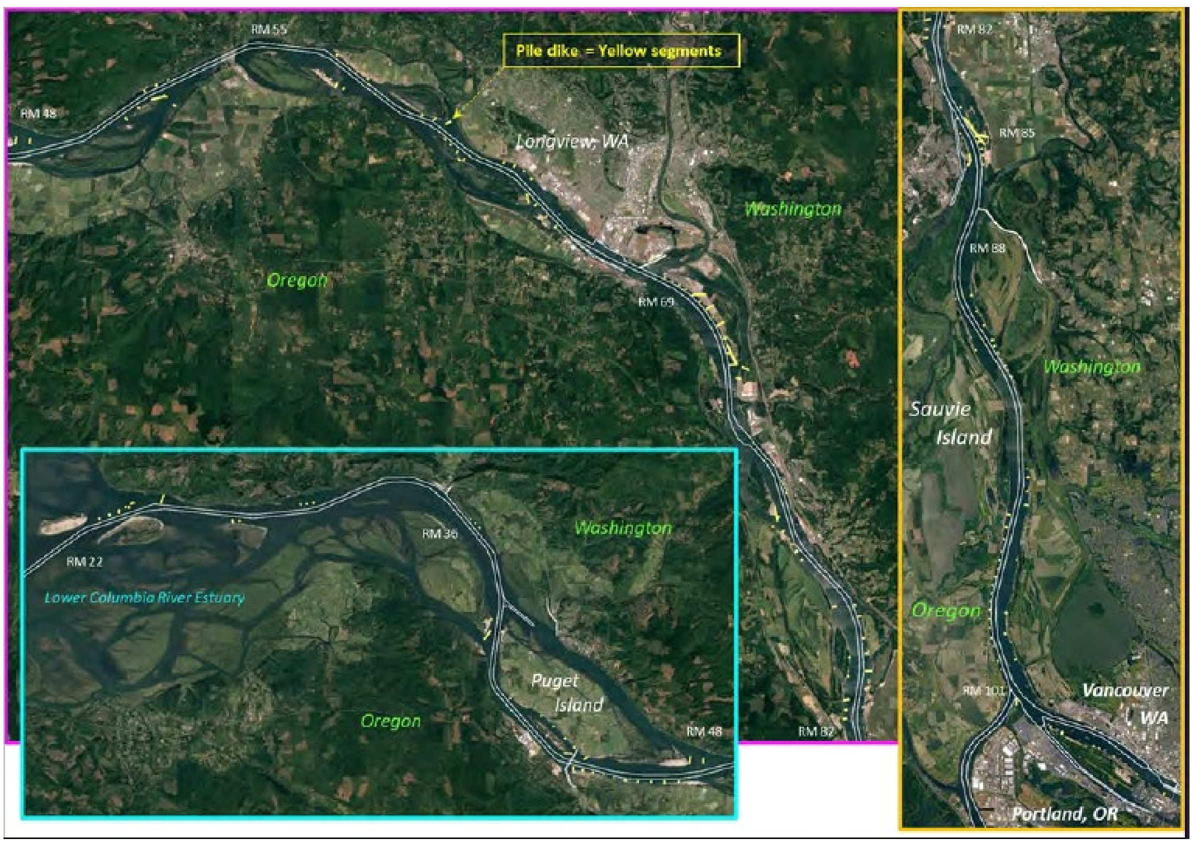
US Army Corps
of Engineers ®
Portland District

REQUEST FOR LETTER OF AUTHORIZATION UNDER THE MARINE MAMMAL PROTECTION ACT

LOWER COLUMBIA RIVER DREDGED MATERIAL MANAGEMENT PLAN (DMMP)
OREGON AND WASHINGTON



U.S. Army Corps of Engineers
Portland District, Portland, OR

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 DESCRIPTION OF THE ACTIVITY

1.1 Introduction

The U.S. Army Corps of Engineers – Portland District (Corps) has developed a draft Dredged Material Management Plan (DMMP) to support continued operation and maintenance of the Lower Columbia River Federal Navigation Channel (LCR FNC) for the next 20 years. All federally maintained navigation projects must demonstrate that there is sufficient dredged material placement site capacity for a minimum of 20 years.

The Corps is requesting a Letter of Authorization (LOA) for constructing new structures with pilings in the Lower Columbia River. The full DMMP includes proposed dredging and placement operations between river miles (RM) 3 and 105.5. However, the scope of this request for a LOA is limited to potential pile driving that would be associated with any new structures installed under the DMMP.

We are requesting Level A and B harassment take for harbor seals. In addition, we are requesting solely Level B harassment take for Steller and California sea lions.

1.2 Project Purpose and Need

The purpose of the LCR CMP DMMP is to define the dredged material management practices for the LCR FNC to maintain the authorized depth and width for a minimum of 20 years in the least cost, operationally feasible, and environmentally acceptable manner. Dredged material management practices include dredging material impinging on the authorized channel dimensions using a combination of dredge equipment. Material dredged from the LCR FNC is disposed of in dredged material placement sites with sufficient capacity (upland and in-water).

The need for the Federal action is to provide continued reliable, safe, and efficient transportation of waterborne commerce and uninterrupted transit for fully loaded vessels in the LCR FNC. Continued maintenance is warranted based on the significant economic benefits of the Columbia-Snake River Navigation System. Currently, sites that have real estate easements and rights of entry for existing upland placement sites, as well as in-water locations, are reaching placement capacity. Therefore, the need to update the LCR CMP DMMP is required, as established by the Corps of Engineers policy ER 1105-2-100 (April 22, 2000), which states that all federally maintained navigation projects must demonstrate that dredged material placement sites have the capacity to accommodate maintenance dredging for a minimum of 20 years.

The LCR deep draft FNC evaluated in this DMMP is divided into a series of nine reaches (Figure 1). A reach is defined with three to four Columbia River segments. Each reach varies in length between 10 and 15 miles. Segments are distinguished by names that are typically displayed on navigation charts that the Corps uses to communicate with Columbia River pilots and users of the system.

Reach #	Segment Name
1	Lower Desdemona
	Upper Desdemona
	Flavel Bar
	Upper Sands
2	Tongue Point Crossing
	Miller Sands
	Pillar Rock Ranges
3	Brookfield-Welch
	Skamokawa Bar
	Puget Island
4	Wauna Driscoll
	Westport Bar
	Eureka Bar
5	Gull Island Bar
	Stella-Fisher Bar
	Walker Island Bar
6	Slaughters Bar
	Lower Dobelbower Bar
	Upper Dobelbower Bar
7	Kalama Bar
	Lower Martin Island Bar
	Upper Martin Island Bar
8	St. Helens Bar
	Warrior Rock Bar
	Henrici Bar
9	Willow Bar
	Morgan Bar
	Lower Vancouver Bar**
	Vancouver Turning Basin***

Figure 1-1. Lower Columbia River Reaches included In the Dredged Material Management Plan (DMMP)

1.3 Background

The deep draft authorized LCR FNC is established in law from river mile (RM) 3 to RM 106.5. This DMMP is analyzing maintenance from RM 3 to RM 105.5 because the last river mile is not currently maintained to 43 feet. The authorized LCR deep draft FNC has the following authorized features:

- Main navigation channel, advance maintenance to 48 feet deep and generally 600 feet wide, from RM 3 to Vancouver, WA, RM 105.5
- Turning basin 43 feet deep at Astoria, OR, RM 13
- Turning basin 40 feet deep at Longview, WA, RM 66.5
- Turning basin 43 feet deep at Kalama, WA, RM 73.5
- Lower Turning basin 43 feet deep at Vancouver, WA, RM 105.5
- Navigation channel 43 feet deep and 400 feet wide from the Columbia River RM 102 extending 1.5 miles into lower Oregon Slough

1.4 Overview of Channel Maintenance Practices

1.4.1 River Control Structures

The meandering geometry of the LCR is composed of gradual bends with flows splitting around in-river islands. Several of these in-river islands were expanded or created entirely from dredged material that was placed to help maintain the dimensions of the FNC. For example, placing dredged material along the shallow water banks of an existing island serves to redirect flow back into the main navigation channel and narrow the width of the river, which mimics a natural scouring process of the riverbed. This type of channel-maintaining island is referred to in this report as a morphological feature.

Dredged material has been used to build or expand channel training landforms such as in-river islands that reduce the river's cross-section and control channel alignment to aid in maintaining the navigation channel's dimensions. The purpose of reducing the river's cross-section is to increase and redirect flow velocities in localized areas back into the navigation channel to create natural scouring action. Piles are the most common channel training structure in the LCR and may or may not be associated with in-river islands.

1.4.1.1 Channel Control Structures with Pilings

Whether associated with an island or shoreline, channel control structures are most often installed perpendicular to the direction of river flow. The pile dike serves to slow the velocity of the river along the shoreline. This in turn reduces erosion of the island or shoreline and redirects the flow such that the velocity of the river accelerates towards the navigation channel, allowing the river to naturally scour the bed and provide stable areas for placement of dredged material. Existing pile dikes are semi-permeable groins consisting of two rows (riverine) or three rows (estuary) of untreated timber pilings driven on 2 ½ foot centers. These timber piles are alternately placed on each side of horizontal spreader piles, which are bolted in place. Stone is placed along the pile dike and around the outer end for protection from scour. Pile dikes in the FNC average about 400 feet with hundreds of pilings. Pile dike systems consist of a series of timber pile dikes, spaced about 1,200 to 1,500 feet apart for optimum functional efficiency The outer dolphin (king pile) is a taller bundle of piles marking the end of the pile dike for better visibility for users of the channel. Figure 2-5 shows a riverine pile dike. Historic pile dike structures were commonly authorized as part of the navigation project to help maintain navigation by directing flow towards the main channel to reduce dredging requirements, increase channel stabilization, increase bank protection, and protect dredged material placement sites.

From 1885 to 1969, the Corps installed pile dikes between the mouth of the Columbia River and Bonneville Dam at RM 145. The bulk of the present-day pilings system was built in the periods from 1922 to 1929 and 1931 to 1940 (AECOM 2011). Many of the dikes on the lower 110 miles of river were installed between 1915 and 1929. At the end of calendar year 1957, the pile dike system consisted of 221 pile dikes, totaling 219,278 linear feet. During the period from 1957 to 1967, 35 new dikes, totaling 17,365 linear feet, and 13 pile dike extensions, totaling 3,380 linear feet, were built to further reduce the cost of maintenance dredging (Corps 1988). Additional pilings were installed in the late 1960s in support of the 40-foot channel project and to address a number of structural needs throughout the LCR. The Corps has constructed no new pile dikes since the construction of the 40-foot channel (approximately 1969), though some existing dikes have been repaired or rebuilt.

Congressionally authorized pile dikes are presently in varying degrees of deterioration. A 2011 analysis of the pile dikes identified signs of functional failure including increased bank erosion and even shifting channel alignment at some locations. As these structures continue to lose functionality, the dredging need is expected to increase. The 2011 analysis of the existing authorized pile structures also identified potential opportunities for habitat improvement such as placing dredged material around existing piles to improve habitat diversity. The Corps has additional aquatic habitat and ecosystem restoration authorities that could be implemented with cost sharing partners for these types of projects.

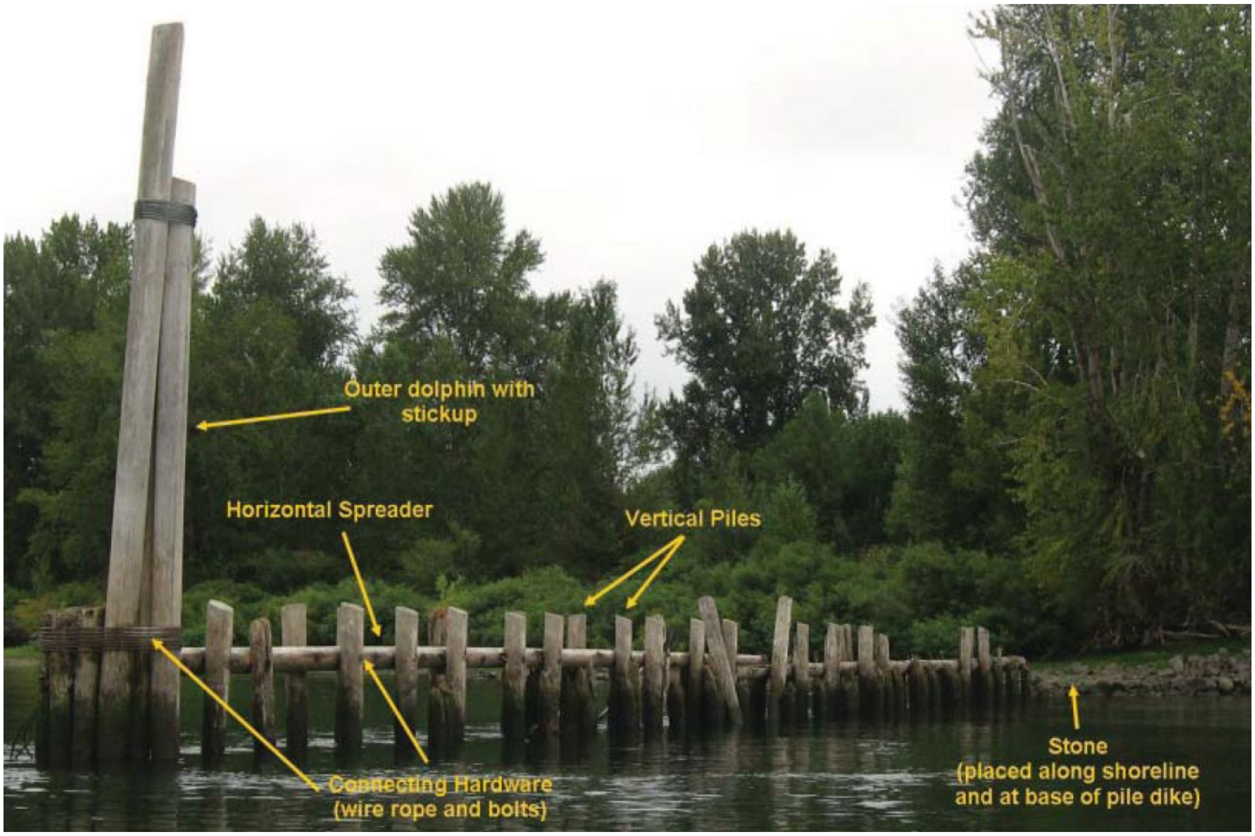

Figure 1-2. Typical pile dike structure in the Lower Columbia River.

