US Army Corps
of Engineers ®
Portland District

REQUEST FOR MARINE MAMMAL PROTECTION ACT INCIDENTAL HARASSMENT AUTHORIZATION FOR SAND ISLAND PILE DIKE REPAIRS

PACIFIC COUNTY, WASHINGTON AND CLATSOP COUNTY, OREGON

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

FEBRUARY 2022
U.S. ARMY CORPS OF ENGINEERS
PORTLAND DISTRICT
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1.0 Description of Specified Activity

1.1 Introduction

The U.S. Army Corps of Engineers, Portland District (Corps) is applying for Incidental Harassment Authorization (IHA) under section 101(a)(5) of the Marine Mammal Protection Act of 1972, as amended, for the take of marine mammals incidental to the Sand Island Pile Dike Repairs project. The Sand Island pile dike system consists of four pile dikes near the mouth of the Columbia River (MCR), between river mile (RM) 4 and RM 7 (Figure 1). The Sand Island pile dike system is one component of a system of structural and operational measures that were authorized to establish and maintain the federal navigation channel (FNC). The purpose of the Sand Island Pile Dike Repairs project is to perform needed repairs.

Currently, it is unknown how long it will take to repair and there are several constraints that affect the construction schedule for the Sand Island Pile Dike Repairs project. The project area is exposed to unsafe sea conditions and weather during much of the year, especially in the winter months, which limits in water work windows. In order to avoid potential impacts to ESA-listed fish and Southern Resident killer whales, no pile installation is proposed during the months of December, January, February, March, April, May, June, or July. The Corps is requesting this IHA for 2023 and 2024.

Figure 1. Sand Island Pile Dike System Location

The Sand Island pile dikes are comprised of four pile dikes, which are named according to RM location, at RMs 4.01, 4.47, 5.15, and 6.37 (the pile dike at RM 6.37 is also referred to as the Chinook pile dike). One of the pile dikes is connected to West Sand Island (4.01), two of the pile dikes are connected to East Sand Island (4.47, 5.15), and the fourth pile dike is in open water and runs parallel to the Chinook Federal Navigation Channel on the upstream side (Figure 2). The Sand Island pile dikes are part of the Columbia River pile dike system and were installed in the 1930's. The three pile dikes connected to West Sand Island and East Sand Island are located within Oregon, while the fourth pile dike in open water spans both Oregon and Washington.

Figure 2. Sand Island Pile Dikes.

1.2 Project Overview

The purpose of the Sand Island Pile Dike Repairs project is to perform needed repairs. The existing timber pile dikes at Sand Island consist of three rows of vertical timber pilings between 12 and 20 inches in diameter with two rows of horizontal spreaders, which provide structural stability of the vertical timber pilings. Figure 3 below is an example of pile dike with two rows of timber pilings. A cluster of piles with one or more taller piles, called an outer dolphin with king piles, is used to anchor and mark the end for navigational safety. There is rock apron at the base of the vertical piles and at the shore connection to protect against scour. The existing pile dikes have deteriorated greatly due to lack of maintenance.

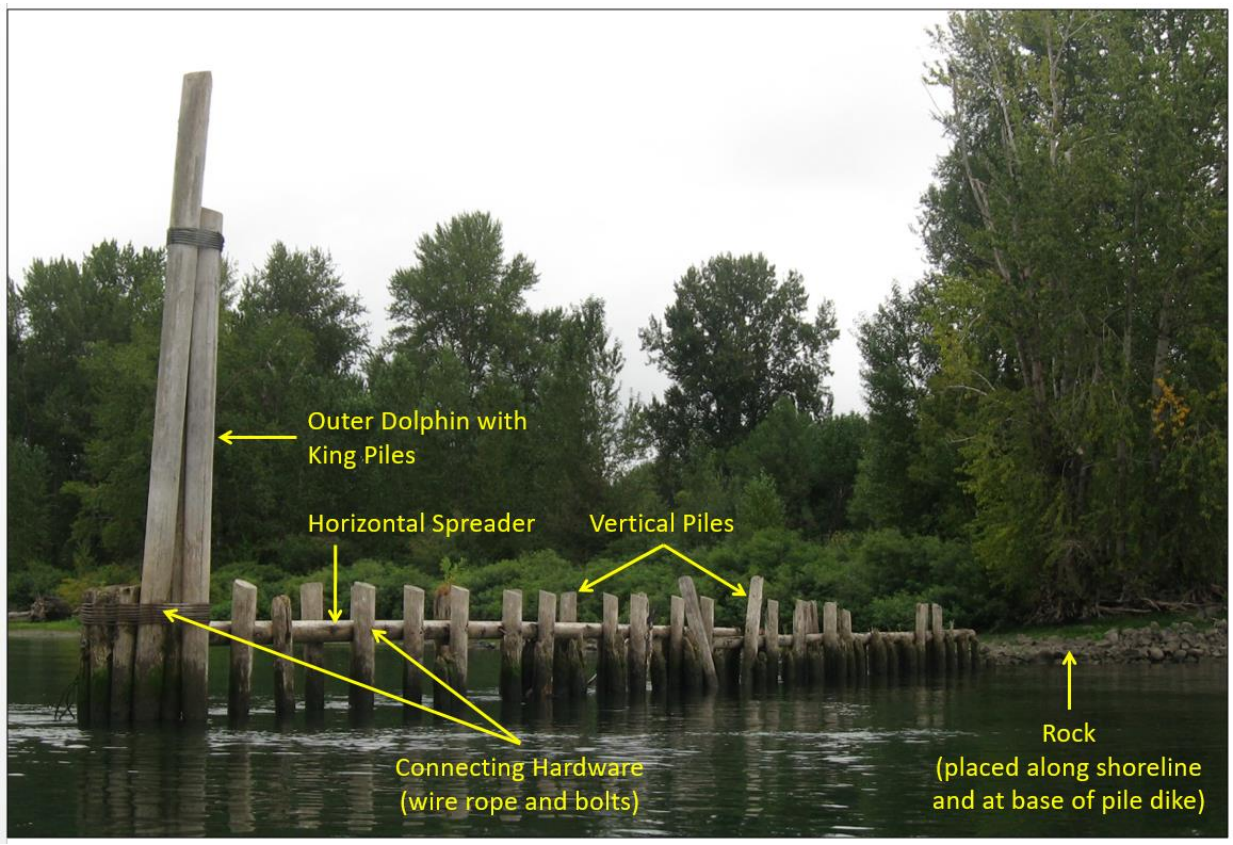

Figure 3. General features of existing Columbia River pile dikes.

The project design team evaluated the existing timber pile dike design using extensive hydrodynamic and sediment transport modeling (Figure 4).

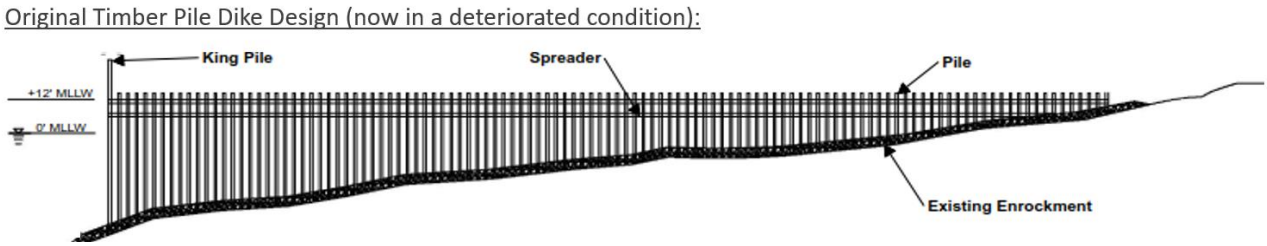

Figure 4. Existing Timber Pile Dike Design

It was determined that at the channel-ward ends of the pile dikes, replacement of the existing, deteriorated piles with new piles is necessary but that in shallower water depths, it is possible to remove timber pilings completely and add rock for higher enrockment elevation to achieve equivalent hydraulic and sediment transport functions (Figure 5).

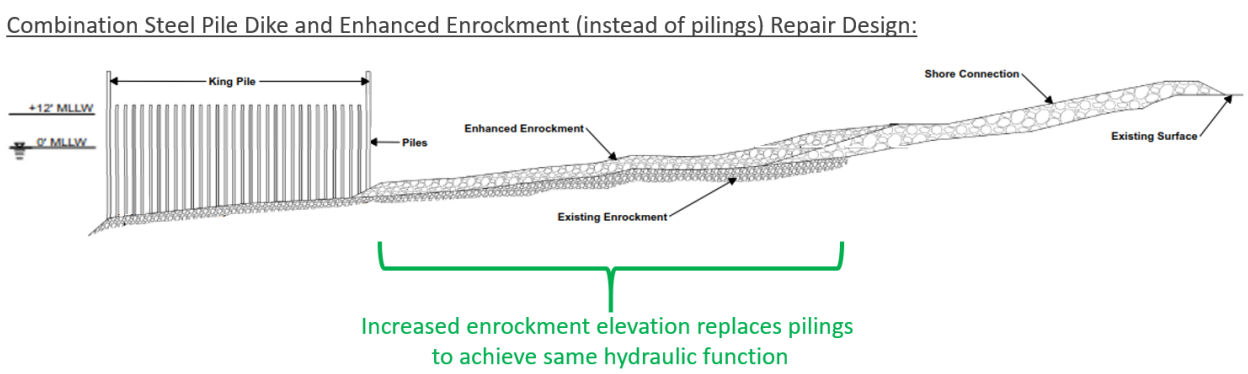

Figure 5. Proposed Repair Design for Pile Dikes.

The project design team also determined that steel piles can provide equivalent hydraulic function and do not require horizontal spreaders, thus reducing required construction materials. In addition it is feasible to cap steel piles with cones to discourage piscivorous bird perching.

1.3 Project Elements

The major project elements proposed for 2023 and 2024 include removing existing timber piles, driving new steel pipe piles and placing rock for multiple purposes including: scour protection at the base of the new piles, enhanced enrockment segments, shore connections, and revetment along the western portion of the shoreline at East Sand Island. Staging areas and associated haul roads will also be needed. Each element is described below in more detail.

1.3.1 Existing Timber Pile Removal

Hydraulic modeling of the Sand Island Pile Dike System demonstrated that existing timber piles would need to be removed because leaving them in place would affect the hydraulic function of the new design. Existing timber piles may be removed by pulling, cutting or snapping at the approximate level of the enrockment. Vibratory hammers will not be used for timber pile removal. Pile removal is expected to proceed incrementally as replacement repairs are made to ensure that overall function is maintained during construction. The original construction of the four pile dikes included 3,936 timber piles. It is estimated that 20% of those are now missing and that approximately 3,000 will be removed and disposed of. None of the timber piles are suspected to have been treated with creosote due to the age of the timber piles and their appearance.

1.3.2 New Steel Pipe Pile Installation

It is anticipated that 652 24-inch, steel pipe piles will be installed at the four pile dike locations during three or four construction seasons and 24 24-inch, steel pipe piles will be installed as marker piles along the enrockment (see Table 1). Each pile dike is 80 feet long; minimum embedment depths are between approximately 30 and 40 feet. The contractor may use barge-

mounted cranes equipped with survey grade positioning software to ensure the piles are installed with precision. Piles are generally installed by a rig which supports the pile leads, raises the pile, and operates a hammer. It is anticipated that vibratory hammers will be used to start the pile driving and will drive them 50% of the way, and impact hammers will be used to complete the pile driving for the remaining 50%. Pile tip attachments may be used to facilitate driving by pushing existing material aside or breaking through thick strata, which could reduce driving time. Pile dampeners/cushions will be used to reduce noise impacts. The use of a pile cushion could reduce the sound pressure levels (SPLs) by up to 27 dB (Laughlin 2006). The extent of sound dampening is a factor of the type of material used(e.g., Conbest, Nylon, Micarta). Per NOAA, source level reductions for pile cushions are not given. Pile driving shoes will be required to protect pile tips during driving and are anticipated to reduce noise impacts; however, no source level reductions were applied here.

