hammer starts and comes off pile, not intermittent striking of pile.
Species Code: **DP** Dall's Porpise **GW** Gray Whale; **HB** Humpback Whale; **HP** Harbor Porpoise; **HS** Harbor Seal; **KW** Killer Whale; **MW** Minke Whale; **SL** Steller Sea Lion; **SO** Sea Otter;
UMM Unidentified Marine Mammal; UP Unidentified Pinniped., CSL = California Sea Lion
Visibility: **B** Bad (<0.5km) **P** Poor (0.5 - 1.5km) **M** Moderate (1.5 - 10km) **G** Good (10-15km) **E** Excellent (<15km)
Sightings: If the same animal is seen on multiple occasions use the 1.1, etc. Each new animal should be done sequentially.

Marine Mammal Observation Form
Northwest Environmental Consulting

Observer: Glenn Johnson Date: 2/19/2014 Monitoring Location: Pier 6, Bremerton

Use separate line for each sighting or recording

Activity	Sighting (1.0 or 1.1 for resight)	Time of Sighting or activity	End of Sighting or activity	Species	Behavior	Number of Animals	Gender of Animal	No. adult, sub-adult, pups	Direction of Travel	Distance to sighting	Distance from activity	Notes (record environmental condtions including cloud cover, visibility, beaufort state, and tides at start of shift and note significant changes) record if animals are tagged or marked, react to construction activity, or other observations including other activities in area. Use multiple lines if needed.
PRE	1.0	1100	1709	CSL	Basking + resting	20	11-males 9-females	All adults	not moving	100-130	90-117	30% cloud cover, Visibility 75 Km, B.S.S.=1-2, Ebb Tide. Basking/resting w/ occassional barking etc.
PRE	2.0	1100	1709	CSL	Basking + resting	11	8-male 3-Female	adults.	not moving	120-185	120-165	Summary entries for all animals resting within 117m of pile location (above) + all outside (this line)
P ON		1250	1255									Several hits w/ pile-drive hammer, similar to soft start. Break: 1330-1445
PRE		1445										Same sea lion distribution as earlier.
P ON		1450	1455									Several hits occur, similar to soft start.
PRE	2.	1620	1709	CSL	Basking + resting	31	19-Male 11-Female	Adults	not moving	170-280	150-250	Crew moves barge/crane/etc to new location ~100 m north, All animals now >117m From activity
P on		1634	1641									Soft start conducted over 1634-1637, then a few more hits.
P on		1654	1654									Several strikes, no movement or other behavioral change from sea lions.
POST		1654	1709									end monitoring at 1709, left pier.

Activity: P ON Pile Driver On PRE Pre Watch POST Post Watch M-SD Mitigation Shutdown - note time when hammer starts and comes off pile, not intermittent striking of pile.
Species Code: DP Dall's Porpise GW Gray Whale; HB Humpback Whale; HP Harbor Porpoise; HS Harbor Seal; KW Killer Whale; MW Minke Whale; SL Steller Sea Lion; SO Sea Otter, UMM Unidentified Marine Mammal; UP Unidentified Pinniped.
Visibility: B Bad (<0.5km) P Poor (0.5 - 1.5km) M Moderate (1.5 - 10km) G Good (10-15km) E Excellent (<15km)
Sightings: If the same animal is seen on multiple occasions use the 1.1, etc. Each new animal should be done sequentially.

Marine Mammal Observation Form
Northwest Environmental Consulting

Observer: Glenn Johnson **Date:** 2/20/2014 **Monitoring Location:** Pier 6, Bremerton **Page** 1 **of** 1

Use separate line for each sighting or recording

Activity	Sighting (1.0 or 1.1 for resight)	Time of Sighting or activity	End of Sighting or activity	Species	Behavior	Number of Animals	Gender of Animal	No. adult, sub-adult, pups	Direction of Travel	Distance to sighting	Distance from activity	Notes (record environmental condtions including cloud cover, visibility, beaufort state, and tides at start of shift and note significant changes) record if animals are tagged or marked, react to construction activity, or other observations including other activities in area. Use multiple lines if needed.
PRE	1.0	0803	1049	CSL	Bask/Rest	14	7-male 7-Female	Adults	not traveling	150-280	150-260	14 Basking/Resting on Navy Security Fence Buoys. Did not react to pile Drive or other construction activity.
P on		0819	0819									Soft Start, Several strikes (< 1 minute)
P on		0820	0826									Soft start continues,
P on		0821	0821									soft start completed.
P on		0823	0824									Pile Drive on (< 2 minutes)
~~post~~ P-on		0833	0835									Pile Drive on.
post		0835	0850									post-drive monitoring, Break From 0850-1000.
PRE	1.1	1000	1049	CSL	Bask/rest	14	7-M 7-F	Adults	not Traveling	150-280	150-260	Same sea lion distribution as earlier.
P on		1025	1027									Soft Start Conducted.
P on		1028	1031									Pile Drive on, no behavior change
P on		1033	1034									Pile Drive on, no movement/behavior change.
post		1034	1049									post-watch, left Pier at 1052.

Activity: P ON Pile Driver On **PRE** Pre Watch **POST** Post Watch **M-SD** Mitigation Shutdown - note time when hammer starts and comes off pile, not intermittent striking of pile.
Species Code: DP Dall's Porpise **GW** Gray Whale; **HB** Humpback Whale; **HP** Harbor Porpoise; **HS** Harbor Seal; **KW** Killer Whale; **MW** Minke Whale; **SL** Steller Sea Lion; **SO** Sea Otter; **UMM** Unidentified Marine Mammal; **UP** Unidentified Pinniped.
Visibility: B Bad (<0.5km) P Poor (0.5 - 1.5km) M Moderate (1.5 - 10km) G Good (10-15km) E Excellent (<15km)
Sightings: If the same animal is seen on multiple occasions use the 1.1, etc. Each new animal should be done sequentially.