1.4.1.2 Channel Training Landforms

Dredged material has also been used intentionally to maintain the navigation channel by reducing the river cross-section (placing fill in shallow water near the banks, which increases velocities in the navigation channel to create natural scouring action) and to control channel alignment (by redirecting flow). In many cases, these river training fill sites were constructed along with pile structures to protect the dredged material from erosion. Examples of islands built or expanded to improve channel maintenance include Rice, Miller Sands Spit, Pillar Rock, Tenasillahe, Coffeepot, Brown, Crims, Hump, Lord, Howard, Sandy, Goat, and Sand Island near St. Helens. Henrici Bar is a good example of the successful use of river training structures where FNC depths increased by up to 20 feet (combination of pilings and dredged material fill). Before (1909) and after (1959) results of training structures at Henrici Bar are shown in Figure 2-6.

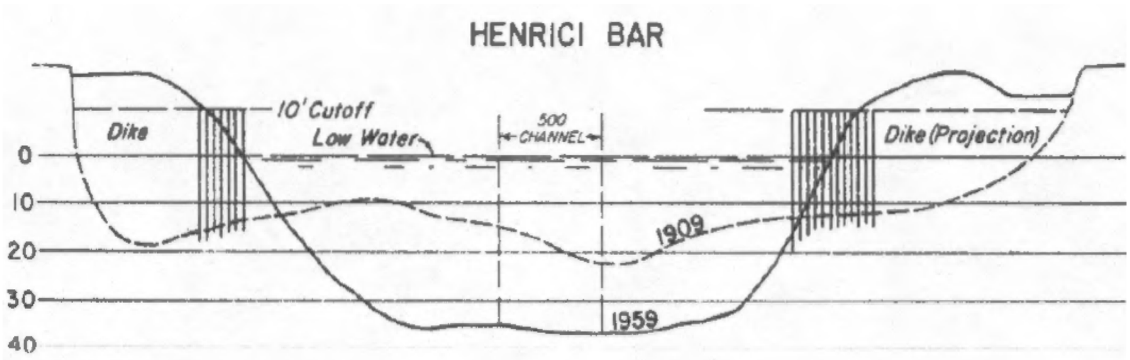

Figure 1-3. Cross section of Henrici Bar before and after pile dike construction.

1.4.2 Dredging

In addition to the major phases of channel deepening and widening listed above, the LCR is subject to regular maintenance dredging. Maintenance dredging is required to remove shoals that form in the navigation channel. Maintenance dredging varies, with 6.7 to 11.8 million cubic yards of material dredged each year. The standard of maintenance dredging has been to dredge material from areas in which navigation is affected, and to dispose of the dredged material in upland or shoreline placement sites or areas of the navigation channel where the channel is deeper, referred to as “flow lane placement.” Dredged materials have historically been placed between or adjacent to pile dike structures to supplement natural accretion of sediment. Advanced maintenance dredging (AMD) is allowed up to 5 feet below authorized depth (-48 feet) and up to 100 feet outside the authorized channel width. AMD is performed to provide a reliable channel for deep draft navigation year-round.

The channel is maintained annually by three hopper dredges and one pipeline dredge. Two of the hopper dredges are owned by the U.S. Government: the ESSAYONS, which is considered a medium-sized dredge, and the YAQUINA, which is a smaller dredge. One additional medium hopper dredge is used through contract by the Corps. The Port of Portland furnishes the pipeline dredge OREGON, as authorized by Congress, to assist in the maintenance of the LCR on a cost-reimbursable basis.

Clamshell dredges, which remove shoals mechanically using buckets operated by floating cranes on barges, are best suited for material that cannot be removed by hydraulic dredging or work near structures like docks. Clamshell dredges are only used occasionally in the FNC for maintenance. During the 2005 to 2010 construction of the -43-foot channel, another contract hopper (with upland placement) and clamshell dredges (for rock material) were used.

1.4.2.1 Hopper Dredging

Hopper dredges are mobile vessels (ships) that can quickly move between shoals and are designed to operate in unprotected sea conditions. Hopper dredges are most efficient for removal of small volume sand wave shoals in the river and larger cutline shoals in the estuary. The drag head moves along the channel bottom and material is pumped into a temporary storage (hopper) within the dredge as displayed in Figure 2-7. Once the hopper is full, dredging stops and the hopper transits to the placement location and places the material in-water by opening the bottom of the vessel to release the material by gravity. The in-river placement location must be deep enough for the dredge to safely access based on the vessel's draft below the water surface.

The ESSAYONS and YAQUINA are based on the West Coast in the Portland District. The ESSAYONS requires depths greater than 35 feet and the YAQUINA requires depths greater than 20 feet. When possible, dredges are assigned to shoals that are located closest to in-river placement locations that are best suited to their limiting draft, to maximize production.

Some contract hoppers are equipped to hook up to a pipeline and pump dredged material back out of the hopper to placement sites on shore, but the ESSAYONS and YAQUINA do not have that capability. It takes approximately twice as long to clear a shoal when material is pumped back out of a hopper dredge (compared with in-water placement), at a significantly higher cost; as a result, this method has not been used since the 43-foot deepening. Hopper dredges are self-propelled and are not physically limited to placement sites near a dredging area; however, increased haul distance translates to increased time and cost required to remove a shoal.

The Corps' Portland District leads a regional dredging program on the West Coast with other Corps' Districts, and dredging equipment is shared between the Corps' Districts through this program. This regional collaboration is necessary to create an effective and feasible dredging plan that optimizes project funding and resources available from the national hopper dredging fleet of Government and contract hopper dredges. However, the work available for contract hopper dredges is located on the East and Gulf coasts of the United States, with the exception of the annual West Coast contract. Because of this, each year one contract hopper dredge must transit through the Panama Canal to and from the West Coast (at an increasing cost) in order to meet the regional dredging program needs.

The schedule for this regional dredging is established through annual regional planning meetings and is meant to meet the needs of all the Corps' Districts involved. However, there could be times that dredging is needed in the LCR FNC, but equipment is not readily available because it is being used to meet the needs of another Corps' District. This DMMP will consider equipment availability to inform the planning process based on lessons learned from prior years of regional dredge planning.

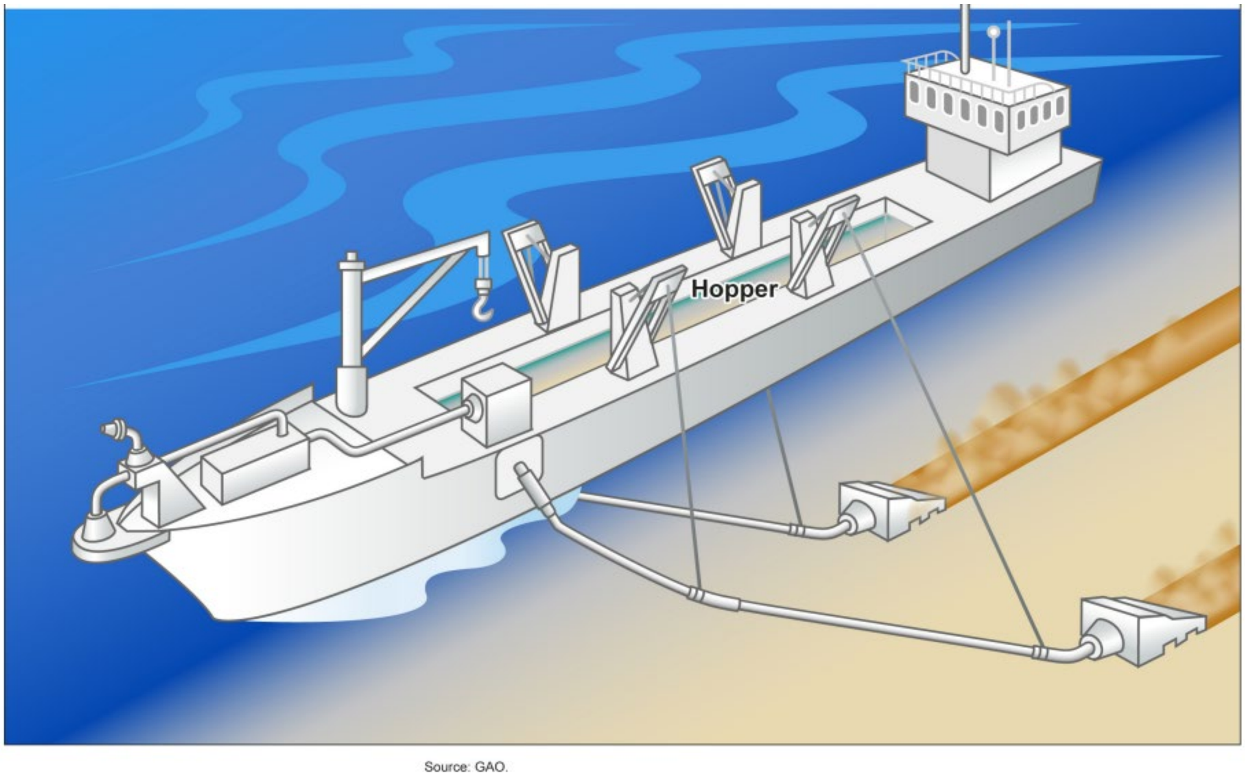

Figure 1-4. Diagram of typical hopper dredge using during dredging operations in the Lower Columbia River.

1.4.2.2 Pipeline Dredging

As required by the authorized project, the Port of Portland is to furnish a dredge on a cost reimbursable basis for assisting in maintaining the FNC. The pipeline dredge OREGON is most efficient for removing larger cutline shoals where a large quantity of material is concentrated within a small area. The dredge is typically attached to 1 to 2 miles of pipeline (floating or submerged) during operation, so a significant effort is involved to move the dredge between shoals. Material is pumped from the shoal to the placement site through the pipeline in one continuous action, so the distance between the shoal and the placement location is limited by the physical length of pipeline available, up to 2 miles. This pipeline dredge should be used in more protected reaches of the river because the pipeline is not designed to withstand large waves or high-flow velocities in the lower estuary. The pipeline dredge is equipped to place material in-water or at upland and shoreline sites at the same production rate. For this reason, the dredge OREGON is more efficient than hopper dredges for upland and shoreline placement of dredged material in the LCR. Figure 2-8 is a photograph of the dredge OREGON and a contract hopper dredge working in the same area of the river. The floating line from the dredge OREGON can be seen extending to the shore.

Figure 1-5. Photograph of actual pipeline (center) and hopper (bottom) dredges.

Table 1-1 displays typical dredge equipment used for maintenance in the LCR. Each type of equipment lists the daily production rate in cubic yards (cy) per day, the type of shoal the equipment is used for and the efficiency of use, the placement method by dredge and limitations, the estimated cost, and the time of year the equipment is used.

Table 1-1. Lower Columbia River channel maintenance summary with typical dredge assumptions.

Typical Dredge Equipment	Estimated Production (cy/day)	Typical Shoaling	Placement Range, Method	Estimated Costs ($/cy)	Seasonal Availability (flexibility to add days end of season)
Pipeline dredge OREGON	22,000	Heavy, continuous cut Efficient dredging	2-mile maximum Mostly upland/shore, minimum in-river >20 feet	8.10	1 Jun to Dec (AMD)
Hopper dredge ESSAYONS	32,000	Light sand waves Less efficient dredging	Target under 6 miles, rarely more than 10 In-river only >35 feet	6.00	7 days Mar/Apr 30 days Jul/Aug 30 days Oct/Nov (AMD)
Hopper dredge YAQUINA	14,500	Isolated high spots Inefficient dredging	Target under 3 miles, rarely more than 5 In-river only >20 feet	6.00	7 days Mar/Apr 25 days Jul/Aug 25 days Oct/Nov (AMD)
Hopper dredge “Contractor varies annually”	30,000	Heavy sand waves More efficient dredging	Target under 6 miles, rarely more than 10 In-river now >30 feet	4.10	30 days Jul/Jul 30 days Oct (AMD)

			Upland capable, cost more, production less		

1.4.3 Upland, Shoreline, In-Water, and Ocean Placement

There may be more than one placement option for a given dredging event. Placement site selection considerations include dredge equipment capabilities and availability, distance from the dredging location, remaining site capacities, competing placement needs of other dredging events that are ongoing or planned, and how it will contribute to overall project strategies.