In the event that unusually difficult driving conditions are encountered, the contractor will be allowed to temporarily excavate the minimum amount of existing scour protection rock needed in order to drive the new pile. The contractor will then reinstall the rock to provide scour protection for the new pile.

The proposed design is an offset of the existing pile dike alignment, with piles driven approximately 30 feet downstream of existing centerline (Figure 6). The pile configuration needed to achieve hydraulic and sediment transport functions includes two rows of 24” steel pipe piles, staggered and spaced 6.2 feet on center.

The Corps is coordinating with National Marine Fisheries Services (NMFS) for Endangered Species Act consultation. Per NMFS, pile driving may not occur until August 1 of each construction season.

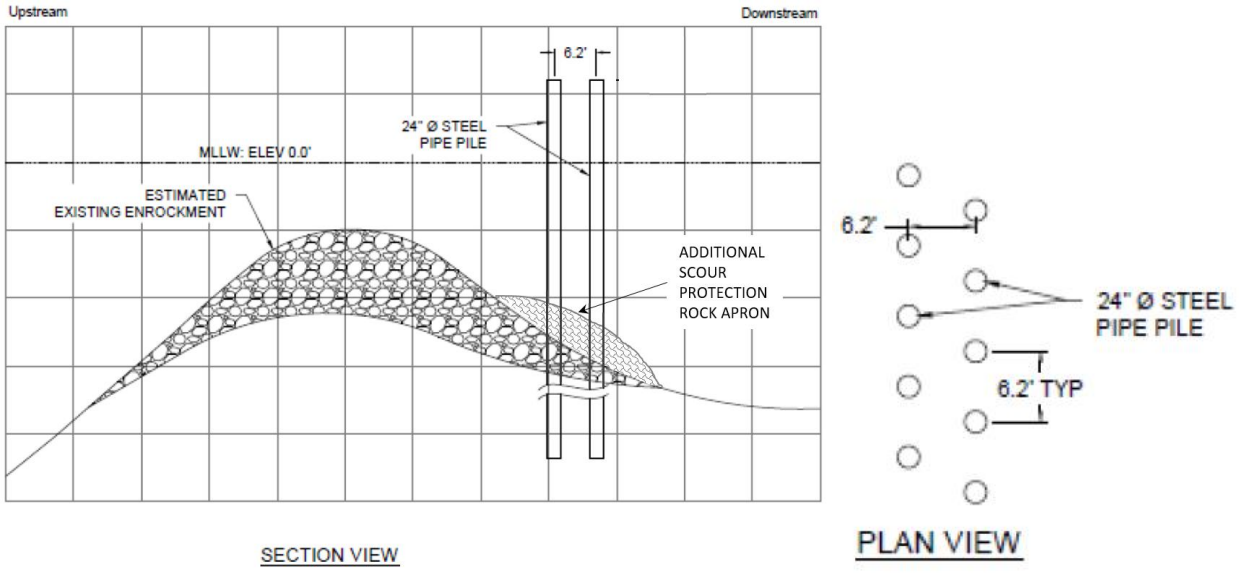

Figure 6. Steel pile alignment and configuration.

1.3.3 Rock Installation

Additional rock installation will be required for scour protection at the base of the new piles, enhanced enrockment segments, shore connections and for revetment at East Sand Island. Scour protection rock creates a rock apron to stabilize piles. Enhanced enrockment will replace some sections of piles (see **Error! Reference source not found.**). Shore connections currently consist of enrockment and would be reinforced where needed. Existing revetment on East Sand Island would be reinforced where needed on the western portion of the island, which involves re-grading some existing rock and augmenting with new rock. Rock placement will occur by means of land-based or barge-based excavators and cranes. A specialized dump barge may also be used. Per NMFS direction, rock will not be "dumped" but will be placed carefully to minimize turbidity and general disturbance.

The volume of enhanced enrockment and scour apron rock corresponds to the volume to be installed below MLLW. The volume of shore connection and revetment rock (cubic yards) corresponds to the volume to be installed above MLLW. The rock quantities were calculated using an estimated 35% porosity.

Table 1 below shows estimated construction quantities for the full scope of pile dike repairs; however, only a portion of these pile installations will be completed in 2023 and 2024 the focus of this request for incidental harassment authorization. Refer to Table 8.

Table 1. Estimated Construction Quantities to Complete Repairs

Pile Dike	Timber Piling Removal	Steel Piling Installation	Marker Pile Installation	Enhanced Enrockment & Scour Apron Installation[1]	Shore Connection & Revetment Installation
4.01	all remaining	138 piles	2	35,555 CY	9,297 CY
4.47	all remaining	138 piles	4	13,053 CY	1,559 CY
5.15	all remaining	146 piles	4	7,742 CY	4,576 CY
6.37	all remaining	230 piles	14	6,819 CY	n/a
Total	(-3,000 piles)	652 piles	24	63,169 CY	15,432 CY

1.3.4 Site Access and Staging

The plans and specifications document for this project has not been finalized; therefore, the Corps used the best available information to estimate equipment and materials to be used for the pile dike repairs and associated construction activities.

Barges will transport all equipment and material to and from the project area and serve as staging platforms for in-water construction. Barges may be spudded or anchored into position.

Land based work will be necessary at pile dikes 4.01, 4.47 and 5.15 to remove some existing timber piles and improve the existing pile dike shore connections and sections of enhanced enrockment that are too shallow for barge-based equipment access. Construction of pile dike 6.37 will occur by over-water equipment only. Conceptual locations for a temporary material off-loading facility (MOF) and staging areas have been chosen based upon multiple constraints including cultural resources, avian presence, ordinary high water depths, and tidal currents, especially during ebb tide. Approaching and landing a barge may not be feasible or safe during some periods of the day during high tidal velocities. Conceptual locations are shown in (Figure 7).

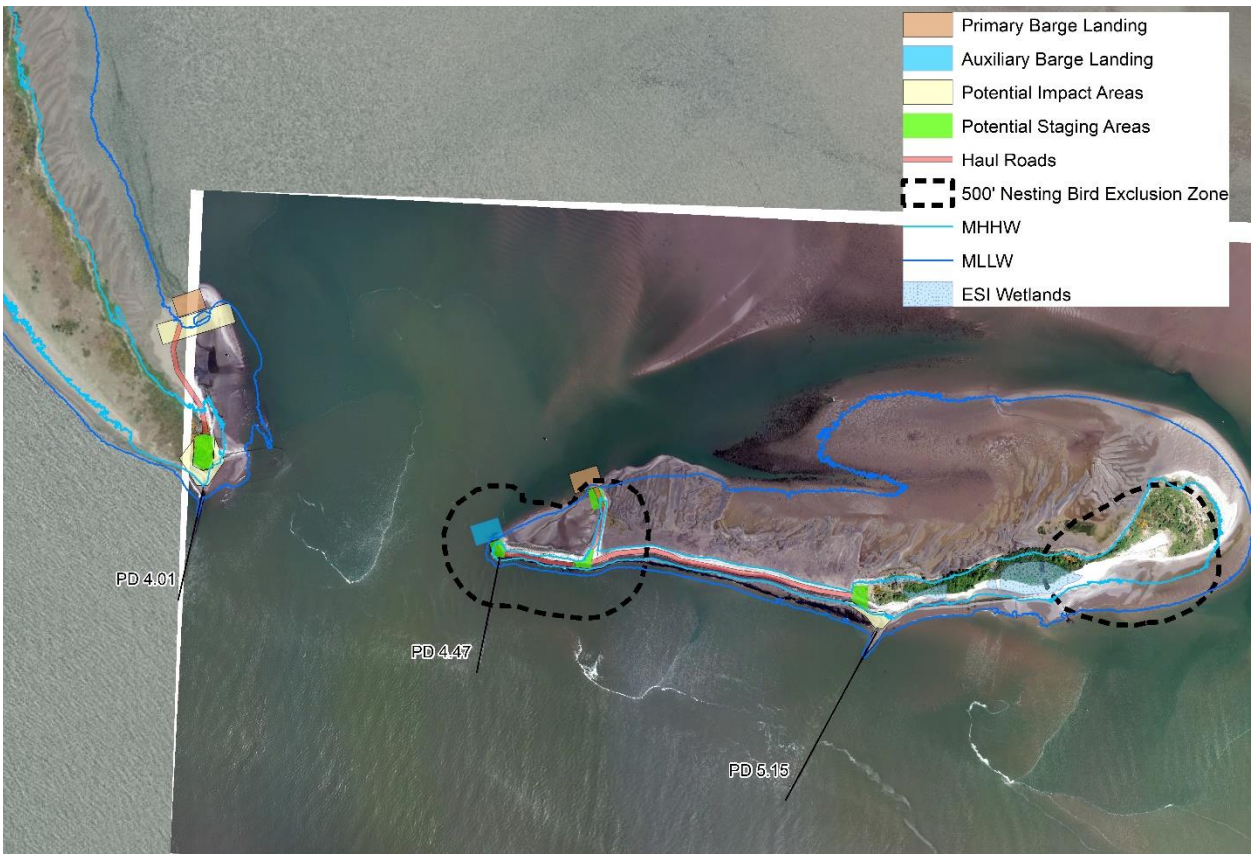

Figure 7. Conceptual barge landing (i.e., MOF site) and staging areas.

For land access to pile dike 4.01 on West Sand Island, the proposed barge landing area and associated MOF is approximately 2,000 ft. north on the southeast side of the island. This area was chosen because it is protected from tidal currents and ocean swell, and offers deep water adjacent to the shoreline. The MOF would require minor dredging and pilings supporting dolphins will be installed by barge using vibratory pile driving methods. It is estimated that a maximum of 24 steel pipe piles with a maximum diameter of 24 inches and up to 100 (24-inch) AZ steel sheet piles will be required. The proposed haul road would provide access to a 1.5-acre staging area at the terminus of the pile dike shore connection (shown as "Potential Staging Area" above in Figure 7).

For access to work on land at pile dikes 4.47 and 5.15, the "primary barge landing" shown in Figure 7 is anticipated to be used as the MOF and is approximately one acre; alternatively, the landing may be constructed in the "auxiliary barge landing" area shown, depending upon site conditions. The primary barge landing area has been used previously for a previous project, the East Sand Island Terrain Modification project. The MOF would require minor dredging and pilings supporting dolphins will be installed by barge using vibratory pile driving methods. It is estimated that a maximum of 24 steel pipe piles with a maximum diameter of 24 inch and up to 100 (24-inch) AZ steel sheet piles will be required (example photos shown in Figure 8).

Construction of temporary haul roads, using a combination of material located onsite and imported to the site, may be necessary to provide access from the barge landing and staging areas to the pile dikes.

Figure 8. Example photos of island access for materials and equipment.

1.4 Noise Emission

1.4.1 In-air Noise

Wind, waves, vessels transiting the Columbia River, and recreational activities all contribute to ambient in-air sound levels in the project vicinity.

Pile installation would result in some airborne noises; however, in-air noise was not a factor in assessing take for in-water activities because the Level B Zone of Influence (ZOI) for underwater noise extends farther. Any marine mammals impacted by in-air noise will be accounted for during the in-water noise assessment and therefore not further assessed in this document.