1.4.3.1 Upland Placement

Upland placement is conducted within the confines of a containment dike. Containment dikes are initially constructed by using shore equipment to establish a containment area, after which material placement can be used to further raise the containment dikes. Upland placement can be done directly by pipeline dredges, by pumping ashore from hopper dredges, or by mechanically unloading barges from a clamshell dredging operation. However, for this DMMP, only pipeline dredging was considered for upland placement. This practice is a cost-effective means of removing large shoals from the navigation channel. The cost effectiveness depends on the availability of placement sites close to the dredging locations, within about 2 miles.

Staging of all construction vehicles and placement equipment occurs within the boundary of the placement site. When equipment is barged in from the river, the barge is maneuvered to the shoreline and usually anchored for the duration of the operation. A landing ramp is constructed from existing shore material for earth-moving equipment to gain access. Containment berms are created around the perimeter of the placement area by pushing existing material from the center of the placement area out to the perimeter (Figure 1-6). The purpose of containment berms is to retain the slurry of material and water pumped into the site during future placement operations.

Figure 1-6. Outer berm construction at an upland placement site.

Generally, the dredged material discharge pipe is positioned to fill material at the farthest landward area first. The pipe is moved periodically over the duration of placement operations to achieve a relatively uniform layer of dredged material over the full area enclosed by the containment berm. As the slurry discharges from the pipe, the dredged material quickly settles out, and bulldozers work throughout the placement process to move both the pipe and dredged material at regular intervals. This minimizes unintentional mounding on the site and ensures that the excess water drains toward a weir system. Excess water flows across the site before reaching a settling pond and then eventually passes through the weir system and back into the river. Larger upland sites provide more distance, area, and time for material to settle before the discharge water enters the river. Interior berms or secondary settling ponds may be constructed within the containment area to increase retention of fine sediments. Weirs are used strategically to control discharge water into the river. The weirs skim water from the settling pond using gravity (low velocity). Additionally, the outfall pipes are submerged in the river to depth of at least 20 feet, as a measure to minimize turbidity. As the level of fill approaches the top of the containment berm, bulldozers push some of the material to the edges of the site. This raises the height of containment berm to provide additional storage capacity. Figure 1-7 provides an overview of a typical upland placement site.

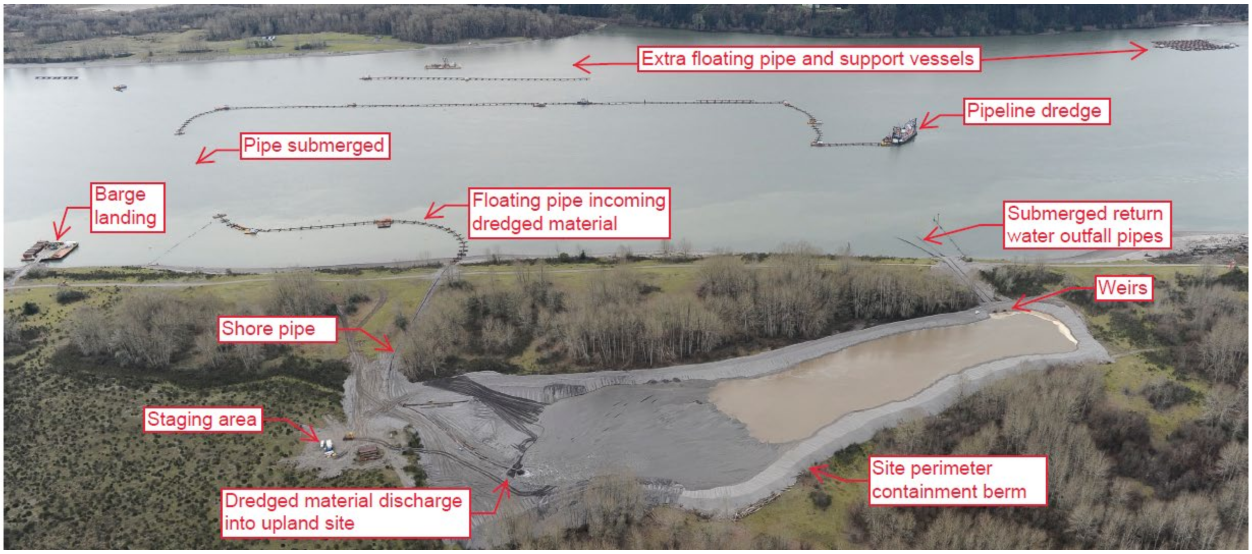

Figure 1-7. Upland placement site layout and operations.

1.4.3.2 Shoreline Placement

Shoreline placement (also called beach nourishment, BN) is used to create land in areas that start out completely or periodically inundated in water. All placement at these sites occurs in water less than 20 feet deep. The combination of river flows, waves, and tidal effects naturally erodes material from riverbanks. Shoreline placement replenishes material that has eroded and may be used to restore upland placement sites to their original footprint to reach intended upland placement capacity.

Figure 1-8. Aerial view of shoreline placement operations progressing left to right.

Initially, shallow water placement is used to establish a landing above water so that bulldozers can start moving material around to begin shoreline placement. The enclosed floating pipe transitions to an enclosed shore pipe, which discharges a slurry of material and water at low pressure at the shore river interface (Figure 1-6). The source is often a pipeline dredge (pumping continuously) but could be a hopper dredge instead (pumping intermittently). Using existing or newly dredged material, bulldozers construct a temporary material berm along the outer edge of the fill area. The purpose of the temporary berm is to retain dredged material during placement until the area is filled in and becomes new land (Figure 1-7). As dredged material settles out of the slurry, it builds up above the river water level, and the excess slurry water flows across the new material and back into the river. After sufficient material has settled out and begins to build in height, bulldozers grade it to the desired elevation at or above "high water." If the site is adding to existing land, the new dredged material is typically graded to match the elevation of the existing shoreline and the process continues incrementally.

Figure 1-9. Overview of typical shoreline placement with interim berm created from dredged material.

Shoreline placement can be either permanent or temporary fills. Permanent fill results from placing dredged material in areas protected from erosion by natural channel features or river control structures. Temporary fills can result in refreshed capacity and can provide beneficial reuse. Like upland placement, shoreline placement can use pipeline, hopper, or clamshell/barge dredging, but pipeline dredges are most efficient. Shoreline placement is less expensive to implement in the short term, but material can erode from the sites and return to the channel to increase future operations and maintenance (O&M) dredging.

1.4.3.3 Shallow-Water Placement

Shallow-water sites are defined as sites that initially contain areas that are shallower than -20 feet Columbia River Datum (CRD) and will remain at elevations below ordinary high water (OHW) during and after dredged material placement. Portions of shallow-water sites may be submerged or tidally or seasonally inundated. Shallow-water placement sites are often adjacent to or abut shoreline placement sites in the LCR.

Placing dredged material into shallow water uses an enclosed floating pipe to discharge a slurry of material and water at low pressure at the water surface (Figure 1-6). The floating pipe is held in place by anchors, which are periodically moved using support vessels, as the material falls through the water and builds up on the river bottom. The floating pipe is most likely connected to a pipeline dredge (pumping continuously) but could be connected to a hopper dredge instead (pumping intermittently). This method may be used to create features in water shallower than 20 feet or to initiate shoreline placement. A diffuser plate may be attached to the open end of the discharge pipe to increase material dispersal. This placement method is not precise but may be used to create more complex, uneven river bottom features. Sites accommodating smaller volumes of material may be filled in a single event. Larger volume sites would be filled incrementally over multiple, similar placement events, with each event raising a portion of the site to its estimated design fill elevation. Events may occur within the same dredge season or years apart.

Figure 1-10. Shallow water placement operations.

Three shallow water sites (O-25.4-IW-S, O-27.4-IW-S, and O-55.8-IW-S) work together with shoreline sites, such that the shoreline site forms a berm along the upstream edge of the shallow water site, creating a protected lagoon. Several sites are protected from erosion by existing pile dike structures.

1.4.3.4 Deep-Water (Flow Lane) Placement

In-water, flow-lane placement typically occurs along the riverbed adjacent to the FNC at depths between 35 and 65 feet, with occasional exceptions where geologic features situated throughout the Columbia River constrain the channel. This type of placement does not occur at depths shallower than 20 feet or deeper than 65 feet (USACE 2014). The areas used for placement change from year to year, depending on the dredging location and river depths. In-water placement can be used by hopper, pipeline, and clamshell dredges.

Hopper dredges and mechanical dredged material transport barges (scows) place dredged material in water deeper than 20 feet by releasing stored material from the bottom of the hull as shown below in Figure 1-11. The placement location must be deep enough for the vessel to safely access (greater than 30 or 35 feet for medium hopper dredges and greater than 20 feet for the small hopper dredge and scows). For each load, the dredge or scow may be either stationary or moving, and the material may be discharged at varying rates, depending on how many hull doors sequentially open or how far the hull opens.

There are two different placement methods that are used, depending on site conditions. In the “thin layer” placement, the dredge or scow is moving, and material is released slowly so that it distributes gently over a long distance in a layer of a few inches thick. In the “point placement” method, the vessel is stationary, and material is released quickly over a short distance, forcibly impacting the river bottom at the point of release and consolidating into a mound of a few feet thick. Dredges and scows are capable of both of these methods, plus the range of options in between. The thin layer method is typically used where river bottom depths are shallow, where mounding would make a site inaccessible. The point placement method is typically used where water velocity and river bottom depths are greater to maximize material retention within the site.

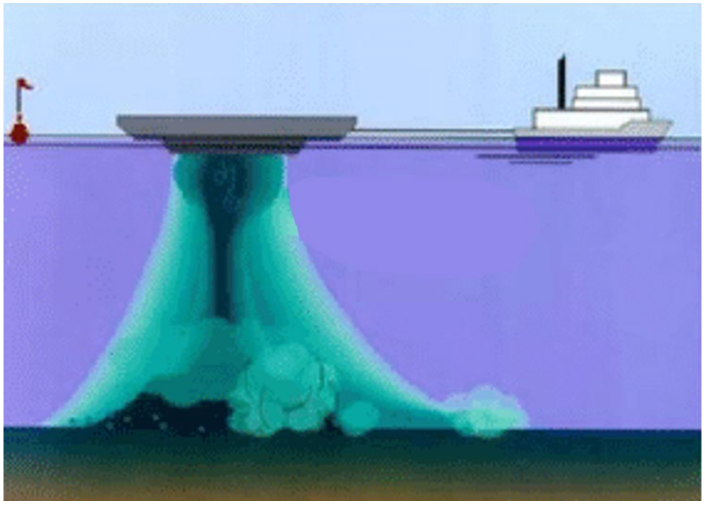

Figure 1-11. Placement of material in deep water from a hopper dredge or scow.

The pipeline dredge OREGON places material in water where the existing river depth is greater than 30 or 35 feet. OREGON uses an enclosed pipe with a diffuser at the end, placed 20 feet below the river water surface (Figure 1-12). The diffuser further reduces the velocity of the slurry as it exits the discharge pipe and angles it away from the river bottom to reduce scour. This section of pipe is attached to a small barge, which is held in place by anchors on each side. As material exits the diffuser and builds up on the river bottom, the barge is pulled back and forth between the anchors. Support vessels periodically reposition the barge to distribute the dredged material throughout the site.

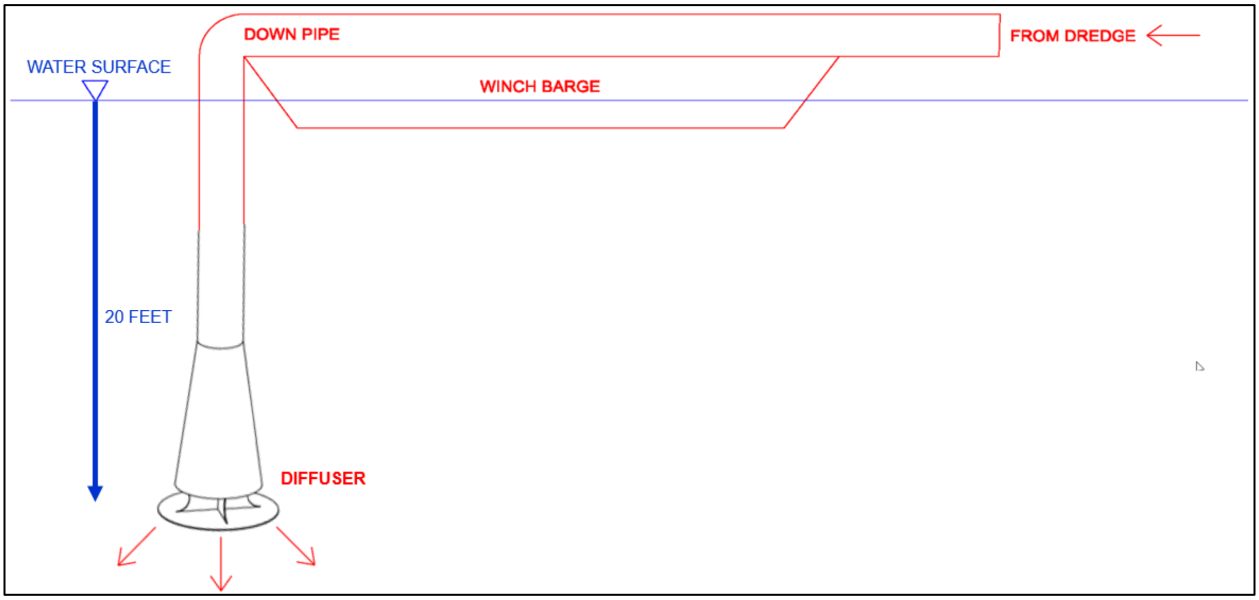

Figure 1-12. Deep water placement diagram for a pipeline dredge.

1.4.3.5 Ocean Placement

The Deep-Water Site (DWS) is an ocean dredged material disposal site (ODMDS) designated by EPA in 2005 to support the Mouth of the Columbia River (MCR) project, RM -3 to 3, and the FNC for material dredged from RM 3 to 30. The DWS ODMDS, located 6 miles offshore of the MCR, is used annually to maintain the MCR channel but is also available for up to 14 million cubic yards (mcy) of capacity remaining for material dredged from the LCR FNC (1999 CRCIP Feasibility/EIS and interim O&M Plan). Currently, no dredged material from the LCR FNC is placed in the ocean site because it is not an efficient way to maintain the FNC. The haul distance from the dredging location to the ocean disposal site is over 20 miles round trip, taking the dredge out of production while transporting material to the placement site. When the other placement options become unavailable under the Base Condition, dredged material will be hauled to the DWS ODMDS, which will reduce dredging production and increase dredging costs.

Ocean placement can be accomplished by hopper dredges or by clamshell and barge operations. Pipeline dredges cannot operate in the ocean environment. Currently, there are four EPA-designated ocean placement sites at the MCR. Three of the sites are used for the MCR project. DWS is an EPA-designated, Section 102 site that was sized for both the MCR and LCR FNCs.

1.5 Confined Aquatic Placement with Supporting Piles

1.5.1 Description of Pile Structures

Each pile structure will be composed of one or more piles. Proposed structures are slightly different from those typically found throughout the LCR. One main difference is that pile spacing within structures at confined aquatic placement sites needs to be smaller to slow river currents and prevent newly placed material from washing away. Because any pile structures would be buried to some degree by placed material, they include only one row of piles that are not connected by a horizontal spreader.

The design of each pile structure is tailored to the site conditions. For current planning purposes, the pile spacing is assumed to increase as you move from the shore toward the FNC over four segments (Figure 1-12):

- Shore to 1/3 point of structure
- 1/3 point to 1/2 point of structure
- 1/2 point to 3/4 point of structure
- 3/4 point to end of structure (enrockment only, no piles)
- Steel marker pile at riverward end of structure

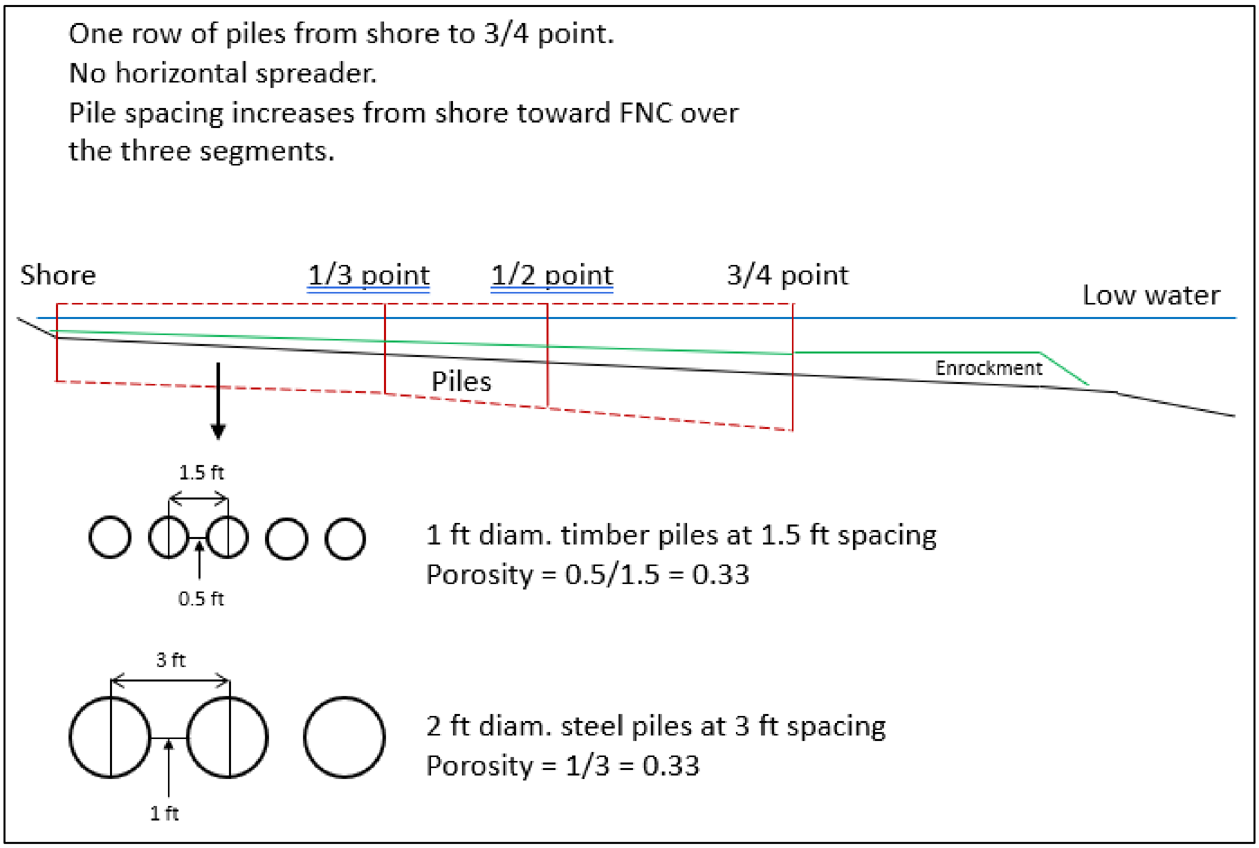

Figure 1-13. Profile and diagram of timber and steel pile structures.

The pile spacing within the first three segments depends on whether piles are timber or steel. For planning purposes (subject to change during the design phase), all timber piles are assumed to be 12 inches in diameter and all steel piles are assumed to be 24 inches in diameter. These assumptions would represent maximum pile widths, though smaller piles could ultimately be selected should more in-depth site assessments deem smaller pile widths acceptable. The permissible spacing for steel piles is twice the spacing of timber piles because the diameter of the steel piles is twice that of the timber piles. Both configurations would result in the same porosity (Figure 1-12).

The decision to use timber or steel piles will be made on a site-by-site basis depending on the site conditions (e.g., water depth, currents, wave conditions, foundation conditions, etc.) along with the availability and cost of materials at the time of design and construction. Timber piles will most likely be installed in areas of shallow water with loose/soft to medium dense foundation. Steel piles will most likely be installed in deep water or in dense/hard foundations. **For planning purposes and the calculations included in this LOA, it is assumed that one-third of the piles will be timber and two-thirds will be steel**. This is a conservative assumption to ensure sufficient numbers of steel piles and associated effects are accounted for should hard foundations be more prevalent. Prior contractors have also expressed difficulties securing timber piles over the last 3-5 years. Thus, this assumption also accounts for potential supply chain issues affecting the availability of timber pilings.

Table 1-3 summarizes the spacing assumptions for potential pile structures used at confined aquatic placement sites. For the first 3/4 of each structure (from the shore), the bottom width of the enrockment is assumed to be 50 feet (based on a water depth of 30 ft). For the outer (riverward) 1/4 of each structure, the bottom width of the enrockment increases to about 100 feet. The average width is about 65 feet. Note that for site W-35.6-IW-D, the two structures will be primarily rock with steel marker piles; the average bottom width is assumed to be 100 ft.

Table 1-2. Pile spacing assumptions for timber and steel pipe piles.

Pile Dike Segment	Pile Spacing for 12-in Timber	Pile Spacing for 24-in Steel Pipe
Shore to 1/3 point of structure	1.5 feet	3 feet
1/3 point to 1/2 point of structure	2.5 feet	5 feet
1/2 point to 3/4 point of structure	4 feet	8 feet

For a structure with a total length of L, the formulas for computing the number of piles are:

(Equation 1)

Timber piles number of piles = 0.351 x L
Steel piles number of piles = 0.176 x L

The total length of proposed structures is approximately 13,050 feet. However, excluding W-35.6-IW-D (only marker piles) and the two sites beyond the scope of this LOA, the total length for estimating the number of piles is 8,796 feet (Table 1-3). The assumed length of timber pile structures to be installed under this LOA is 2,932 ft (one-third of the total length) and the assumed length of steel pile structures is 5,864 ft (two-thirds of the total length). Using Equation 1, the anticipated total number of timber piles will be 1,029 and the total number of steel piles will be 1,032 + 6 marker piles for site W-35.6-IW-D. These total numbers of piles are for the five confined aquatic placement sites that will require pile driving under this LOA (Table 1-3). It is unknown at this time which sites will use timber vs. steel piles.

Table 1-3. Location and properties of proposed pile structures at confined aquatic placement sites.

System Name	Structures in System	Length of Structures (ft)	Width of Structures (ft)	Enrockment Footprint (ac)	Material	Anticipated Construction Year(s)#
O-23.5-BN-ADD1	5	2119	50 – 100	3.16	Piles and enrockment	Year 6
O-23.5-BN-ADD2	4	1544	50 – 100	2.30	Piles and enrockment	Year 4
W-24.9-IW-S*	2	1846	50 – 100	2.75	Piles and enrockment	Year 9
O-26.7-IW-S*	1	853	50 – 100	1.27	Piles and enrockment	Year 10
O-27.3-BN	3	1906	50 – 100	2.84	Piles and enrockment	Year 7
O-31.4-BN	3	3227	50 – 100	4.82	Piles and enrockment	Year 8
W-35.6-IW-D	2	1555	100	3.57	Enrockment and 6 marker piles	Year 5

*Shaded rows indicate sites where pile installation will likely commence after the five-year duration of the current LOA. Thus, new marine mammal compliance (i.e., LOA or IHA) will be sought to cover pile driving at those placement sites.
#The anticipated construction year reflects the year within the 20-year plan. If the DMMP is finalized in 2023, Year 1 (YR1) would be in 2024 and the earliest pile driving at new confined aquatic placement sites would start in Year 4 (YR4) or 2027.

1.5.2 Pile Installation

Piles in each system will be installed using a combination of vibratory and impact hammers. Vibratory hammers operate on electric or hydraulic power by quickly rotating eccentric weights to create strong vibrations that drive piles. The vibratory unit consists of rotating eccentric weights, a suspension system that isolates the vibratory forces from the lifting device, and a clamping system that connects the vibratory driver to the pile. These hammers have short strokes and very high impulse rates, up to 2,000 pulses per minute.

Three types of impact hammers may be used for pile driving: drop, pneumatic, and diesel hammers. A drop hammer consists of a metal block that is raised by the drive unit and then allowed to drop, striking the pile cap. Compared to other hammers, drop hammers are cumbersome and have slower driving actions. Impact velocities are high and can damage the top of the pile. This type of hammer is most suited for driving piles where the soil above the bearing stratum can be penetrated rapidly under easy driving conditions.

A pneumatic hammer consists of stationary cylinders and moving rams that include a piston and a striking head. Simple acting pneumatic hammers work by using compressed air to lift the piston and then allowing gravity to let it strike the pile. In double-acting hammers, the compressed air works on the upstroke and downstroke, thereby providing a higher blow rate. This process keeps the pile moving and prevents the buildup of friction, thus enabling faster driving. This type of hammer is preferred when piles must be driven to considerable depth in areas where penetration per blow is small.

Diesel hammers ignite diesel fuel in a cylinder atop the pile. This ignition both provides pile driving force and cycles the hammer. The cycle begins when a piston in the cylinder is raised, usually by a cable, to the top of the cylinder. When the piston is released, diesel fuel is injected into the cylinder, and the falling piston compresses the air-fuel mix in the cylinder to the point of combustion. Fuel ignition exerts downward force on the pile, while at the same time, forcing the piston back to the top of the cylinder to begin the cycle again. Diesel hammers are considerably more powerful than other hammers. They are compact and lightweight, making them easy to transport to project sites. Unlike other hammers, diesel hammers do not require a specialist to carry out repairs. Repairs can often be done by crew on site, reducing downtime and ensuring maximum production. While the means and methods have not been finalized, impact pile driving under the DMMP will most likely use a diesel hammer.