1.4.2 In-water Noise

Ambient in-water sound in the Proposed Action Area is affected by many factors including: wind and waves from the Pacific Ocean, commercial and recreational vessel use, sounds from resident aquatic animals, nearby landmasses and the ocean floor, currents, etc. A recent study of ambient ocean sound for Oregon's nearshore environment observed maximum and minimum levels of 136 decibels (dB) referenced to a standard pressure level of one micro Pascal (re µPa) and 95 dB re 1 µPa, respectively, with an average level of 113 dB re 1 µPa over a period of one year (Haxel et al. 2011). This level could vary given different recreational and commercial vessels; up to 150 dB for smaller fishing vessels (Hildebrand 2005), up to 186 dB for large vessels, 81 to 166 dB for empty tugs and barges and up to 170 dB for loaded tugs and barges (Richardson et al. 1995) within the frequencies between 20 and 5000 hertz (Hz). Dolphins and toothed whales produce broadband clicks of 125 to 173 dB within frequencies between one kilohertz (KHz) and 200 KHz and humpback whale songs can range between 144 and 174 dB (DOSITS 2012).

Pile driving to repair existing dikes may be done with either vibratory or impact hammer, but due to enrockment surrounding existing piles, it is anticipated that impact hammer will primarily be used. It is not possible to use bubble curtains due to heavy tidal action. However, pile cushions will be used during all impact driving and are estimated to reduce SPLs by 10 dB (see Section 1.3.2 for further details). Pile driving to construct the temporary MOF will be done solely using vibratory means. Vibratory drivers will also be used to remove the MOF piles and sheets at the conclusion of construction. Pile driving noise will be intermittent, but could temporarily disturb marine mammals in the proposed project area. Estimated in-water sound levels anticipated from vibratory and impact hammer installation of steel piles are summarized in

.

Table 2. Estimated Unattenuated Underwater Sound Pressure Levels Associated with Vibratory and Impact Pile Driving

Pile Type & Activity	Sound Pressure Level (SPL) (single strike)[1]		
24-Inch Steel Pile Installation w/impact hammer[2]	203 dB_{PK}	190 dB_{RMS}	177 dB_{SEL}
24-Inch Steel Pile Installation or Removal w/vibratory[3]	Not Available	161 dB_{RMS}	Not Available
24-Inch Steel Sheet Installation or Removal w/vibratory[4]	175 dB_{PK}	160 dB_{RMS}	160 dB_{SEL}

[1] SPL Notations: PK = Peak; RMS = Root mean squared; SEL = Sound exposure level
[2] From CalTrans 2015 Table I.2-1. Summary of Near-Source (10-Meter) Unattenuated Sound Pressure Levels for In-Water Pile Driving Using an Impact Hammer: 0.61-meter (24-inch) steel pipe pile in water ~5 meters deep.
[3] From United States Navy. 2015. Prepared by Michael Slater, Naval Surface Warfare Center, Carderock Division, and Sharon Rainsberry, Naval Facilities Engineering Command Northwest. Revised January 2015. Table 2-2.
[4] Estimated average typical sound pressure levels for 24-inch AZ steel sheets, referenced from Caltrans (2015)

1.5 Best Management Practices, Mitigation and Impact Minimization Measures

General Best Management Practices (BMPs), mitigation and minimization measures that may be implemented for the project are described in Section 11 of this application.

2.0 Dates and Duration

Currently, it is unknown how long the pile dike repairs will take and there are several constraints that affect the construction schedule for the Sand Island Pile Dike Repairs project including the following: ESA-listed fish presence, marine mammal presence, marbled murrelet considerations, and migratory bird presence including cormorant and Caspian tern nesting on East Sand Island. In addition, the project area is exposed to unsafe sea conditions and weather during much of the year, especially in the winter months, which limits in water work windows. In order to avoid potential impacts to ESA-listed fish and Southern Resident killer whales, no pile installation is proposed during the months of December, January, February, March, April, May, June, or July. The Corps is requesting this IHA for 2023 and 2024.

Pile driving work would start no sooner than 30 minutes after sunrise and would stop no later than 30 minutes before sunset, which equates to a maximum work day of approximately 13 hours.

Estimated construction durations for major repair activities are shown below in Table 3.

Table 3. Estimated Duration of Major Repair Activities

Repair Activity	Estimated Start	Estimated Duration
Season One 2023		
Mobilization	June 2023	2 weeks
New pile installation at PD 6.37	August 2023	2 months
Enrockment at PD 6.37	July 2023	2 months
Marine based construction on East Sand Island (dredge temp channel,	October 2023	1 month

construct MOF/barge landing, delivery)		
Land Based Construction on East Sand Island (haul road, staging) and demobilization	October 2023	1 month
Deconstruction of MOF (removal of steel pipe piles and sheet piles)	October 2023	1 month
Season Two 2024		
Mobilization	June 2024	1 week
Enrockment at 5.15	July 2024	1 month
New pile installation at PD 5.15	August 2024	5 weeks
New pile installation at PD 6.37	August 2024	1 month
Land based construction on East Sand Island (5.15 shore connection) and demobilization	October 2024	1 month

3.0 Marine Mammal Species and Numbers

We identified 26 species that have the potential to occur in waters off the Oregon coast during project construction (Table 4

Table 4). Marine mammals are, to varying degrees, susceptible to Level B harassment (i.e., behavioral disturbance or temporary hearing threshold shift) and the more severe Level A harassment (i.e., non-serious injury or permanent threshold shift).

Table 5 outlines the sound thresholds for each marine mammal group. We use this information in Section 4.0 to help assess the potential effects of proposed construction activities on species likely to be encountered in the project vicinity.

The majority of the species listed in (Table 4

Table 4)

Table 4 are unlikely to occur in the project vicinity. For example, numerous cetaceans (i.e., sei whale (*Balaenoptera borealis borealis)*, Risso's dolphin (*Grampus griseus),* common bottlenose dolphin *(Tursiops truncatus truncates),* striped dolphin (*Stenella coeruleoalba),* short-beaked common dolphin *(Delphinus delphis)*, short-finned pilot whale (*Globicephala macrorhynchus),* Baird's beaked whale (*Berardius bairdii)*, Mesoplodont beacked whale (*Mesoplodon* spp.), Cuvier's beaked whale (*Ziphius cavirostris),* pygmy sperm whale (*Kogia breviceps),* dwarf sperm whale (*Kogia sima),* sperm whale *(Physeter macrocephalus*) are only encountered at the continental slope (>12 miles/20 km offshore) or in deeper waters offshore and are unlikely to be affected by construction activities. Other species may occur closer inshore, but are rare or infrequently encountered off the Oregon coast (i.e., minke whale (*Balaenoptera acutorostrata scammoni),* Pacific white-sided dolphin *(Lagenorhynchus obliquidens),* northern right-whale dolphin *(Lissodelphis borealis),* and Dall's porpoise *(Phocoenoides dalli dalli).* Given these considerations and no reasonable expectation for proposed activities to affect the above species, they will not be addressed in Section 4.

Table 4. Marine Mammal Species in the Vicinity of West and East Sand Island

Species and Marine Mammal Group[1]	Estimated Stock(s) Abundance[2]	ESA* Status	MMPA** Status	Frequency of Occurrence[3]	Distributional Range
Phocid pinnipeds					
Harbor seal (*Phoca vitulina richardii*) Oregon and Washington Coast Stock	24,732 (CV= 0.12)	Not listed	Non-strategic	Likely	Continental shelf (coastal and estuarine)
Northern Elephant Seal (*Mirounga angustirostris*) California Breeding Stock	179,000	Not listed	Not depleted; Non-strategic	Infrequent	Continental shelf
Otariid pinnipeds					
Steller sea lion (*Eumetopias jubatus*) Eastern U.S. Stock	43,201 (minimum)	Not listed	Not depleted; Non-strategic	Seasonal (Sept – May)	Continental shelf
California sea lion (*Zalophus californianus*) U.S. Stock, Pacific Temperate Population	257,606	Not-listed	Not depleted; Non-strategic	Seasonal[4] (Sept – May)	Continental shelf
Low-frequency cetaceans					
Humpback whale (*Megaptera novaeangliae*) California/Oregon/Washington Stock	2,900 (CV ≈ 0.05)	Endangered	Depleted and Strategic	Seasonal	Continental shelf and slope
Fin whale (*Balaenoptera physalus physalus*) California/Oregon/Washington Stock	9,029 (CV = 0.12)	Endangered	Depleted and Strategic	Rare	Continental shelf, slope, and offshore
Gray whale (*Eschrichtius robustus*) Eastern North Pacific Stock	26,960 (CV = 0.05)	Not listed	Non-strategic	Seasonal (Nov - June)	Continental shelf, slope, and offshore
Minke whale (*Balaenoptera acutorostrata scammoni*) California/Oregon/Washington Stock	636 (CV = 0.72)	Not listed	Non-strategic	Rare	Continental shelf
Blue whale (*Balaenoptera musculus musculus*) Eastern North Pacific Stock	1,647 (CV = 0.07)	Endangered	Depleted and Strategic	Seasonal (summer and fall)	Continental slope and offshore
Sei whale (*Balaenoptera borealis borealis*) Eastern North Pacific Stock	519 (CV = 0.40)	Endangered	Depleted and Strategic	Rare	Offshore
Mid-frequency cetaceans					

Species and Marine Mammal Group[1]	Estimated Stock(s) Abundance[2]	ESA* Status	MMPA** Status	Frequency of Occurrence[3]	Distributional Range
Pacific white-sided dolphin (*Lagenorhynchus obliquidens*) California/Oregon/Washington, Northern and Southern Stocks	26,814 (CV = 0.28)	Not listed	Non-strategic	Infrequent and seasonal (late spring and summer)	Continental shelf and slope
Risso's dolphin (*Grampus griseus*) California/Oregon/Washington Stock	6,336 (CV = 0.32)	Not listed	Non-strategic	Rare	Continental slope and offshore
Common Bottlenose dolphin (*Tursiops truncatus truncatus*) California/Oregon/Washington Offshore Stock	1,924 (CV = 0.54)	Not listed	Non-strategic	Rare	Offshore
Striped dolphin (*Stenella coeruleoalba*) California/Oregon/Washington Stock	29,211 (CV = 0.20)	Not listed	Non-strategic	Infrequent and seasonal	Generally offshore
Short-beaked Common dolphin, (*Delphinus delphis delphis*) California/Oregon/Washington Stock	969,861 (CV = 0.17)	Not listed	Non-strategic	Rare	Continental slope and offshore
Northern right-whale dolphin (*Lissodelphis borealis*) California/Oregon/Washington Stock	26,556 (CV = 0.44)	Not listed	Non-strategic	Infrequent (late spring and summer)	Continental shelf and slope
Killer whale (*Orcinus orca*), West Coast Transient Stock	349	Not-listed	Not depleted; Non-strategic	Infrequent	Continental shelf, slope, and offshore
Short-finned pilot whale (*Globicephala macrorhynchus*) California/Oregon/Washington Stock	836 (CV = 0.79)	Not listed	Non-strategic	Rare	Deep waters and continental slopes
Baird's beaked whale (*Berardius bairdii*) California/Oregon/Washington Stock	2,697 (CV = 0.60)	Not listed	Non-strategic	Infrequent (late spring to early fall)	Continental slope
Mesoplodont beaked whale (*Mesoplodon* spp.) California/Oregon/Washington Stock	3,044 (CV = 0.54)	Not listed	Non-strategic	Unknown	Deep waters and continental slopes
Cuvier's beaked whale (*Ziphius cavirostris*) California/Oregon/Washington Stock	3,274 (CV=0.67)	Not listed	Non-strategic	Likely	Deep waters
Pygmy Sperm whale (*Kogia breviceps*) California/Oregon/Washington Stock	4,111 (CV = 1.12)	Not listed	Non-strategic	Rare	Deep waters and continental slopes
Dwarf Sperm whale (*Kogia sima*) California/Oregon/Washington Stock	Unknown	Not listed	Non-strategic	Rare	Deep waters and continental slopes