1.5.3 Enrockment Installation

The lower parts of the piles will be surrounded by enrockment (aka stone or riprap). The thickness of the enrockment will be about one-third of the water depth in terms of low water (elevation zero CRD). The top width of the enrockment will range from about 10 to 15 ft. The side slopes will be 1.5H:1V. The volume of enrockment will depend on the elevation profile of the riverbed along the structure alignment. A volume of 10 cubic yards per linear foot of structure is assumed for planning purposes. The bottom width of the enrockment (the part in contact with the riverbed) will vary. A bottom width of 45 ft is assumed for evaluating environmental and biological effects. For the enhanced-enrockment-only segment from the ¾ point to the end of the structures, the thickness of the enrockment will be greater than the thickness in the structure’s segments closer to shore. The bottom width is assumed to be about 90 ft.

Enrockment will be composed of quarried stone with size ranging from 50 to 1,500 lbs. Rock placement would occur using land-based or barge-based excavators and cranes, or specialized placement barges. In-water rock placement would occur by means of barge-mounted cranes or long reach excavators. The equipment barge would typically be moored adjacent to a stone barge so that stone could be lifted via crane or using a long arm excavator equipped with an appropriately sized rock bucket, then placed at the designated in-water site. Contractors may also use controlled dumping as another means of placing smaller stones.

During rock placement, the Corps would work closely with the contractor to regularly assess subsurface conditions and grades via conditional surveys, taking corrective actions as necessary. Contractors are required to perform hydrographic and topographic surveys during construction to ensure proper rock placement. At some structures, enrockment may be placed on top of a new bedding layer. The bedding layer will be 18 inches thick and comprised of Oregon Department of Transportation (ODOT) Class 50 riprap. The enrockment layer will vary in thickness from about 2 to 25 feet and consist of ODOT Class 1500 riprap with a density of about 165 pounds per cubic foot.

1.6 Access and Staging

Barges will be used to transport all equipment and materials to confined aquatic placement sites. They will also serve as staging platforms to facilitate pile installation. Barges could be spudded into the river bottom with vertical piles or anchored into position. Barge-mounted cranes will drive timber or steel piles into the river bottom using vibratory or impact hammers. Rock placement will occur using land-based or barge-based excavators and cranes, or by using specialized placement barges.

1.7 Noise Emissions

1.7.1 In-air

Sources of ambient in-air sound in the Lower Columbia River include wind, waves, and recreational and personal vessels transiting the river, and traffic along the roadways abutting the river. The proposed locations for confined aquatic placement are located in the central channel along existing channel islands (i.e., between Miller Sands and Tenasillahe Island). The closest population centers are along the Washington coast in Altoona, Brookfield, and Skamokawa Valley, each with less than 500 permanent residents. Astoria, Oregon is roughly ten river miles downstream of the western most placement site, and the Port of Longview is 30 river miles upstream.

Sound levels are measured in decibels on a logarithmic scale. Sound level meters and monitors utilize a filtering system to approximate the human perception of sound, referred to as A-weighted decibels (dBA). The most likely sources of ambient noise in the project vicinity would be from transiting vessels and during poor weather conditions, foghorns can reach levels of about 95 to 120 dBA (FTA 2006).

The loudest (dBA_{LMAX}) anticipated in-air noise levels would occur during impact pile driving and could reach approximately 110 dBA (Table 1-4, WSDOT 2018). Using the rules for decibel addition and the fact that the top three loudest pieces of equipment listed in Table 1-4 could be operating on the same day, we assume a maximum of 111 dBA during construction. This would be a temporary increase in in-air sound, which would attenuate to 67 dBA within approximately 1.5 miles. In the absence of ambient noise measurements, we used 67 dBA as a reference because this is the threshold specified by the Federal Highway Administration's noise abatement criteria (23 CFR 772, July 2010) for campgrounds, parks, trails, and other outdoor recreation areas. Transportation projects with noise levels exceeding this threshold would typically require mitigation.

Noise levels would fall below the disturbance threshold for pinnipeds in approximately 171 meters (phocids) and 54 meters (otariids). These estimates were derived from Equation 1, a practical spreading loss model for sound attenuation (WSDOT 2018).

(Equation 2)

$$D_{ambient} = D_0 * 10^{\left(\frac{Construction\ Noise - Ambient\ Sound\ Level\ in\ dBA}{\alpha}\right)}$$

With D_0 reference measurement distance (50 feet or 15.24 meters), $D_{ambient}$ calculated distance from source to reach 67 dBA, peak construction noise values from Tables 1-4, and assuming α = 20 for hard ground (e.g., water, concrete, packed soil).

Table 1-4. Average (A-weighted) maximum in-air sound pressure levels for typical construction equipment.

Equipment Type	Average dBA_{Lmax}* at 50 ft.
Impact Pile Driver	110
Vibratory Pile Driver	101
Bulldozer	82
Crane	81
Excavator	81
Front End Loader	79
Dump Truck	76
Pickup Truck	75

Table adapted from WSDOT 2018, Table 7-4
*The maximum value of a noise level that occurs running a single event

1.7.2 In-water

Ambient in-water sound in the Proposed Action Area is affected by many factors including wind and waves, commercial and recreational vessel use, aquatic animals, water currents, etc. A recent study of ambient ocean sound for Oregon's nearshore environment observed maximum and minimum levels of 136 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 small 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).

Based on a Corps study of three trailing hopper dredges and sound source levels measured during transit, sediment removal, pump-out of material, and pump-out of clear water, noise levels ranged between 161 and 177 dBA (Reine et al. 2014). Pile driving noise would be intermittent and could temporarily disturb marine mammals. A vibratory driver is the preferred means for pile installation to minimize potential injury to marine mammals and fish species protected under the Endangered Species Act (ESA). However, impact driving will likely be required to reach embedment depth. A confined bubble curtain will be used when feasibly to reduce in-water sound. Estimated in-water sound pressure levels anticipated from installation of 24-inch diameter steel pipes and 12-inch diameter timber piles are summarized in Table 1-5. We assume all piles will be installed in water depths less than 10 meters. For steel pile assumptions, we referenced a test pile project that was completed roughly 20 miles downstream at Sand Island. The Corps initiated a study to conduct hydroacoustic monitoring while 29, 24-inch pipe piles were installed at two pile structures (Robert Miner Dynamic Testing, 2021). Timber pile sound levels were based on Caltrans (2020).

Table 1-5. Estimated underwater sound pressure levels associated with pile driving.

Pile Type	Sound Pressure Level (single strike)		
24-in Steel Pipe[1] **Vibratory (unattenuated)**	---	159 dB_{RMS}	---
24-in Steel Pipe[1,3] **Impact (attenuated)**	198 dB_{PEAK}	180 dB_{RMS}	171 dB_{SEL}
12-Inch Timber[2] **Vibratory (unattenuated)**	---	162 dB_{RMS}	---
12-Inch Timber[2,3] **Impact (attenuated)**	177 dB_{PEAK}	162 dB_{RMS}	152 dB_{SEL}

[1] Reference levels based on the Sand Island Test Piles project in the Columbia River (Robert Miner Dynamic Testing 2021). While the original study tested various pile tips for driving through existing enrockment, the DMMP will not use pile tips so we referenced sound levels solely for piles excluding tips during vibratory driving. For impact driving, all piles in the Sand Island study included tips so we used the average SPLs across all piles as a conservative estimate.
[2] All timber pile assumptions are based on Caltrans (2020). The impact source levels are for the generic example and appear to be based on an average derived from several projects. For vibratory installation of timber piles, we referenced the Norfolk Naval Station site in Virginia because they were installing piles in comparable water depths.
[3]We assume bubble curtains will be employed for all piles installed with an impact hammer under this LOA, thus, SPLs in this table reflect reference noise estimates reduced by 5 dB.

1.6 Conservation Measures and Best Management Practices

Conservation measures and Best Management Practices (BMPs) for the Proposed Action would be used during construction to avoid and minimize the potential for adverse impacts to physical and biological resources.

Upland and Shoreline Placement

Conservation measures and BMPs to reduce the environmental footprint and to avoid and minimize impacts on upland areas and significant cultural resources are incorporated in the Proposed Action and would be implemented during construction. The following conservation measures and BMPs would be implemented during construction in upland areas as needed.

- Staging and stockpile areas would remain above Ordinary High Water (OHW) or Mean Higher High Water (MHHW) mark when feasible and would be sited to minimize adverse effects to wetlands, habitats identified as having higher ecological value, and any locations identified as having significant cultural resources.
- Ground disturbance and removal of native vegetation, especially trees and shrubs, would be kept to a minimum, as feasible.
- Berms are constructed, as needed, to prevent material from entering areas below OHW/MHHW, to maintain habitat functions/values of aquatic resources.
- Shoreline placement sites are graded to a slope of 10% to 15%, with no swales, to reduce the possibility of stranding juvenile salmonids.

- Land-based construction equipment that enters within the wetted perimeter of a waterbody shall be cleaned before use and shall use environmentally acceptable lubricants and other fluids, to protect riparian and aquatic resources.
- Erosion control measures shall be utilized during upland placement actions to prevent erosion into the LCR. Dredged material containment berms with weir systems are used to maximize sediment retention within the site. These BMPs minimize potential deleterious effects to water quality and aquatic resources.
- New upland placement sites with a base of fine sediment will be prepared in advance so vegetation can develop to minimize erosion during first use.
- Vegetation along the water shall be left in its natural conditions with minimum removal required for equipment and pipe access, to maintain habitat functions/values of riparian and aquatic areas.
- Site preparation including vegetation removal will occur outside of the songbird nesting and Columbia white tail deer (CWTD) breeding season, generally March through August, to minimize impacts to songbirds and CWTD during breeding season.
- Construction access routes and barge ramps will be limited to the smallest footprint practicable to minimize potential discharge into areas waterward of OHW or MHHW, to minimize potential deleterious effects to water quality and aquatic resources.
- Construction debris (e.g., fuel and oil containers and barrels, misc. litter, etc.) shall be removed by the contractor(s) and no equipment shall be abandoned, to minimize and ensure safe disposal of hazardous waste.
- Any unintentional in-water release will be immediately reported to the National Spill Response Center, U.S. Coast Guard, and other federal and state agencies for appropriate response. If material is released, it shall be immediately cleaned up/removed and the affected area shall be restored to a condition approximating adjacent undisturbed areas. Contaminated soils shall be excavated and removed.
- If contamination is suspected, discovered, or occurs during operations, testing of potentially contaminated media must occur, to minimize and ensure safe disposal of hazardous waste, protection of aquatic resources. If contaminated soil or groundwater is apparent or revealed through testing, required agencies will be notified.
- No construction materials shall be abandoned on site at project completion, to maintain habitat functions/values of riparian and aquatic areas.
- An Erosion and Sediment Control Plan (ESCP) would outline facilities and BMPs that would be implemented and installed prior to any ground-disturbing activities on the project site, including mobilization. These erosion controls would prevent pollution caused by surveying or construction operations and ensure sediment-laden water do not leave the project site, enter the river, or impact aquatic and terrestrial wildlife.
- Training would be provided to construction workers and equipment operators on the identification of weeds to be avoided.
- All construction material sources used for supplies of sand, gravel, rock, and mulch would be certified as weed-free prior to transport or use.
- Certified weed-free straw or fiber roll logs would be used for sediment containment.
- All vehicles would be completely washed (or blown clean using an air compressor) and inspected for weed seeds and plant parts prior to mobilization onto the job site or after entering weed-infested areas of the job site.
- All revegetation materials (i.e., soil components and mulches) would be obtained from

non-weed infested sources. Seed procured for the project would be certified as noxious weed-free with a weed content of 0.05 percent or less.
- Site revegetation will use plant materials with a high likelihood of survival and consist of regionally native species.

In-water or Near-water

- All Corps-owned and contracted dredging equipment and operations are in compliance with federal and state air emissions and performance laws and standards. Beyond state requirements, the Corps recently replaced the older combustion engines on dredges in order to meet California Air Quality standards. (California Air Quality standards are stricter than those of Oregon and Washington). In addition, the Port of Portland cutterhead suction Dredge Oregon, which is contracted to the Corps, was repowered in 2014 to significantly reduce emissions.
- To minimize water turbidity and the potential for entrainment of organisms during dredging, drag heads (Hopper Dredges) or cutterheads (Pipeline Dredges) will be buried in the substrate when dredging and will not exceed an elevation of 3 feet off the bottom. If water is pumped through drag head to clean the hopper or cutterhead to clear the pipeline, the drag heads or cutterheads will be 20 feet below the surface.
- The scope and duration of dredging would be limited to the minimum area and amount of time needed to achieve project purposes.
- In-water and shoreline work elements would be completed between the designated in-water work windows for the Columbia River (November 1 to February 15), consistent with pending National Marine Fisheries Service (NMFS), otherwise known as National Oceanic and Atmospheric Administration (NOAA) Fisheries coordination to obtain ESA coverage for this project.
- Prior to the commencement of construction operations, the Corps would coordinate the work schedule with the local port, the U.S. Coast Guard (USCG), and respective counties.
- To protect aquatic resources, Contractor(s) shall not release any trash, garbage, oil, grease, chemicals, or other contaminants into waterways.
- If the Captain or crew operating the vessels observes any kind of sheen or other indication of contaminants, they would immediately stop their activities and notify the USCG and the Corps environmental staff to determine the appropriate action.
- Contractors will not release any trash, garbage, oil, grease, chemicals, or other contaminants into the waterway. Spill prevention measures shall be in place prior to and during construction activities.
- The Corps works to meet state water quality standards. Water turbidity - no more than10% cumulative increase in natural stream turbidities may be allowed, as measured relative to a control point immediately upstream of the turbidity causing activity. However, limited duration activities necessary to address an emergency or to accommodate essential dredging, construction, or other legitimate activities and which cause the standard to be exceeded may occur provided all practicable turbidity control techniques have been applied. See Oregon Administrative Rules (OAR) 340-041-0036.
- The discharge pipe of the pipeline dredge is maintained at or below 20 ft depth during placement, to reduce impact of placement, suspended sediment, and turbidity to migrating juvenile salmonids.

- Dredged material placed in-water shall be spread out during operations to prevent mounding and reduce the depth of material to minimize effects to fish and invertebrates.
- Any necessary ocean placement would be done in accordance with the applicable site management and monitoring plan to reduce suspended sediments and turbidity.

Pile-driving

- Pile driving will occur during the in-water work window for the LCR, November through February.
- Bubble curtains will be used during all impact pile driving in water that is deeper than 2 feet at the time of driving. The bubble curtain is anticipated to reduce initial sound pressure levels by approximately 5 dB (Pauline 2022, pers. comm.). Where current (velocity) is 2 fps or less, the project will use an unconfined bubble curtain; where current is 5 fps or less a confined bubble curtain will be used.
- The project will implement a soft-start procedure during impact and vibratory pile driving. The soft start provides a warning that allows listed species to leave the action area before the pile driver operates at full capacity, thereby reducing exposure to loud noise.
- Visual monitoring for marine mammals will be conducted by qualified, trained marine mammal observers and done in accordance with requirements specified in the final LOA.

Site-specific BMPs

- If non-routine dredging is required near or just downstream of the mouth of the Cowlitz River (RM 63 to RM 70) between December 16 and May 31, in water placement will not occur. This will avoid or minimize impacts to eulachon adults, eggs, and larvae.
- If alternative sites are available, the Corps will not place material in water near the mouths of the Kalama River (RM 71 to RM 75) and Lewis River (RM 85 to RM 89). This will avoid or minimize impacts to eulachon in these streams.
- If testing and calibrating dredges with in-water placement occurs between December 16 and May 31, this action will be limited to areas upstream of Columbia RM 89. This will avoid impacts to most of the Columbia basin eulachon population.

2 LOCATION, DATES, AND DURATION OF ACTIVITY

This LOA is specifically to address potential effects to marine mammals during installation of ***new*** pile structures proposed under the DMMP. While still under review and subject to change (i.e., some locations could be eliminated from the final plan), new pile structures would tentatively be installed between RM 23 and RM 36. Table 2-1 outlines new structure locations using a reference system name that denotes the side of the channel (i.e., O for Oregon; W for Washington), river mile, type of placement (i.e., BN for beach nourishment; IW-S for in-water shallow; IW-D for in-water deeper than 20 ft), and any additional notation to distinguish the site. Figure 2-1 shows the approximate scope of new structures spanning roughly 13 river miles. These structures will support new confined aquatic placement sites in the LCR.

As indicated by the site nomenclature, confined aquatic placement sites will include beach nourishment, shallow water placement, deep water (flow lane) placement, or a combination. Material placement operations would proceed as described under Section 1.4.3 of this LOA request.

Figure 2-1. Aerial view of the river segment with potential new structures supporting confined aquatic placement sites.

Completion of new pile structures will take multiple construction seasons once all environmental review and regulatory compliance processes have been completed. The Corps anticipates that piles for each confined aquatic placement site will be installed in a single year, with the exception of Site O-31.4-BN, which may require two years of construction.

The Corps anticipates finalizing the DMMP in 2023 and under this assumption, 2024 would be Year 1 of the DMMP and pile driving could commence as early as Year 4, or 2027 (Table 2-1).

Given the above considerations, the Corps is requesting an LOA to cover the first five years of pile driving at new confined aquatic placement sites. Pile driving would occur during the in-water work window for the Columbia River, November 1 – February 28/29. Thus, we are requesting a 5-year LOA for the period of November 1, 2027 – February 29, 2032.

- LOA Year 1: November 1, 2027 – February 29, 2028
- LOA Year 2: November 1, 2028 – February 28, 2029
- LOA Year 3: November 1, 2029 – February 28, 2030
- LOA Year 4: November 1, 2030 – February 28, 2031
- LOA Year 5: November 1, 2031 – February 29, 2032

With a tentative 2024 start year for the 20-year DMMP, pile dike construction would occur: in 2027/2028 at Site O-23.5-BN-ADD2; in 2028/2029 at Site W-35.6-IW-D (limited pile driving for marker piles); in 2029/2030 at Site O-23.5-BN-ADD1; in 2030/2031 at Site O-27.3-BN; and in 2031/2032 at Site O-31.4-BN (Table 1-3). **The Corps will seek a new marine mammal compliance (i.e., LOA or separate IHAs) for structures needed to support confined aquatic placement at sites W-24.9-IW-S and O-26.7-IW-S since pile driving at those sites is tentatively planned for 2032/2033 and 2033/2034, respectively**. Given the number of potential structures needed at Site O-31.4-BN, it is possible that an additional season of work will be required to complete pile installation. Should that occur, the Corps will include the second year of work under the new LOA or a separate IHA request.

Construction activities would be limited by the following timing considerations:

- In-water rock placement and staging could occur year-around and typically during high water levels to maximize the amount of area that can be reached by barge.
- Pile driving is expected to occur during the in-water work window of the Columbia River: November 1 through February 28/29.
- Marine construction contractors will likely work 8 to 12 hours per day, 5 to 7 days per week.
- We estimated the approximate number of workdays based on the assumption that an average of 15 piles would be installed in a given day. However, contractors could install up to 20 piles in a day under favorable conditions so the final total number of workdays may be less.
- Other in-water and shoreline work elements will be coordinated with NMFS and USFWS to minimize potential impacts to listed and protected species, while accounting for site conditions that may limit construction during certain timeframes.
- In-water construction would consist of placing enrockment and timber or pipe piles as described in Table 2-2.

Table 2-1. In-water work, pile installation, and workday assumptions.

In-water Work	Timber Piles	Pipe Piles	Total Piles	Anticipated pile driving workdays*
LOA YR-1 (Nov 2027- Feb 2028)				
Enrockment placement and pile installation to construct 4 structures at Site O-23.5-BN-ADD2	181	181	362	25
LOA YR-2 (Nov 2028 - Feb 2029)				
Construction of 2 new structures at Site W-35.6-IW-D using enrockment and marker piles only	NA	6	6	1
LOA YR-3 (Nov 2029 - Feb 2030)				
Enrockment placement and pile installation to construct 5 structures at Site O-23.5-BN-ADD1	248	249	497	34
LOA YR-4 (Nov 2030 - Feb 2031)				
Enrockment placement and pile installation to construct 3 structures at Site O-27.3-BN	223	224	447	30
LOA YR-5 (Nov 2031 - Feb 2032)				
Enrockment placement and pile installation to construct 3 structures at Site O-31.4-BN	377	379	756	51
TOTAL	**1,029**	**1,038**	**2,068**	**141**

*Though up to 20 piles will be installed in a day, we estimate the total number of workdays based on an average of 15 piles being installed per day to account for potential delays due to equipment, weather, and other unforeseen circumstances.

3 SPECIES AND NUMBERS OF MARINE MAMMALS IN THE AREA

Marine mammals are, to varying degrees, susceptible to Level B (i.e., behavioral disturbance or temporary hearing threshold shift) and more severe Level A (i.e., non-serious injury or permanent threshold shift) harassment. Table 3-1 and Table 3-2 outline the sound threshold values for disturbance and injury, respectively, corresponding with 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.

Of the nearly 30 marine mammals that may occur off the northern Oregon coast in the vicinity of the Columbia River, most cetacean species occur further offshore or are infrequently encountered. For example, numerous cetaceans (i.e., *Balaenoptera borealis borealis*, *Balaenoptera physalus physalus, Grampus griseus, Tursiops truncatus truncatus, Stenella coeruleoalba, Delphinus delphis, Globicephala macrorhynchus, Berardius bairdii*, *Mesoplodon* spp., *Ziphius cavirostris, Kogia breviceps, Kogia sima, Physeter macrocephalus*) are only encountered at the continental slope (>12 miles/20 km offshore) or in deeper waters offshore and would not be affected by construction activities. Other species may occur closer nearshore but are rare or infrequent seasonal inhabitants off the Oregon coast (i.e., *Balaenoptera acutorostrata scammoni, Lagenorhynchus obliquidens, Lissodelphis borealis, Orcinus orca (“Eastern North Pacific Southern Resident Stock”), Phocoenoides dalli dalli)* and unlikely to enter the Columbia estuary. Humpback (*Megaptera novaeangliae)* and blue (*Balaenoptera musculus musculus*) whales are not uncommon along the Oregon Coast; however, they are highly unlikely to enter the estuary and traverse roughly 23 miles upstream to be affected by construction noise.

Marine mammals most likely to be present in the study area include seals and sea lions. Seals and sea lions (pinnipeds) are present in the estuarine waters of the study area, and sea lions have been documented as far upriver as the Bonneville Dam on the Columbia River and Willamette Falls on the Willamette River, where they prey on adult salmon. Porpoises (cetaceans) may occur in the lower Columbia River near the mouth. Orcas and humpback whales have also been spotted near the river mouth, but there are no recent detections suggesting that they would transit beyond the Astoria bridge.

Table 3-1. Marine mammal hearing groups, hearing range, and noise disturbance thresholds.

Hearing Group	Generalized Hearing Range	In-Air Noise[1]	Underwater Noise[2]	
			Vibratory	Impulse
Low-frequency (LF) cetaceans (baleen whales)	7 Hz – 35 kHz	NA	120 dB	160 dB
Mid-frequency (MF) cetaceans (dolphins, toothed whales, etc.)	150 Hz – 160 kHz	NA	120 dB	160 dB
High-frequency (HF) cetaceans (true porpoises, river dolphins, etc.)	275 Hz – 160 kHz	NA	120 dB	160 dB
Phocid pinnipeds (PW) (true seals)	50 Hz – 86 kHz	90 dBA	120 dB	160 dB
Otariid pinnipeds (OW) (sea lions and fur seals)	60 Hz – 39 kHz	100 dBA	120 dB	160 dB

[1]All thresholds reported as the A-weighted root mean square (RMS) sound pressure level (SPL_{RMS}) and decibels are referenced to 20 micro-Pascal (20µPa), NOAA 2018
[2]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 (NOAA 2018)

Table 3-2. Underwater injury thresholds for the five marine mammal hearing groups.

Hearing Group	Vibratory	Impulse	
	SEL_{cum}[1]	SEL_{cum}[1]	SPL_{peak}[2]
Low-frequency (LF) cetaceans (baleen whales)	199 dB	183 dB	219 dB
Mid-frequency (MF) cetaceans (dolphins, toothed whales, etc.)	198 dB	185 dB	230 dB
High-frequency (HF) cetaceans (true porpoises, river dolphins, etc.)	173 dB	155 dB	202 dB
Phocid pinnipeds (PW) (true seals)	201 dB	185 dB	218 dB
Otariid pinnipeds (OW) (sea lions and fur seals)	219 dB	203 dB	232 dB

Table adapted from NOAA (2018)
[1]Cumulative sound exposure level (SELcum) for weighted permanent threshold shift (PTS) onset with a reference value of 1 μPa2s
[2]Peak sound pressure level (SPLpeak) threshold for impulsive sources with a reference value of 1 μPa

3.1 Pinnipeds

The most common pinnipeds likely to be present in the lower Columbia River estuary are California sea lions (*Zalophus californianus*), Stellar sea lions (*Eumetopias jubatus*), and eastern Pacific harbor seals (*Phoca vitulina richardii*). Northern fur seals (*Callorhinus ursinus*) females and pups may transit waters off the Oregon coast during their extensive migrations; however, they are unlikely to enter the Columbia River itself. These individuals breed in the Pribilof Islands near Alaska from June through November and are otherwise at sea. Similarly, individuals from the California breeding stock of northern elephant seals (*Mirounga angustirostris*) could migrate through waters off the Oregon coast but are not known to occur further up the estuary (Carretta et al. 2022). The most recent reported sighting was outside the river mouth west of Fort Stevens State Park in 2011 (Coyne et al. 2005, Halpin et al. 2009, Robinson 2021).

Harbor seals are present year-round at the mouth of the Columbia River and are one of the most abundant pinnipeds in Oregon. They can commonly be found on offshore rocks and islands, along shores, and on exposed flats in the estuary (Harvey 1987). Pacific harbor seals can grow approximately 5 to 6 feet in length and up to 300 pounds (ODFW 2019). They were historically hunted in Oregon as a nuisance to fishermen, however, their numbers have increased since the passage of the MMPA in 1972 (Carretta et al. 2022). The most recent stock assessment estimated the potential population size was 24,732 (CV=0.12) based on 1999 aerial surveys and a correction factor to account for individuals hauled out. However, given that over 20 years have passed since these surveys were conducted and the lack of more recent data, there is no current abundance estimate for the population (Carretta et al. 2022).