Species and Marine Mammal Group[1]	**Estimated Stock(s) Abundance**[2]	**ESA* Status**	**MMPA** Status**	**Frequency of Occurrence**[3]	**Distributional Range**
Sperm whale (*Physeter macrocephalus*) California/Oregon/Washington Stock	1,997 (CV = 0.57)	Endangered	Depleted and Strategic	Seasonal (spring, summer, and fall)	Continental slope and offshore
High-frequency cetaceans					
Harbor porpoise (*Phocoena phocoena*) Northern Oregon/Washington Coast Stock	21,487 (CV = 0.44)	Not listed	Non-strategic	Likely	Continental shelf (coastal and estuarine)
Dall's porpoise (*Phocoenoides dalli dalli*) California/Oregon/Washington Stock	25,750 (CV = 0.45)	Not listed	Non-strategic	Infrequent	Continental shelf, slope, and offshore

[1]NOAA Marine Mammal Stock Assessments by Species

[2]Frequency defined here in the range of:

- 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 stock area year-round.
- Seasonal – Confirmed and regular sightings of the species in the area on a seasonal basis.
- Unknown – Insufficient data to assess patterns in occurrence

* ESA = Endangered Species Act; ** MMPA = Marine Mammal Protection Act

Table 5. Marine Mammal Hearing Groups, Hearing Range, and Level B Disturbance Thresholds*

Hearing Group	Generalized Hearing Range	In-Air Noise	Underwater Noise	
			Non-Impulsive (Vibratory Hammer)	Impulse (Impact Hammer)
Low-frequency (LF) cetaceans (baleen whales including humpbacks)	7 Hz – 35 kHz	NA	120 dB	160 dB
Mid-frequency (MF) cetaceans (dolphins, toothed whales, including killer whales)	150 Hz – 160 kHz	NA	120 dB	160 dB
High-frequency (HF) cetaceans (true porpoises, river dolphins, including harbor porpoises)	275 Hz – 160 kHz	NA	120 dB	160 dB
Phocid pinnipeds (PW) (true seals including harbor seals)	50 Hz – 86 kHz	90 dB	120 dB	160 dB
Otariid pinnipeds (OW) (fur seals and sea lions including Stellers and California)	60 Hz – 39 kHz	100 dB	120 dB	160 dB

*All thresholds reported as the root mean square (RMS) sound pressure level (SPL_{RMS}) and decibels are referenced to 1 micro Pascal (1µPa); Reference: NOAA West Coast Fisheries (online guidance, accessed 03 January 2019)
https://www.westcoast.fisheries.noaa.gov/protected_species/marine_mammals/threshold_guidance.html

Table 6. Marine Mammal Hearing Groups and Level A Underwater Injury Thresholds*

Hearing Group	Non-Impulsive (Vibratory Hammer)	Impulse (Impact Hammer)
	SEL_{cum}	SEL_{cum}
Low-frequency (LF) cetaceans (baleen whales including humpbacks)	199 dB	183 dB

Mid-frequency (MF) cetaceans (dolphins, toothed whales, including killer whales)	198 dB	185 dB
High-frequency (HF) cetaceans (true porpoises, river dolphins, including harbor porpoises)	173 dB	155 dB
Phocid pinnipeds (PW) (true seals including harbor seals)	201 dB	185 dB
Otariid pinnipeds (OW) (fur seals and sea lions including Stellers and California)	219 dB	203 dB

* Cumulative sound exposure level (SEL_{cum}) for weighted permanent threshold shift (PTS) onset based on the Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (NMFS 2018)

4.0 Affected Species Status and Distribution

The species shown in Table 4 occur off the coast of Oregon. Most of those marine mammals would not enter the mouth of the Columbia River and therefore have no potential to be impacted by the Sand Island Pile Dike Repairs project and no take is being requested. All stock estimates were derived from NOAA/NMFS most recent marine mammal stock assessment reports available. Given these considerations, ten marine mammal species could potentially be affected by proposed project activities (i.e., *Orcinus orca, Megaptera novaeangliae, Eschrichtius robustus, Balaenoptera physalus physalus, Balaenoptera musculus musculus, Phocoena phocoena, Eumetopias jubatus, Zalophus californianus, Phoca vitulina richardii,* and *Mirounga angustirostris*). The following paragraphs provide further details on their status and distribution.

4.1 Cetaceans

4.1.1 Killer Whale

Killer whales (*Orcinus orca*) are found in waters throughout the North Pacific. Along the west coast of North American, 'resident,' transient,' and 'offshore' ecotypes have overlapping distributions and multiple stocks are recognized within that broader classification scheme. According to the most recent stock assessment (NOAA 2017b), the West Coast Transient (WCT) Stock includes animals that range from California to southern Alaska, and is genetically distinct from other transient populations in the region (i.e., Gulf of Alaska, Aleutian Islands, and Bering Sea transients and AT1 transients).

There are an estimated 349 killer whales in the WCT Stock, excluding animals from the 'outer coast.' This estimate is considered conservative because it also excludes animals from California that have not been catalogued in recent years (NOAA 2017a). Overall, the population appears to be increasing, potentially corresponding in greater prey abundance (Houghton et al. 2015a). Killer whales are subject to injury from ship strikes and vessel noise that may interfere with echolocation (Veirs et al. 2016). Vessel speed has been shown as one of the best predictors of sound levels received by killer whales and adherence to speed limits may ultimately reduce the level of disturbance to the species (Houghton et al. 2015b). While not regularly seen in the project area, transient killer whales have been observed near the mouth of the Columbia River during the peak spring Chinook salmon migration in March and April and a pod of transient killer whales were detected near the Astoria Bridge in May of 2018 (Frankowicz 2018). Southern Resident killer whales have not been documented entering into the Columbia River.

4.1.2 Humpback Whale

The estimated population of the humpback whale (*Megaptera novaeangliae*) California/Oregon/Washington stock is about 2,900 animals (Carretta et al. 2019). Sources of human-caused mortality and injury include pot/trap and gillnet fisheries, vessel strikes, entanglements, and marine debris. The entire species was previously listed as "endangered" under Endangered Species Act (ESA) due to historical commercial whaling practices that decimated populations. The stock is now managed as three Distinct Population Segments (DPS) units and humpback whales in the Mexican and Central American DPSs are currently listed "threatened" and "endangered", respectively, under ESA. As such, the California/Washington/Oregon Stock is currently considered "endangered," "depleted," and "strategic" under Marine Mammal Protection Act (MMPA) (Carretta et al. 2019).

Humpback whales migrate long distances between winter breeding areas and summer feeding areas. Humpback whales in the North Pacific have several populations distinguished by their winter breeding areas (Calambokidis et al. 2000). Whales found off the coast of Oregon comprise the California/Washington/Oregon Stock that may include animals from the California-Oregon and Washington-southern British Columbia feeding groups (Carretta et al. 2019). These animals belong almost exclusively to the Mexican and Central American DPSs. Humpback whales are primarily found on the continental shelf and slope (Adams et al. 2014). Humpback whales are

typically seen off the Oregon coast from April to October, with peak numbers from June through August. Humpback whales were observed near Heceta Bank (i.e., 15 to 30 miles off the Oregon coast in Lincoln and Lane counties) in June 1990 (Green et al. 1991).

Humpback whale feeding groups have begun utilizing the MCR as foraging ground, arriving in the lower Columbia estuary as early as mid-June, and have been observed as late as mid-November with a peak of abundance coinciding with the peak abundance of forage fish in mid-summer. Humpback whale were observed in the immediate vicinity of West and East Sand Islands in late summer and fall of 2015 and 2016 (The Columbian, 2016). They were also observed in the area in 2017 and 2019, but their presence was not documented there in 2018 (The Columbian, 2019). Most recently they were again seen earlier in the season than ever, at the beginning of April in 2020 (Chinook Observer, 2020). Based on this information, it is possible that humpback whales may pass through and may forage intermittently in the immediate project vicinity.

4.1.3 Gray Whale

Gray whales (*Eschrichtius robustus*) in the North Pacific have two distinct population stocks, Eastern North Pacific (ENP) and Western North Pacific. During summer and fall, gray whales in the ENP migrate from breeding grounds off the coast of Baja California and Mexico to feeding areas in the Bering Seas. Approximately 200 of the aforementioned migrating whales feed between northern California and northern British Columbia (Sumich 1984, NOAA 2014). Whales seen along the Oregon coastline are typically part of this Pacific Coast Feeding Group (PCFG) and their abundance and residence time in Oregon may correlate with the availability of mysids (*Holmesimysis sculpta*), a major prey item (Newell and Cowles 2006).

The best available abundance estimate for ENP gray whales is 26,960, as of the 2015 abundance estimates from NOAA 2020 stock assessment. Though not currently managed as a separate stock, the estimated number of gray whales in the PCFG is approximately 209 (CV=0.07) animals. Gray whales in the ENP seem to have increased over the last few decades, in spite of an unusual mortality event (UME) in 1999/2000. Entanglement, ship strikes, and habitat change are ongoing concerns for the population, but the current level of human-caused mortality is still well below the potential biological removal (PBR) for the stock. ENP gray whales are not currently listed under ESA and are not considered a “strategic” stock under the MMPA (NOAA 2014).

Gray whales are generally not known to enter the MCR. Prior to 1984, the only cetacean species recorded to have entered the Columbia River was the gray whale (Jeffries 1984). There are a few observations from 1989 and 1990 just north of the Long Beach Peninsula (OBIS http://seamap.env.duke.edu/species/180521 (accessed 1/18/2019)). Gray whales migrate along the Oregon coast in

three discernible phases from early December through May (Herzing and Mate 1984); therefore, animals would not be expected to be found near the MCR during the in water work period.

4.1.4 Fin Whales

Fin whales (*Balaenoptera physalus physalus*) have three recognized stocks in the North Pacific, with whales off the Oregon coast typically part of the California/Oregon/Washington Stock. Fin whales are present year-around in Oregon waters, though they may be less abundant in spring and winter (Mizroch et al. 2009, NOAA 2016). Evidence from prey remains found in carcasses and historic whaling records suggest they inhabit waters of the continental shelf, slope and offshore, and predominantly near the surface (Mizroch et al. 2009).

Fin whales in the North Pacific were extensively harvested during commercial whaling operations. Available catch data estimates 40,650 fin whales were killed between 1911 and 1985, with the majority of harvested from May to October, 1905 to 1971 (Mizroch et al. 2009). There are currently just over 9,000 fin whales estimated in waters (out to 300 nautical miles) off California, Oregon, and Washington coasts (NOAA 2016). While their numbers appear to be increasing, fin whales are still susceptible to injury or death due to gillnet entanglement or ship strikes. Fin whales, like other low-frequency cetaceans, may also be negatively affected by increasing levels of anthropogenic noise (NOAA 2016). The California/Oregon/Washington Stock of fin whales has protective status under ESA and the MMPA. They are considered “endangered” under ESA, with a default status of “depleted” and “strategic” under the MMPA (NOAA 2016).