California sea lions, typically males, can be found in Oregon from September through May, following the summer breeding season that centers around rookeries in Southern California. The males are not quite as large as Steller sea lions but can grow upwards of 7 feet in length and weigh up to 1,000 pounds. Females and pups typically remain near the California breeding grounds year-around (ODFW 2023). California sea lions are fairly abundant along the West Coast, and the population has an estimated annual growth rate of 7% or higher. The minimum population estimate for California sea lions in U.S. waters is 233,515 (Carretta et al. 2022), making them one of the most abundant marine mammals within the California Current. There is a variety of human-caused mortality (e.g., due to commercial fisheries incidental take, shootings, collisions, entrainment, etc.). However, the combined annual take from these sources (≥321 animals) is well below the PBR (14,011 animals).

Steller sea lions are some of the largest pinnipeds found along the Oregon coast, with an average 9-foot length and weight of 1,500-2,000 pounds (ODFW 2023). Steller sea lions in Oregon are part of the Eastern U.S. stock that includes animals born east of Cape Suckling, Alaska. There are several rookeries dispersed along the west coast of southeastern Alaska, British Columbia, Washington, Oregon, and California (Muto et al. 2020). Oregon rookeries include Rogue Reef and Orford Reef, but there are also multiple haul-out sites where Steller sea lions may aggregate seasonally (Pitcher et al. 2007, ODFW 2023). The south jetty of the Columbia River is one such haul-out site where animals often aggregate in winter months (Jeffries et al. 2000). The minimum population estimate for the Eastern U.S. stock of Steller sea lions, which excludes Canada and does not account for animals at sea, is 32,510 non-pups and 10,691 pups (Muto et al. 2020).

All marine mammals are protected under the MMPA; however, Section 120(a) of the Act allows for the authorized lethal removal of "individually identifiable pinnipeds which are having a significant negative impact on the decline or recovery of salmonid fishery stocks" listed as threatened species or endangered species under the ESA. In the Columbia River, both California and Steller sea lions are known to aggregate at the base of Bonneville Dam and feed on listed salmonid species. There are ongoing efforts to monitor pinnipeds at the dam and to deter nuisance animals that pose an increasing risk to salmon stocks. Recent 2017-2018 monitoring results indicate that about 7% of the winter and summer steelhead runs were subject to sea lion predation at Bonneville Dam (Tidwell et al. 2019).

3.2 Cetaceans

Killer whales (*Orcinus orca*) are found in waters throughout the North Pacific. Along the west coast of North America, '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 (Muto et al. 2020, Carretta et al. 2022), 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). The Southern Resident killer whale (SRKW) DPS was listed as endangered under the ESA in 2006 and remains listed due to: 1) scarcity of prey, 2) high levels of contaminants from pollution, and 3) disturbance from vessels and noise impacts (Carretta et al 2022). Critical habitat for SRKW occurs in inland waters of Washington State and was updated to include newly designated critical habitat for marine waters off the US West Coast between the approximate 6.1 m and 200-meter depth contour (86 FR 41668). There is no designated critical habitat for SRKW in the study area. Salmon are an important part of the prey base for killer whales, and they have been observed near the mouth of the Columbia River. Individuals from the WCT stock were most recently detected inside the Columbia River near Hammond, Oregon (Oregon Coast Beach Connection 2022). The estimated minimum number of whales in the West Coast Transient stock is 243 individuals (95% CI = 180-339), as it does not account for animals from the "outer coast" or California (Muto et al. 2020).

Humpback whales (*Megaptera novaeangliae*) 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 (Carretta et al. 2022). Whales off the coast of Oregon are part of the California/Washington/Oregon Stock and may include California-Oregon or Washington southern British Columbia feeding groups. Humpback whales are typically seen off the Oregon coast from April to October, with peak numbers from June through August. While humpback whales are typically found at the continental shelf and slope 5 to 15 miles offshore, there has been at least one documented occurrence of humpback whales feeding in the Columbia River near the Astoria-Megler Bridge, approximately 14 miles upstream of the mouth (Bessex 2015). The best available mark-recapture data available suggests that there are 4,973 (CV=0.048) whales in the California/Washington/Oregon stock (Carretta et al. 2022).

Harbor porpoises (*Phocoena phocoena*) occupy nearshore and inland waters throughout the Pacific. They range from southern California to Alaska in the eastern Pacific, and harbor porpoises in the vicinity of the Columbia River are likely part of the Northern Oregon/Washington Coast stock (Carretta et al. 2022). Though harbor porpoises are observed year-round in waters off Oregon and Washington coasts, sightings near the mouth or up the channel of the Columbia River are not common, with only a single recorded detection (i.e., in September 2015) of a harbor porpoise inside the estuary to date (Cheeseman and Southerland 2022, Happywhale 2022). There are an estimated 21,487 (CV = 0.44) harbor porpoises that occupy waters in coastal northern Oregon, north of Lincoln City (Carretta et al. 2022).

4 STATUS AND DISTRIBUTION OF AFFECTED SPECIES AND STOCKS

The majority of marine mammal species are unlikely to occur in the project vicinity over 20 miles from the mouth of the Columbia River. Thus, there is no reasonable expectation that proposed pile driving activities would affect cetaceans. Only three pinniped species (i.e., harbor seals, Steller sea lions, and California sea lions) will be addressed in the remaining sections of this LOA application (Table 4-1). These species are known to frequent the lower Columbia River estuary and could be affected by pile driving associated with constructing 17 new structures between RM 23 and 36 in support of proposed confined aquatic dredge material placement sites.

Orcas, humpback whales, and harbor porpoises, while observed in the lower estuary below the Astoria bridge, are excluded from take considerations because they are highly unlikely to transit far enough upriver to be subject to pile driving noise disturbance. Should any of these species, or any other marine mammal, be observed in the project vicinity, pile driving would cease until they voluntarily leave and have been visually confirmed beyond the disturbance zone; or animals have not been re-detected in 15 minutes.

Table 4-1. Marine mammals likely to occur in the project vicinity.

Species and Marine Mammal Group	Estimated Stock Abundance[1]	ESA Status	MMPA Status	Occurrence	Distribution
Phocids					
Harbor seal (*Phoca vitulina richardii*) Oregon and Washington Coast Stock	unknown	Not listed	Non-strategic	Likely	Continental shelf (coastal and estuarine)
Otariids					
Steller sea lion (*Eumetopias jubatus*) Eastern U.S. Stock	32,510 non-pups 10,691 pups (minimum)	Not listed	Not depleted; Non-strategic	Likely	Continental shelf
California sea lion (*Zalophus californianus*) U.S. Stock, Pacific Temperate Population	233,515 (minimum)	Not listed	Not depleted; Non-strategic	Likely	Continental shelf

Sources: U.S. Pacific Marine Stock Assessments (Carretta et al. 2022)

4.1 Harbor seals

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. Peak harbor seal abundances in the Columbia River occur during the winter and spring when a number of upriver haul-out sites are used. Pups are typically born in March to April and females will leave pups at haulout sites while searching for prey (ODFW 2023). Peak abundances and upriver movements in the winter and spring months are correlated with spawning runs of eulachon and out migration of salmonid smolts (Jeffries 1984; Beach et al. 1985). In the summer and fall, harbor seals move back downriver to haul-out sites at Desdemona Sands, shoals north of Tongue Point, Grays Bay, and Cathlamet Bay (Jeffries 1984; Beach et al. 1985). Harbor seals are generally non-migratory, but local movements may vary with tides, weather, seasons, food resources, and reproductive behavior (Carretta et al. 2022). There are several known haul-out sites within 5 miles of the stretch of river (i.e., RM 23 to RM 36) proposed for new pile driving (Figure 4-1) and highest utilization of these lower river sights has typically been observed in May/June (B.E. Wright, personal communication, 15 May 2023, Wright and Riemer 2023). The Oregon/Washington Coast stock is not considered “depleted” under MMPA or listed as threatened or endangered under the ESA (Carretta et al. 2022).

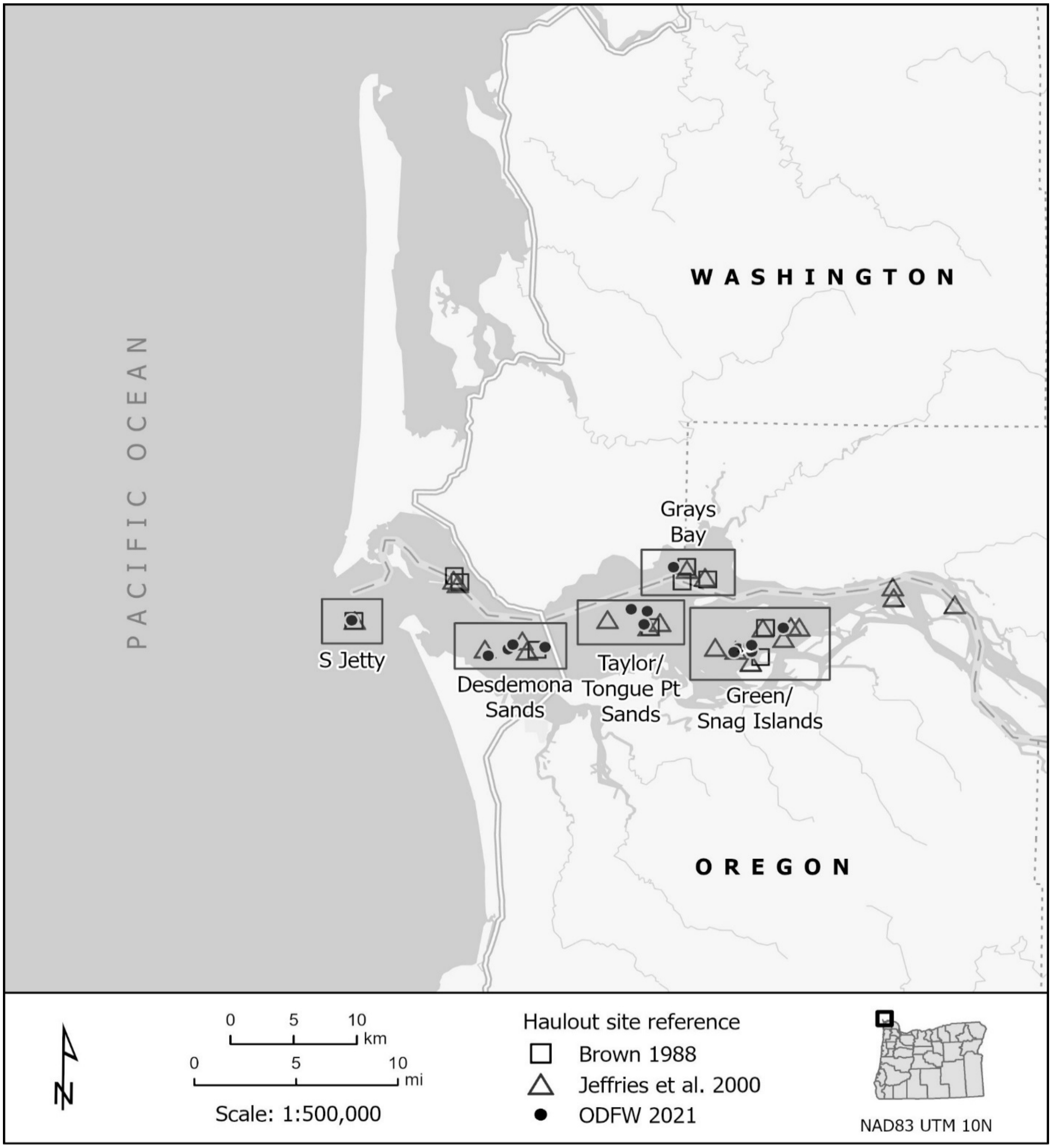

Figure 4-1. Harbor seal haulout sites observed historically and during the most recent 2021 ODFW aerial surveys (Wright and Riemer 2023).

4.2 Steller sea lions

Steller sea lions (*Eumetopias jubatus*) encountered off the Oregon coast are part of the Eastern U.S. Stock, with rookeries in California, Oregon, Washington, Southeast Alaska, and British Columbia (Muto et al. 2020). Off the Oregon coast, Steller sea lions have been observed ashore from the Columbia River south to Rogue Reef and typically inhabit offshore rocks and islands.

There are seven major hall-out sites noted in Oregon during the breeding season (Pitcher et al. 2007). Steller sea lions have been detected in the Columbia River and may occur in the vicinity of the project. All sea lions detected in the Columbia River are male and the nearest sea lion haulout sites are in Astoria and upriver near Rainier, Washington (B.E. Wright, personal communication, 15 May 2023, Figure 4-2). However, sea lions will likely transit the project area during winter, depending on the timing of the eulachon spawning run which can attract large numbers of sea lions. While Steller sea lions were listed as threatened under the ESA in 1997, the population has been stable or increasing for several years, and NOAA Fisheries removed the Eastern stock from the list of threatened species under the ESA in 2013 (Muto et al. 2020). Counts of Steller sea lions in the Eastern U.S. Stock have steadily increased over the past 30 years and available data suggest human-caused mortality and serious injury are fairly insignificant.