4.1.5 Blue Whales

Blue whales (*Balaenoptera musculus musculus*) have both and eastern and western north Pacific stock, each with a unique acoustic call (Stafford et al. 2001). The ENP Stock includes animals found between the eastern tropical Pacific and the northern Gulf of Alaska and the Pacific coast represents an important feeding area for blue whales during summer and fall (Carretta et al. 2019). The majority of summer/fall feeding activity occurs off the California coast (Calambokidis et al. 2004, 2009). Blue whales are only occasionally detected in offshore waters of Oregon and Washington (Calambokidis et al. 2009, Carretta et al. 2019), and sightings of whales from the California feeding population in British Columbia and the Gulf of Alaska would suggest that animals do migrate through Oregon and Washington waters (Calambokidis et al. 2004).

There are currently an estimated 1,647 blue whales in the ENP stock, with a fairly constant population size since the 1990s. There was extensive harvest of blue whales between 1910 and 1965, prompting their listing under ESA. Although the population is likely near the carrying capacity, entanglement, ship strikes, and increased levels of anthropogenic sound pose ongoing risks to blue whales. Blue whales are currently listed "endangered" under ESA, and "depleted" and "strategic" under MMPA (Carretta et al. 2019).

4.1.6 Harbor Porpoise

For the Northern Oregon/Washington Coast stock (Lincoln City, OR, to Cape Flattery, WA) of harbor porpoises (*Phocoena phocoena)*, the corrected estimate of abundance in the coastal waters in 2010-2011 was 21,487 (CV = 0.44) (Forney et al. 2013 cited in NOAA 2014b) and is currently estimated at 35,769 (NOAA 2017).

Harbor porpoise are known to occur year-round in the inland transboundary waters of Washington and British Columbia, Canada (Osborne et al. 1988 cited in NOAA 2014b) and along the Oregon/Washington coast (Barlow 1988, Barlow et al. 1988, Green et al. 1992 cited in NOAA 2014b). Aerial survey data from coastal Oregon and Washington, collected during all seasons, suggest that harbor porpoise distribution varies by depth (Green et al. 1992 cited in NOAA 2014b). Although distinct seasonal changes in abundance along the west coast have been noted and attributed to possible shifts in distribution to deeper offshore waters during late winter (Dohl et al. 1983, Barlow 1988 cited in NOAA 2014b), seasonal movement patterns are not fully understood.

Harbor porpoises are usually found in shallow water, most often nearshore, although they occasionally travel over deeper offshore waters (NOAA 2013a). West Coast populations have more restricted movements and do not migrate as much as East Coast populations (Halpin, OBIS-SEAMAP 2019). Most harbor porpoise groups are small, generally consisting of less than five or six individuals, though for feeding or migration they may aggregate into large, loose groups of 50 to several hundred animals (Halpin, OBIS-SEAMAP 2019). Behavior tends to be inconspicuous, compared to most dolphins, and they feed by seizing prey which consists of wide variety of fish and cephalopods ranging from benthic or demersal (Halpern, OBIS-SEAMAP 2019).

Harbor porpoises are sighted year round in the MCR (Griffith 2015). Their abundance peaks with the abundance of anchovy presence in the river and nearshore. The Corps does not have good information on their presence in the immediate work area during the fall, but their presence is assumed.

4.2 Pinnipeds

The following table (Table 7) shows the average number of pinnipeds found at South Jetty, which is approximately four miles southwest of West and East Sand Island for 2000-2014.

Table 7. Average Number of Pinnipeds per Month on South Jetty, 2000-2014 (WDFW)

Month	# of Times Surveyed in Month	Avg. Number of Steller Sea Lions	# of Times Surveyed in Month	Avg. Number of California Sea Lions	# of Times Surveyed in Month	Avg. Number of Harbor Seals
January	1	249	2	10	0	--
February	6	259 (*)	7	28	1	1
March	6	177	4	17	2	14
April	8	587	7	99	0	--
May	6	824	6	125	0	--
June	18	676	14	202	7	57
July	10	358	2	1	0	--
August	4	324	4	115	2	1
September	2	209	2	249	0	--
October	6	384	6	508 (***)	0	--
November	3	1,663	3	1,214 (**)	0	--
December	1	1,112	1	725	1	57
Totals	71	6,822	58	3,293	13	130

(*) 2012 may be an anomaly with only 1 sighting.
(**) Driven by 2011 counts, which could be an anomaly.
(***) Appears to be driven by high numbers in 2006.
Source: Data from Washington Department of Fish and Wildlife 2014.

4.2.1 Steller Sea Lion

Large numbers of Steller sea lions (*Eumetopias jubatus*) use the nearby South Jetty for hauling out (Jeffries 2000) and are present, in varying abundances, all year (Table 7). Abundance is typically lower as the summer progresses when adults are at the breeding rookeries. Steller sea lions are most abundant in the vicinity during the winter months and tend to disperse elsewhere to rookeries during breeding season between May and July (Corps 2007). All population age classes, and both males and females, use the South Jetty to haul out. Only non-breeding individuals are typically found on the jetty during May-July, and a greater percentage of juveniles are present. There is probably a lot of turnover in sea lion numbers using the jetty, meaning that the 100 or so sea lions hauled out one week might not be the same individuals hauled out the following week.

California sea lions can intermingle with Steller sea lions but Steller sea lions appear to out-compete California sea lions for the preferred haul out area. Previous monthly averages between 1995 and 2004 for Steller sea lions hauled-out at the South Jetty head ranged from about 168 to 1,106 animals. Data from Oregon Department of Fish and Wildlife (ODFW) from 2000-2014 reflects a lower frequency of surveys, and numbers ranged from zero animals to 606 Steller sea lions (ODFW 2014). More frequent surveys by Washington Department of Fish and Wildlife (WDFW) for the same time frame (2000-2014) put the monthly range at 177 to 1,663 animals throughout the year.

4.2.2 California Sea Lion

Large numbers of California sea lions (*Zalophus californianus*) use the nearby South Jetty for hauling out (Jeffries 2000). The population size of the U.S. stock of California sea lions is estimated at 257,606 animals (NOAA 2019). According to ODFW (2014) most counts of California sea lions are also concentrated near the tip of the South Jetty. California sea lions can intermingle with Steller sea lions. ODFW survey information (2007 and 2014) indicates that California sea lions are relatively less prevalent in the Pacific Northwest during June and July, though in the months just before and after their absence there can be several hundred using the South Jetty. More frequent WDFW surveys (2014) indicate greater numbers in the summer, and use remains concentrated to fall and winter months. Nearly all California sea lions in the Pacific Northwest are sub-adult and adult males (females and young generally stay in California).

4.2.3 Harbor Seal

Harbor seals (*Phoca vitulina richardii*) are one of the most abundant pinnipeds in Oregon and can typically be found in coastal marine and estuarine waters of the Oregon coast throughout the year. On land, they can be found on offshore rocks and islands, along shore, and on exposed flats in the estuary (Harvey 1987). In 2002, the estimated absolute abundance of harbor seals on the

Oregon coast (excluding Hunters Island) was 10,087 (8,445-12,046 95% CI) animals (Brown et al. 2005). Harbor seals are known to use the Chinook Channel/Baker Bay area during low tides for hauling out (Jeffries 2000).

Harbor seals are generally non-migratory, but local movements may vary with tides, weather, seasons, food resources, and reproductive behavior (NOAA 2013). They were historically hunted in Oregon as a nuisance to fishermen, however, their numbers have steadily increased since the passage of the MMPA in 1972 (Harvey 1987, Brown et al. 2005). While harbor seals are still subject to incidental take from commercial fisheries in the region, the overall mortality is relatively small and the Oregon/Washington Coast stock of harbor seals is not depleted under MMPA or listed under ESA (NOAA 2013).

4.2.4 Northern Elephant Seals

The California Breeding Stock of Northern elephant seals (*Mirounga angustirostris*) breeds and gives birth in California, but makes extended foraging trips to areas including coastal Oregon biannually during the fall and spring (Le Boeuf et al. 2000). They spend about 90% of their time at sea underwater, making sequential deep dives. While both males and females may transit areas off the Oregon coast, males seem to have focal forage areas near the continental shelf break while females typically move further offshore and feed opportunistically at numerous sites while in route (Le Beouf et al. 2000). Prior to 1984, only two sightings of Northern elephant seals were recorded (Jeffries 1984). Since then, they have been seen at the MCR infrequently.

There are 159,000-199,000 Northern elephant seals in the United States, with an estimated annual growth rate of 3.8% between 1988 and 2010 (Lowry et al. 2014). The population is susceptible to incidental take and injury from gillnet and trawl fisheries operating offshore, however, the human-caused mortality is still well below the estimated potential biological removal (PBR) level. Northern elephant seals are not currently listed under ESA, nor considered “strategic” or “depleted” under MMPA (NOAA 2014c).

5.0 Type of Incidental Take Authorization Requested

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.” Under Section 101(a)(5)(D) of the MMPA, the Corps requests an Incidental Harassment Authorization for marine mammals that may be affected by the Sand Island Pile Dike Repairs project as described in Sections 1 and 2 above.

The in-air effects of pile driving noise were considered for this project; however, we assume that animals that would be present in the in-air disturbance zone would have already entered the in-water disturbance isopleth. Therefore, no separate take is being requested for disturbance to marine mammals outside of the water.

The in-water effects of pile driving noise include potential Level A and Level B effects on marine mammals. No serious injury or mortality is anticipated with this project. The activities including work day estimates anticipated to disturb marine mammals are shown below in Table 8.

Table 8. Summary of Proposed Pile Driving Installation Activities

Type of Disturbance	**Work Days**	**Estimated Time of Year**
Season One 2023		
Steel pipe pile installation at PD 6.37 (vibratory and impact hammer)	56	August/September
MOF/barge landing install steel pipe piles (impact hammer)	5	October
MOF/barge landing install sheet piles (vibratory hammer)	4	October
Deconstruction MOF remove steel pipe piles (vibratory hammer)	1	October
Deconstruction MOF remove sheet piles (vibratory hammer)	1	October
Total	67	
Season Two 2024		
Steel pipe pile installation at PD 5.15 (vibratory and impact hammer - including shore connection)	71	August/September/October

Steel pipe pile installation at PD 6.37 (vibratory and impact hammer)	24	August
Total	95	

5.1 Level A Harassment - Permanent Threshold Shift

Level A harassment includes permanent hearing threshold shift or other types of non-serious injury. We utilized the NMFS technical guidance and tool for estimating Level A permanent threshold shift (PTS) isopleths, the area within which auditory damage could occur, calculated separately for each marine mammal hearing group (NMFS 2018). The estimated isopleth distances were calculated using the un-weighted Sound Pressure Levels (SPL) Root Mean Squared (RMS) values from

, with the following assumptions:

- The average number of hours in each work day is 13 hours per day.
- In a 24-hour period, no more than 14 piles would be installed using either an impact or vibratory hammer per day, with an average of 5 piles installed each day.
- The steel pipe piles will be driven using a vibratory hammer in the beginning, and with an impact hammer to finish. Therefore, estimates are for 50% impact hammer use and 50% vibratory hammer use.
- The average number of strikes per pile, to imbed to depth, with an impact hammer is 450 (USACE 2019). However, for this project, piles will be started with a vibratory hammer, so we used the average number of strikes per half pile with an impact hammer is 225.
- The average number of strikes per minute with an impact hammer is 43.
- The average duration to install a single 24-inch pile with an impact hammer is 11 minutes (USACE 2019).
- Noise dampeners, also called pile cushions or caps, will be used during all pile installations with an impact hammer and are estimated to reduce SPLs by 10 dB; however, per NOAA this deduction should not be applied to noise calculations.

- The average duration to install a single 24-inch steel pipe pile with vibratory is 30 minutes. The average duration to install half of a single 24-inch steel pipe pile with vibratory is 15 minutes.

MOF Construction/Deconstruction assumptions:

Though site specific designs for the MOF have not been written, the Corps has recently constructed two MOFs for the Columbia River Jetty Rehabilitation projects, and has made the following assumptions:

Steel pipe piles:

- A maximum of 24 steel pipe piles with a maximum diameter of 24 inches may be installed for the MOF (estimated 5 days in 2023).
- Up to 20 steel pipe piles could be removed in a 24-hour period using vibratory methods.
- The average duration to remove a single 24-inch pipe pile with a vibratory hammer is 5 minutes (estimated 1 day in 2023).

Sheet piles:

- A maximum of 100 (24-inch) AZ steel sheet piles may be installed for the MOF.
- Up to 25 steel sheets could be installed in a 24-hour period using vibratory methods (estimated 4 days in 2023).
- The average duration to install a single steel sheet is 10 minutes (or less).
- Up to 50 steel sheets could be removed in a 24-hour period using vibratory methods (estimated 1 day in 2023).
- The average duration to remove a single steel sheet is 3 minutes.

A Constructability Assessment Report was prepared for USACE for Sand Island Pile Dike Repairs in 2019 which used site specific conditions to estimate the average number of strikes per pile that would be required.

The spreadsheet calculations associated with PTS values presented in Table 6 are provided in Appendix A, with corresponding figures in Appendix B.

5.2 Level B Harassment – Behavioral Disturbance

We used the following practical spreading loss equation to calculate the Level B disturbance distances in water (i.e., Equation 1):

$$D_{thresh-water} = D_0 * 10^{(\frac{SPL\ Estimate\ in\ dB_{RMS\ or\ Leq} - Disturbance\ threshold\ in\ dB}{\alpha})}$$

With $D_{thresh\text{-}water}$ calculated distance from source to reach in-water threshold values, D_0 reference measurement distance (10 meters), water disturbance threshold values from

Table 5, and α = 15. Estimated sound pressure levels in water were referenced from

, using the dB_{RMS} values for installing 24-inch steel piles with a vibratory hammer and 24-inch piles with an impact hammer. Figures in Appendix B show marine mammal Level B disturbance zones associated with the two types of pile driving activity (i.e., impact and vibratory).

Table 9. Calculated Level A PTS and Level B Disturbance Isopleths During Construction

Noise Generation Type	Level A Permanent Threshold Shift (PTS) Isopleth Distances[1] (meters)					Level B Disturbance[2] All Groups
	LF Cetacean	MF Cetacean	HF Cetacean	Phocid Pinniped	Otariid Pinniped	Isopleth Distances (meters)
24" Steel Pile Impact Installation	430.0	15.3	512.2*	230.1**	16.8	1,000
24" Steel Pile Vibratory Installation	7.9	0.7	11.7	4.8	0.3	5,412 (estimated ZOI[#])
#Steel Sheets Vibratory Installation	36.8	3.3	54.4	22.4	1.6	4,642
Steel Sheets Vibratory Removal	9.6	0.9	14.2	5.8	0.4	4,642

[1] Calculated using NMFS technical tool and spreadsheet for estimating PTS levels associated with pile driving (NMFS 2018) (see Appendix A). Estimates for vibratory installation assume unattenuated sound. Estimates associated with impact driving assume pile cushions/caps are used, per text in Sections 1.3 and 1.4 of this document.
* The resulting Level A isopleth areas are between 0.78 and 0.83 km^2, depending on a pile dike's proximity to land, and were used to inform harbor porpoise take estimates in Table 12.
**The resulting Level A isopleth areas are between 0.20 and 0.23 km^2, depending on a pile dike's proximity to land, and were used to inform harbor seal take estimates in Table 12.
[#] Zone of Influence (ZOI) is approximately 94 km^2 and was used for estimating Level B disturbance during all pile driving.

6.0 Take Estimates for Marine Mammals

6.1 Level A Take

A minimum shutdown zone of 25 meters will be strictly enforced at all times during any pile driving to minimize potential Level A injury. If a marine mammal is entering or is observed within an established shutdown zone, pile installation will be halted or delayed. These precautions, soft start procedures, and multiple trained observers onsite will minimize potential injury to marine mammals during proposed work.

During impact driving, trained observers will monitor wider shutdown zones to avoid Level A injury to larger marine mammals such as humpback whales. If any of these species are detected approaching Level A isopleth distances associated with their respective marine mammal group, observers will notify construction personnel and pile driving will cease.

Harbor seals and harbor porpoises may go undetected until they are already within established Level A zones for phocids and HF cetaceans, and some individuals may be undetected altogether. For these species, a 50-meter shutdown zone will be enforced. Due to potential difficulty detecting these two latter species, observers would extrapolate counts from a monitoring zone established by the lead observer based on site conditions on the day of observation. Counts of harbor seals and harbor porpoises within this "observable" zone will be adjusted to get a daily take estimate that accounts for the percentage of the larger Level A zones (i.e., 230 meters for harbor seals; 512 meters for harbor porpoises) that were not visible.

A Level A shutdown zone of 50 meters will be strictly enforced for harbor porpoises and low frequency cetaceans (e.g., humpback) during all vibratory pile driving. The shutdown zone for all other species will remain at the 25-meter minimum during vibratory driving. Measures to stop work will be implemented should a harbor porpoise be detected approaching this 50-meter shutdown zone.

6.2 Level B Take

This authorization is also requesting incidental take for Level B marine mammal disturbance that may occur due to proposed project activities. Fin, gray, and blue whales may occur in the broader region, but none are likely to enter the Columbia River and come within the Level B disturbance zone for proposed work. In the rare event that one of these species enters the Level B disturbance zone, any pile driving will cease. Based on the marine mammal monitoring procedures and the low likelihood of these three species entering the Columbia River, no Level B acoustical harassment is anticipated or requested for fin, gray, and blue whales. We are requesting authorization for Level B take for harbor seals, Northern elephant seals, Steller sea lions, California sea lions, humpback whales, killer whales (WCT stock only), and harbor porpoises during vibratory pile driving activities.

Level B underwater disturbance of marine mammals would occur within 1,000 meters during impact pile driving, within 5412 meters during vibratory installation or removal of piles, and within 4,642 meters during sheet pile installation and removal (Table 9). A general monitoring zone of 1,000 meters will be established during all pile driving. The potential Level B exposure recorded by observers during vibratory driving will be extrapolated based upon the number of observed takes and the percentage of the Level B zone beyond 215 meters that was not visible. Level B monitoring protocols, outlined in Section 12, will be implemented according to these stated distances for potential in-water and in-air disturbance.

6.3 Marine Mammal Abundances in Project Area

6.1.1 Cetacean Abundances

Marine mammal counts specific to the MCR were sparse. Thus, we compiled available data in order to estimate abundances. Ancillary data may result in over-estimation of the density of animals likely to be encountered in the direct project vicinity and thus the request take quantities are likely higher than the actual take that may be attributed to proposed project activities.

Killer whale

Killer whales are mostly migratory in the vicinity of the MCR, generally are not found close to shore, and are highly mobile. Killer whales were not detected in fall and winter aerial surveys off the Oregon coast documented in Adams et al. 2014. Aerial seabird marine mammal surveys observed zero killer whales in January 2011, zero in February 2012, and ten in September 2012 within an approximately 1,500 km^2 range near the MCR (Adams 2014). While a rare occurrence, a pod of transient killer whales were detected near the Astoria Bridge in May of 2018 (Frankowicz 2018). There have been no confirmed sightings of southern resident killer whales entering the project area. We conservatively estimate that two transient killer whales per year could be near the MCR during proposed work and subject to disturbance from pile driving.

Humpback whale

Humpback whales have been observed in the immediate vicinity of the project area in recent years. Humpbacks have been arriving in the lower Columbia estuary as early as mid-June and have been observed as late as mid-November with a peak of abundance coinciding with the peak abundance of forage fish in mid-summer. No surveys were located for the project area, but it is assumed that they could be present during pile driving activities. Given the higher observed abundances in summer, we assume up to two individuals per month could be in the project vicinity during pile installation.

Gray whale

Gray whales have not been documented near the project area and are not known to enter the MCR. In addition, gray whales migrate along the Oregon coast in three discernible phases from early December through May (Herzing and Mate 1984). Therefore, they are unlikely to occur near the project area in the months of proposed work and no take is requested.

Fin whale

Fin whales have not been documented near the project area and are not known to enter the MCR. Therefore, they are unlikely to occur near the project area in the months of proposed work and no take is requested.

Blue whale

Blue whales have not been documented near the project area and are not known to enter the MCR. Therefore, they are unlikely to occur near the project area in the months of proposed work and no take is requested.

Harbor porpoise

Harbor porpoises are regularly observed in the oceanward waters adjacent to the project area and are known to occur year-round. Their nearshore abundance peaks with anchovy presence, which is generally June through October. There was one recorded sighting of a harbor porpoise in the project area east of the jetties in the Sept-Nov timeframe (OBIS-SEAMAP 2019). Therefore, it is feasible that animals could be present during pile driving activities. The Corps does not have (nor is aware of) data for the number of harbor porpoises that may be present in the project vicinity. The closest derived estimates of inshore density (3.642 animals/km^2) are for the entire Northern California and Southern Oregon Stock (Barlow et al. 2009), and likely overestimate the number of animals that may occur near the mouth of the Columbia River. Given these constraints, we used the monitoring data associated with the IHA/LOA for Columbia River jetty repairs (USACE 2016) to inform estimates in this document. Over the course of a 5-day monitoring period, observers detected 5 harbor porpoises (Grette Associates 2016). Given the potential for animals to travel in pairs, we estimated a harbor porpoise encounter rate of one per day within the ZOI to calculate Level A and Level B take.

6.1.2 Pinniped Abundances

For Steller sea lions (SSL), California sea lions (CSL), and harbor seals (HS), the numbers of individuals were referenced from WDFW's surveys from 2000-2014 at the South Jetty for the months of in water work (Table 7) and averaged to get an average daily count (Table 10). While animals were surveyed at the prominent haul out site along the South Jetty, we assume each of these estimates represent the total number of individuals present in the project vicinity. As indicated by the numbers in Table 10, peak abundances for all three pinniped species occur in winter and spring (Jeffries et al. 2000). However, work is slated to occur July – October and only MOF removal (~ 4 days) with potential overlap in November. In instances where proposed activities will occur over a span of two or more months, we derived potential take estimates from the average abundance recorded over the specified period (see Section 6.2.2 for further details). For harbor seals, where abundance was only estimated in July, we use that estimate for all projections.

Table 10. Pinniped Abundance Estimates from the South Jetty

	Abundance Estimates (WDFW Average Observations 2000-2014)		
	Steller Sea Lions	**California Sea Lions**	**Harbor Seals**
July	358	1	57
August	324	115	57*

September	209	249	57*
October	384	508	57*
Average	306	291	57
*Actual survey month was June (assume July abundance would be similar to June)			

Northern elephant seals

Northern elephant seals have been observed in the MCR; however, no abundance estimates in the MCR or vicinity were found. They are known to haul out at Cape Arago, which is approximately 250 miles south of the project area. Surveys were conducted near Cape Arago between 2002 and 2005 (Scordino 2006) and the reference abundance (n = 54) was the maximum count observed.

6.2 Incidental Take

Level A permanent threshold shift isopleths and Level B disturbance thresholds were calculated for all species considered (

Table 9; calculations in Appendix A). Some of the marine mammals found in the MCR have large estimated PTS isopleths because it is not possible to use bubble curtains or other noise-attenuating devices due to heavy tidal action in the project area (see Appendix B figures for each pile dike). Table 13 summarizes the request for incidental take due to noise impacts associated with impact pile driving activities, along with the percentage of the stock affected.

Shutdown zones will be enforced to avoid Level A auditory impacts during all vibratory driving and for most species (i.e., most cetaceans and all otariid pinnipeds) during impact driving. Shutdown Zones will be monitored by trained marine mammal spotters that will enforce shutdown zones based upon marine mammal hearing groups during all impact hammer pile driving (

Table 9). If the spotter cannot identify a marine mammal to the species level, they will enforce shutdown zones equal to the largest Level A isopleth.

For harbor seals and harbor porpoises, Level A take is requested at the levels specified in Table 10. Marine mammal spotters will monitor the Level A PTS zones during all driving activities and record "take" as outlined in Section 13 of this document.

6.2.1 Take Estimates for Cetaceans

In the absence of more specific marine mammal survey data at our project location, we are defining the "project vicinity" equal to the Level B disturbance ZOI.

Killer whale

It is rare that killer whales are observed in the coastal waters near the MCR, however, transient killer whales have been detected in recent years and could enter the ZOI during proposed work. The assumed abundance for killer whales for this project is 2 individuals per year. No Level A take is requested given the strict monitoring protocols, Level B take is requested in the amount of two individuals per construction season (four killer whales total).

Humpback whale

No Level A take is being requested because work would cease if any humpback whales were to come within the Level A PTS isopleth of the project. Though the isopleth is large, the humpback whale's large size and distinct behavior make them relatively easy to spot by a qualified biologist. Soft start procedures for resuming construction will be implemented once the work area has been cleared to further eliminate risks. We are requesting Level B take of two humpback whales per month during August, September, and October.

Gray whale, Fin whale, and Blue whale

Gray whales, fin whales, and blue whales are not known to enter the project area and are extremely unlikely to enter the project area. No Level A or Level B take is requested and work will cease in the unlikely event that any of these whales are detected in the Level A PTS or Level B disturbance zone.

Harbor porpoise

Due to the large PTS isopleth, we assume one animal per day could enter the Level A zone during pile driving. Based upon 67 days of pile driving in season 1 and 95 days of pile driving in season 2, we are requesting Level A take of 61 harbor porpoises for season 1 and 95 for season 2. We are also requesting Level B take of 67 harbor porpoises for season 1 and 95 for season 2.

Table 11. Take Estimates for Cetaceans – Years 1 and 2

Species	Presumed Maximum Occurrence in Project Vicinity	Year 1 Level A	Year 1 Level B	Year 2 Level A	Year 2 Level B
Killer (transient) whales	2 animals per year	0	2	0	2
Humpback whales	2 animals per month	0	6	0	6
Harbor porpoises	1 animal per day	61	67	95	95

6.2.2 Take Estimates for Pinnipeds

Take calculations for SSL, CSL, and HS were estimated using abundance estimates from the South Jetty, which is approximately four miles to the south of Sand Island (Table 10). In order to estimate take of SSL, CSL, and HS we used daily abundance estimates (Table 12). For NES, no haul out locations are known in the project vicinity; therefore, we estimate a monthly abundance of two NES in the project area.

Table 12. Estimated Pinniped Abundances for Proposed Work at Sand Island Pile Dikes.

	SSL (average count*)	SSL (daily estimate in Project Vicinity)	CSL (average count)	CSL (daily estimate in Project Vicinity)	HS (average count)	HS (daily estimate in Project Vicinity)	NES (average count)	NES (monthly estimate in Project Vicinity
July	358	72	1	1	196	57	-	2
July - August	341	68	58	12	196	57	-	4
August	324	65	115	23	1	1	-	2
August - September	267	53	182	36	196	57	-	4
September	209	42	249	50	1	1	-	2
September - October	297	59	379	76	196	57	-	2
October	384	77	508	102	196	57	-	2

*See text for explanation of how averages were calculated for each species

Table 13. Level A and B Take Calculations for Pinnipeds.

Type of Disturbance	Number Days Pile Driving	Month(s)	SSL Level A Take	SSL Level B Take	CSL Level A Take	CSL Level B Take	HS Level A Take	HS Level B Take	NES Level A Take	NES Level B Take
Season One 2023										
Steel pile installation at PD 6.37 (impact and vibratory)	56	Aug & Sept	-	2968	-	2016		3192		4
MOF/barge landing install steel pipe piles	5	October	-	385	-	510		285		2
MOF/barge landing install sheet piles	4	October	-	308	-	408		228		
Deconstruction MOF remove sheet piles	1	October	-	77	-	102		57		
MOF/barge landing install steel pipe piles	1	October	-	77	-	102		57		
TOTAL	67			3,815		3,138	38*	3781		6
Season Two 2024										
Pile installation at PD 5.15 (impact and vibratory)	71	Aug & Sept	-	3,763		2,556		4047		4
Pile installation at PD 6.37 (impact)	24	Aug.	-	1560		552		1368		
TOTAL	95			3,150		3,108	41*	5415		4

*Level A take was calculated based on the proportion of the ~94 km^2 Zone of Influence (ZOI) within the Level A isopleth area estimated for phocids (i.e., 0.20-0.23 km^2 per pile dike, 0.82 km^2 total). Given the proportion of the ZOI in which harbor seals could be subject to Level A injury, we estimated Level A take as approximately 1% of the Level B take. No Level A take is requested for other pinniped species.

Table 14. Total Marine Mammal Level A and B Take Estimates and Percentage of Stock Taken for the Sand Island Pile Dike Repairs.

Species	Level A Take*	Level B Take	Stock Abundance	Percentage of Stock Taken Level A	Percentage of Stock Taken Level B
Season One 2023					
Humpback whale (*Megaptera novaeangliae*)	0	6	2,900	0	0.20%
Killer whale (*Orcinus orca*)	0	2	349	0	0.57%
Harbor porpoise (*Phocoena phocoena*)	61	67	21,487	0.28%	0. 31%
Gray whale *(Eschrichtius robustus)*	0	0	26,960	0	0
California Sea Lion (*Zalophus. californianus*)	0	3,138	257,606	0	1.20%
Stellar Sea Lion (*Eumetopias jubatus*)	0	3,815	52,932	0	7.20%
Harbor Seal (*Phoca vitulina richardii*)	38	2,613	24,732	0.15%	15.40%
Northern elephant seal (*Mirounga angustirostris*)	0	6	179,000	0	<1%
Species	**Level A Take***	**Level B Take**	**Stock Abundance**	**Percentage of Stock Taken Level A**	**Percentage of Stock Taken Level B**
Season Two 2024					
Humpback whale (*Megaptera novaeangliae*)	0	6	2,900	0	0.20%
Killer whale (*Orcinus orca*)	0	2	349	0	0.57%
Harbor porpoise (*Phocoena phocoena*)	95	95	21,487	0.44%	0.44%

Gray whale *(Eschrichtius robustus)*	0	0	26,960	0	0
California Sea Lion (*Zalophus. californianus*)	0	3,108	257,606	0	1.20%
Stellar Sea Lion (*Eumetopias jubatus*)	0	5,323	52,932	0	10%
Harbor Seal (*Phoca vitulina richardii*)	41	3,705	24,732	0.16%	21.90%
Northern elephant seal (*Mirounga angustirostris*)	0	4	179,000	0	<1%
* Estimates assume impact driving could occur up to 47 of the 55 workdays. **Median of range reported for the West Coast Transient stock of killer whales					

7.0 Anticipated Impact of the Activity

The proposed work may cause permanent damage to harbor porpoises and harbor seals that enter the project area. Adhering to the marine mammal monitoring protocols described in Section 13 will help ensure that there are no Level A auditory damages to other marine mammal species that could transit the area during pile installation.

Marine mammals that enter the Level B ZOI may experience temporary disturbance. The effects are limited to the species listed in

Table 14. . Marine mammal behavioral responses could include avoidance or altered foraging patterns. Level B harassment take will be greatest for pinniped populations experiencing underwater noise exposure. However, overall project impacts have a negligible effect on marine mammal stocks in the area, as estimated take will affect less than 1% of the stock for most species, and approximately 6% and 9% of the Stellar sea lion and harbor seal stocks, respectively.

8.0 Anticipated Impacts on Subsistence Uses

There are no relevant subsistence uses of marine mammals implicated by this action.

9.0 Anticipated Impacts on Habitat

New pile dikes would be driven in the same location as currently existing pile dikes. Though some marine mammals may pass through the area, the pile dikes are not known to be used as breeding, feeding, sheltering, or foraging specifically for any marine mammals; therefore, no modification to existing habitat is expected.

10.0 Anticipated Effects of Habitat Impacts on Marine Mammals

The proposed project would not result in a permanent adverse impact to marine mammal habitat.

11.0 Mitigation Measures to Protect Marine Mammals and Their Habitat

The following mitigation measures will be implemented during construction activities to minimize disturbance during pile removal and installation activities.

- The contractor will implement a soft-start procedure for impact pile driving activities. 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 an 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 that pile installation activities are conducted.
    - For impact driving, an initial set of three strikes would be made by the hammer at 40 percent energy, followed by a one minute wait period, then two subsequent three-strike sets at 40 percent energy, with one minute waiting periods, before initiating continuous driving.

- Monitoring of marine mammals will take place starting 30 minutes before construction begins until 30 minutes after construction ends (see Section 13 for monitoring details).
- Before commencement of pile driving activities, the Corps will establish zones for each marine mammal group as shown in Isopleth Figures (Appendix B) for Level A Shutdown Zones to prevent auditory injury.
- For in-water heavy machinery work other than pile driving (using, e.g., standard barges, tug boats, barge-mounted excavators, or clamshell equipment used to place or remove material), if a marine mammal comes within 20 meters, operations shall cease and vessels shall reduce speed to the minimum level required to maintain steerage and safe working conditions.
- Prior to initiating in-water pile driving or pile removal, the Corps will establish the following Level B ZOIs for underwater noise.
    - The Level B ZOI for impact and vibratory pile driving activities will be established out to a line of sight distance of up to 5,412 meters, depending on the type of driving (Table 9).
    - If a marine mammal enters the Level B ZOI, but does not enter Level A 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.
- Construction waste material used or stored will be confined, removed, and disposed of properly.
- A description of spill containment and control procedures will be on-site.
- Fueling and lubrication of equipment will be conducted in a manner that affords the maximum protection against spill and evaporation. Fuel, lubricants and oil will be managed and stored in accordance with all Federal, State, Regional, and local laws and regulations. BMPs will be employed in order to prevent petroleum products, chemicals, or other deleterious waste materials from entering waters. Fuel hoses, oil drums, oil or fuel transfer valves and fittings, etc., will undergo frequent inspection for drips or leaks, and shall be maintained in order to prevent spills into waters.
- The contractor will be provided, and will strictly adhere to the marine mammal monitoring plan (Section 13 below).

12.0 Mitigation Measures to Protect Subsistence Uses

The proposed project will take place in the Columbia River at West and East Sand Island, as well as open water east of East Sand Island in Oregon. No activities will take place in or near a traditional Arctic hunting place.

13.0 Monitoring and Reporting

Impacts to marine mammals are likely to be temporary and negligible, and the mitigation measures described in Section 11 are meant to avoid and minimize impacts to any marine

mammals that may be present to the maximum extent practicable. The following Monitoring and Reporting measures will be implemented to further minimize disturbance to marine mammals, improve understanding of the level of taking or impacts on populations of marine mammals that are expected to be present while conducting activities, and increase the general knowledge about these marine mammals and the effectiveness of the mitigation measures.

The Corps proposes the following monitoring protocols:

- Visual monitoring will be conducted by qualified, trained marine mammal observers (hereafter "observer") and will be implemented during all pile removal/installation activities. An observer shall have 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.
- For all pile driving activities, a shutdown and disturbance zone will be monitored.
    - A minimum of two observers will be employed during all driving and removal activities, though more observers may be necessary to adequately monitor marine mammals during periods of low or obstructed visibility to ensure the entirety of the shutdown zone is monitored. One of the required observers will conduct monitoring via boat to count marine mammals entering the Level B disturbance zones and alert construction crew members of marine mammals entering the Level B zone and approaching/entering the Level A zone.
    - Monitoring will take place from 30 minutes prior to initiation through 30 minutes post-completion of pile driving.
    - Impact Pile Driving:
        - During impact hammer use, the Level A isopleth is approximately 17 meters for otariids (e.g., Stellar and California sea lions), 230 meters for phocids (e.g., Harbor seals), 430 meters for LF cetaceans (e.g., humpback and gray whales), 15 meters for MF cetaceans (e.g., killer whale), and 512 meters for HF cetaceans (e.g., harbor porpoises).
        - The shutdown zone will always be a minimum of 25 meters (82 feet) to prevent injury from physical interaction of marine mammals with construction equipment.
        - To avoid Level A injury to larger marine mammals (i.e., humpback, gray, and killer whales) pile driving will cease if any of these species are detected approaching Level A isopleth distances associated with their respective marine mammal group; essentially enforcing shutdown zones equal to the Level A isopleth distances for these species.
        - Shutdown procedures would also commence if a harbor porpoise or harbor seal were detected within 50 meters during impact driving.
        - Should harbor porpoises or harbor seals be observed entering larger Level A zones of their respective marine mammal group during impact pile driving,

those individuals would be counted, but pile driving would not be required to cease unless animals were detected within the 50-meter shutdown zone, or if the project had already reached the maximum Level A Take authorized for each species in the final IHA.

- Vibratory Pile Driving:
  - During vibratory removal and driving of piles, the shutdown zone will always be a minimum of 25 meters (82 feet) to prevent injury from physical interaction of marine mammals with construction equipment.
  - The shutdown zone for harbor porpoises and low frequency cetaceans will be 50 meters during all vibratory driving.
- All Pile Driving:
  - Given potential difficulty detecting marine mammals throughout the entirety of Level A and Level B areas, observers will extrapolate counts of each marine mammal species from a monitoring zone established by the lead observer, largely based on site conditions on the day of observation.
  - This application for IHA requests Level A and Level B take up to the amounts specified in Table 13. Final limits on take would be specified in the final IHA from NOAA and would supersede any values specified in this application.

- Observers will be placed at the best vantage points practicable (from the construction barges or by boat) to monitor for marine mammals and implement shutdown/delay procedures when applicable by calling for the shutdown to the hammer operator.
- If waters exceed a sea-state which restricts the observers' ability to make boat-based observations for the full Level A shutdown zone (e.g., excessive wind, wave action, or fog), impact pile installation will cease until conditions allow monitoring to resume. Contractors should ensure compliance with NOAA advisories for safe boat operations based on the size of vessel to be used by the marine mammal observer.
- Prior to the start of pile driving, the shutdown zone will be monitored for 30 minutes to ensure that the shutdown zone is clear of marine mammals. Pile driving will only commence once observers have declared the shutdown zone clear of marine mammals.
- If a marine mammal is observed in the Level B 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 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.
- The observer will use a hand-held or boat-mounted GPS device or rangefinder to verify the required monitoring distance from the project site.

- The waters will be scanned using binoculars (10x42 or similar) or spotting scopes (20-60 zoom or equivalent), and by making visual observations.
- If any species for which take is not authorized, such as Southern Resident killer whales or other cetaceans, are observed within the area of potential sound effects during or 30 minutes before pile driving, the observer(s) will immediately notify the on-site supervisor or inspector, and require that pile driving either not initiate or temporarily cease until the animals have moved outside of the area of potential sound effects.
- If take limits established in the final IHA are reached, NOAA will be notified as soon as possible and will work with the Corps to adjust take limits or modify work, as necessary.
- Pile driving will be conducted only during daylight hours from sunrise to sunset when it is possible to visually monitor marine mammals.
- A marine mammal observation sheet will be used to record information about marine mammals observed (see NMFS minimum requirements below).
- If any dead or dying marine mammal species are observed in the action area, regardless of known cause, the following measures will be taken:
  - Record the species type (if known), date, time, and location of the observation
  - Take a photograph of the specimen
  - Immediately notify NOAA Fisheries.

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 SPLs.
- 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 Corps will note 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 the project and submitted to NMFS.

According to NMFS Requirements, the Corps will include the following minimum qualifications for marine mammal observers:

- Visual acuity in both eyes (correction is permissible) sufficient to discern moving targets at the water's surface with ability to estimate target size and distance. Use of binoculars or spotting scope 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).
- Experience and ability to conduct field observations and collect data according to assigned protocols (this may include academic experience).
- Experience or training in the field identification of marine mammals (cetaceans and pinnipeds).
- Sufficient training, orientation or experience with vessel operation and pile driving operations to provide for personal safety during observations.
- Writing skills sufficient to prepare a report of observations. Reports should include such information as number, type, and location of marine mammals observed; behavior of marine mammals in the area of potential sound effects during construction; dates and times when observations and in-water construction activities were conducted; dates and times when in-water construction activities were suspended because of marine mammals, etc.
- 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 needed.

The Corps will comply with any additional monitoring measures required by NMFS.

14.0 Suggested Means of Coordination

The Corps has met with staff from the West Coast Marine Mammal Stranding Network to discuss this project action. Based on their feedback, the Corps will continue to coordinate with the Marine Mammal Stranding Network and develop a stranding response plan prior to start of work. The Corps has also checked NMFS' interactive map and reviewed available information for other activities in the lower Columbia River.

The data recorded during marine mammal monitoring activities will be provided to NMFS in the monitoring reports. These reports will provide useful information regarding the presence of the marine mammals discussed in this document in the project area and their behavioral response to construction activities. The monitoring data collected will inform the Corps and NMFS staff and assist the evaluation of the potential effects of future projects of similar scope on the lower Columbia River. The Corps will also share the results of monitoring with ODFW and WDFW and upload the monitoring report into the Corps' public digital library.

The Corps will check NMFS' interactive IHA map prior to the start of work and reach out to any others performing similar activities in the lower Columbia River to exchange monitoring data in real time if practicable to inform both activities. The Corps will also reach out to NMFS Northwest Fisheries Science Center Marine Mammal Ecology Team prior to initiating pile driving to notify them of the activity and gather any new information available on the location of marine mammals in the project area.

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Appendix A: Noise Level Worksheets

Pile Driving Level B Disturbance Calculations

Practical Spreading Loss Model for sound attenuation:				
AIR	D1=D0 * 10^((initial SPL - disturbance threshold)/alpha) with alpha=20 for hard-site conditions			
WATER	D1=D0 * 10^((initial SPL - disturbance threshold)/alpha) with alpha=15 for water			
Calculations for attenuation to MARINE MAMMAL LEVEL B DISTURBANCE				
- should use Leq/RMS dB (unweighted) estimates for these calculations				
			estimated meters	
AIR - impact hammer - phocid			152.4	WSDOT 2014 110 Peak dB
AIR - impact hammer - otariid			48.1931115	
			meters	
AIR - vibratory hammer - phocid			32.209573	
AIR - vibratory hammer - otariid			10.1855613	
Calculations for MARINE MAMMAL LEVEL B DISTURBANCE in WATER				

			Meters	Miles
24-in steel pipe piles w/Impact Hammer*			1000	0.62
24-in steel pipe piles w/Vibratory Hammer			5412	3.36
Sheets install/removal w/Vibratory Hammer			4642	2.88

NOTE:	
D1 (in meters) = distance from the pile at which noise attenuates to the threshold value	
D0 (in meters) = dista since we are using Lmax at 50 feet, D0 should be ~15.24 meters	
*SPL from Caltrans 2015 Table 2-2 (for 30-inch, no estimate for 24-inch is listed)	

Impact Pile (steel pipe) Driving PTS Calculations

Impact Pile Driving

STEP 2: WEIGHTING FACTOR ADJUSTMENT

Weighting Factor Adjustment (kHz)[¥]	2	Default

E.1.2: ALTERNATIVE METHOD TO CALCULATE PK AND SEL_{cum} (SINGLE STRIKE EQUIVALENT)

Unweighted $SEL_{cum\ (at\ measured\ distance)}$ = SEL_{ss} + 10 Log (# strikes)	207.5

SEL_{cum}

Source Level (Single Strike SEL)	177
Number of strikes per pile	225
Number of piles per day	5
Propagation (xLogR)	15
Distance of single strike SEL measurement (meters)*	10

*Unless otherwise specified, source levels are referenced 1 m from the source.

PK

Source Level (PK SPL)	203
Distance of source level measurement (meters)*	10
Source level at 1 meter	218.0

*Unless otherwise specified, source levels are referenced 1 m from the source.

RESULTANT ISOPLETHS*

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

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS Isopleth to threshold (meters)	**430.0**	**15.3**	**512.2**	**230.1**	**16.8**
PK Threshold	219	230	202	218	232
PTS PK Isopleth to threshold (meters)	**NA**	**NA**	**11.7**	**NA**	**NA**

Vibratory Pile (steel pipe) Driving PTS Calculations

Vibratory Pile Driving

STEP 2: WEIGHTING FACTOR ADJUSTMENT

Weighting Factor Adjustment (kHz)¥	2.5	Default

STEP 3: SOURCE-SPECIFIC INFORMATION

Source Level (RMS SPL)	161
Number of piles within 24-h period	5
Duration to drive a single pile (minutes)	15
Duration of Sound Production within 24-h period (seconds)	4500
10 Log (duration of sound production)	36.53
Propagation (xLogR)	15
Distance from source level measurement (meters)*	10

*Unless otherwise specified, source levels are referenced 1 m from the source.

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	199	198	173	201	219
PTS Isopleth to threshold (meters)	**7.9**	**0.7**	**11.7**	**4.8**	**0.3**

Vibratory Pile (sheet pile) Installation/Removal PTS Calculations

Vibratory Sheet Installation/Removal

STEP 2: WEIGHTING FACTOR ADJUSTMENT

Weighting Factor Adjustment (kHz)¥	2.5	Default

STEP 3: SOURCE-SPECIFIC INFORMATION

Source Level (RMS SPL)	161
Number of piles within 24-h period	25
Duration to drive a single pile (minutes)	30
Duration of Sound Production within 24-h period (seconds)	45000
10 Log (duration of sound production)	46.53
Propagation (xLogR)	15
Distance from source level measurement (meters)*	10

*Unless otherwise specified, source levels are referenced 1 m from the source.

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	199	198	173	201	219
PTS Isopleth to threshold (meters)	**36.8**	**3.3**	**54.4**	**22.4**	**1.6**

Vibratory Pile Removal (steel pile) Driving PTS Calculations

Vibratory Steel Pile Removal

STEP 2: WEIGHTING FACTOR ADJUSTMENT

Weighting Factor Adjustment (kHz)¥	2.5	Default

STEP 3: SOURCE-SPECIFIC INFORMATION

Source Level (RMS SPL)	161
Number of piles within 24-h period	20
Duration to drive a single pile (minutes)	5
Duration of Sound Production within 24-h period (seconds)	6000
10 Log (duration of sound production)	37.78
Propagation (xLogR)	15
Distance from source level measurement (meters)*	10

*Unless otherwise specified, source levels are referenced 1 m from the source.

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	199	198	173	201	219
PTS Isopleth to threshold (meters)	**9.6**	**0.9**	**14.2**	**5.8**	**0.4**

Appendix B: Isopleth Figures