4.3 California sea lions

The U.S. stock of California sea lions (*Zalophus californianus*) breeds on islands off the southern California coast. They are commonly found in Oregon haul-out sites from September to May and during this period, adult and subadult males have been observed in bays, estuaries, and offshore rocks along the Oregon coast. In fact, a few males have reported in Oregon waters throughout the year (Mate 1973). The population breeds in the California Channel Islands and most females and young pups remain in that region year-around (Mate 1973, ODFW 2023). California sea lions may occur in the project vicinity and often use that same haulout sites as Steller sea lions (ODFW 2023, B.E. Wright, personal communication, 15 May 2023, Figure 4-2). California sea lions are not “depleted” or “strategic” under the MMPA and have no status under ESA (Carretta et al. 2022).

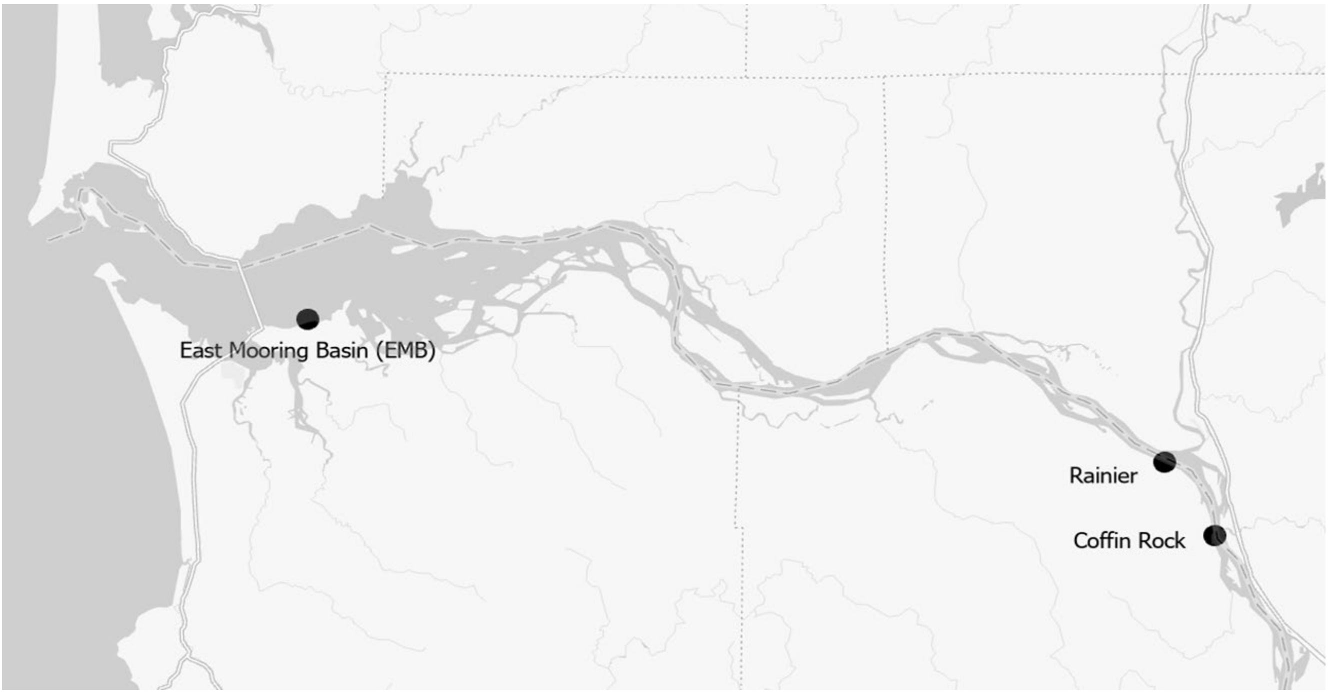

Figure 4-2. Known sea lion haul out sites based on winter aerial surveys (B.E. Wright, 15 May 2023)

5 TYPE OF INCIDENTAL TAKE AUTHORIZATION REQUESTED

Under Section 101(a)(5)(D) of the MMPA, the U.S. Army Corps of Engineers – Portland District requests a Letter of Authorization (LOA) for pinnipeds that may be subject to Level A and Level B harassment during the installation of up to 1030 24-inch steel pipe piles, and up to 1030 12-inch timber piles associated within 17 new pile structures in the LCR.

5.1 Methods of Incidental Taking

In-Air

We assume that the majority of marine mammals that would be present in the in-air disturbance zones would have already entered the respective in-water disturbance isopleth during pile driving. For example, an animal hauled out or resting near construction activities will likely enter the water at some time during the day and will thereby experience Level B harassment from underwater sound. Thus, we assume all animals hauled out are accounted for in the Level B take estimates.

In-Water

The in-water effects of pile driving noise include potential Level A and Level B effects on marine mammals. We used Equation 3 to calculate the Level B disturbance distances in water.

(Equation 3)

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

With D_0 reference measurement distance (10 meters), $D_{thresh\text{-}water}$ calculated distance from source to reach in-water threshold values, water disturbance threshold values from Tables 3-2, and α = 15. Estimated sound pressure levels in water were referenced from Table 1-2, using the dB_{RMS} values for installing 24-inch steel pipe piles (impact and vibratory) and 12-inch timber piles (impact or vibratory).

Table 5-1. In-water Level A (injury) and Level B (disturbance) harassment distances for estimating potential noise effects to marine mammals.

Noise Generation Type	**Level A PTS Distance*** (meters)	**Level A PTS Distance** (meters)	**Level A PTS Distance** (meters)	**Level A PTS Distance** (meters)	**Level A PTS Distance** (meters)	**Level B Disturbance#** (meters)
	LF Cetacean	MF Cetacean	HF Cetacean	Phocid Pinniped	Otariid Pinniped	All Groups
24-inch steel pipe pile (vibratory install)	20.7	1.8	30.5	12.6	0.9	3,981.1
24-inch steel pipe pile (impact attenuated)	147.5	5.2	175.7	79.0	5.7	215.4
12-inch timber piles (vibratory install)	32.7	2.9	48.4	19.9	1.4	6,309.6
12-inch timber piles (impact attenuated)	8.0	0.3	9.5	4.3	0.3	13.6

*Level A permanent threshold shift (PTS) distances (meters) were calculated using NOAA technical tool and spreadsheet for estimating PTS levels associated with pile driving (NOAA 2018, Figures 6-1 and 6-2). See assumptions regarding the number of piles to be driven per day, duration of driving (vibratory), and number of strikes per pile (impact) in Section 5.2. No take is being requested for cetaceans, although distances were calculated, and isopleths are shown in subsequent maps.
#Level B disturbance distances (meters) were estimated using Equation 3 and dB_{RMS} values in Table 1-2

5.2 PTS and Disturbance Isopleths

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 (NOAA 2018). The estimated isopleth distances were calculated using the un-weighted SPL RMS values from Table 1-2, with the assumptions listed below. Estimates are based on observations made during the Sand Island Test Piles project (Robert Miner Dynamic Testing 2021) that was implemented several miles upriver from the pile structures proposed under this LOA. Unlike the Sand Island test project, which required driving piles through existing enrockment, it is conservatively assumed that all piles will be driven through the natural channel substate. Thus, an impact hammer is only assumed necessary for reaching the last 5 feet of embedment. A vibratory driver is the preferred method and will be used for the majority of pile installation.

Pile driving rates are based on information from the Sand Island Test Piles project (Robert Miner Dynamic Testing 2021). The Sand Island Test Piles project found that, for vibratory driving, the average rate of penetration was 1.5 minutes per foot, and the fastest rate was much less than 1 minute per foot. These piles penetrated existing enrockment before penetrating the natural ground. Since pile driving at the confined aquatic sites is not likely to encounter enrockment, a rate of 1 minute per foot is assumed. We assume piles will be driven up to 25 feet with a vibratory driver, for a total of 25 minutes of vibratory driving per pile.

When pile installation required an impact hammer at the Sand Island Test Piles project, the average number of blows per foot was 9, and the average production rate was one blow per 1.3 seconds. Using these numbers as a proxy for impact driving rates on the DMMP project, the Corps assumes that driving a pile the last 5 feet of its depth will require 45 blows and approximately 1 minute.

We were unable to find proxy sources that reported driving conditions when installing 12-inch timber piles. Therefore, we use the same pile strike and installation duration assumptions as for 24-inch steel pipe piles.

Pile driving assumptions:

- Only one pile driver would be operating at a site at any given time. While there could be both an impact hammer and vibratory driver onsite, the two drivers would not be operated at the same time.
- Bubble curtains will be used **during impact pile driving only** in water that is deeper than 2 feet at the time of driving. Where current is 2 fps or less, the project will use an unconfined bubble curtain; where current is 5 fps or less a confined bubble curtain will be used. Bubble curtains are expected to reduce initial SPLs by 5 dB.
- Up to 20, 24-inch steel pipe or 12-inch timber piles could be installed using an impact hammer or vibratory methods in a 24-hour period.
- The average duration to install a single 24-inch steel pipe or 12-inch timber pile with a vibratory hammer is 25 minutes.
- The duration required to reach the final 5 feet of embedment depth with an impact hammer is approximately 1 minute for either pile type.

- It will take no more than 45 strikes to complete the installation of a single, 24-inch steel pipe or 12-inch timber pile with an impact hammer. Again, impact driving will only be used, as necessary, to achieve the final 5-feet of embedment depth.
- The estimated average sound attenuation (dB per Log [distance]) is 15 for all piles (WSDOT 2018)

Spreadsheet calculations corresponding to PTS values in Table 5-1 are provided in Figures 5-1 through 5-4.

IMPACT PILE DRIVING REPORT

PRINT IN LANDSCAPE TO CAPTURE ENTIRE SCREEN
(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

Lower Columbia River Dredged Material Management Plan, USACE - Portland District, Primary POC: C. Littles, chanda.j.littles@usace.army.mil

PROJECT INFORMATION	PEAK	SELss	RMS
Attenuated Single strike level (dB)	198	171	180
Distance associated with single strike level (meters)	10	10	10
Transmission loss constant	15		
Number of piles per day	20		
Number of strikes per pile	45		
Number of strikes per day	900		
Cumulative SEL at measured distance	201		

OTHER INFO: Reference: Sand Island Test Piles project in the Columbia River (Miner 2021).

NOTES: All piles in the Sand Island Test Piles study were driven through existing enrockment - average SPLs for DMMP will likely be lower.

Attenuation: 5

RESULTANT ISOPLETHS
(Range to Effects)

FISHES

	ONSET OF PHYSICAL INJURY			BEHAVIOR
	Peak Isopleth	SEL_{cum} Isopleth Fish ≥ 2 g	SEL_{cum} Isopleth Fish < 2 g	RMS Isopleth
ISOPLETHS (meters)	2.9	80.0	147.7	1000.0

SEA TURTLES

	PTS ONSET		BEHAVIOR
	Peak Isopleth	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	0.1	5.9	21.5

MARINE MAMMALS

	LF Cetacean	MF Cetaceans	HF Cetaceans	PW Pinniped	OW Pinnipeds
PTS ONSET (Peak isopleth, meters)	0.4	0.1	5.4	0.5	0.1
PTS ONSET (SEL_{cum} isopleth, meters)	147.5	5.2	175.7	79.0	5.7
	ALL MM				
Behavior (RMS isopleth, meters)	215.4				

Figure 5-1. PTS Isopleth Data for IMPACT Driving 24-in Steel Pipe Piles

VIBRATORY PILE DRIVING REPORT

PRINT IN **LANDSCAPE** TO CAPTURE ENTIRE SCREEN

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

Lower Columbia River Dredged Material Management Plan, USACE - Portland District, Primary POC: C. Littles

PROJECT INFORMATION	RMS
Attenuated Sound pressure level (dB)	159
Distance associated with sound pressure level (meters)	10
Transmission loss constant	15
Number of piles per day	20
Duration to drive pile (minutes)	25
Duration of sound production in day	30000
Cumulative SEL at measured distance	204

OTHER INFO Reference: Sand Island Test Piles project in the Columbia River (Miner 2021).

NOTES While the Sand Island study tested various pile tips for driving through existing enrockment, the DMMP will not use pile tips so we referenced sound levels solely for piles excluding tips during vibratory driving

Attenuation 0

RESULTANT ISOPLETHS
(Range to Effects)

FISHES

	BEHAVIOR
	RMS Isopleth
ISOPLETHS (meters)	39.8

SEA TURTLES

	PTS ONSET	BEHAVIOR
	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	0.8	0.9

MARINE MAMMALS

	LF Cetacean	MF Cetaceans	HF Cetaceans	PW Pinniped	OW Pinnipeds
PTS ONSET (SELcum isopleth, meters)	20.7	1.8	30.5	12.6	0.9
	ALL MM				
Behavior (RMS isopleth, meters)	3981.1				

Figure 5-2. PTS Isopleth Data for VIBRATORY Driving 24-in Steel Pipe Piles

IMPACT PILE DRIVING REPORT

PRINT IN LANDSCAPE TO CAPTURE ENTIRE SCREEN

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

Lower Columbia River Dredged Material Management Plan, USACE - Portland District, Primary POC: C. Littles, chanda.j.littles@usace.army.mil

PROJECT INFORMATION	PEAK	SELss	RMS
Attenuated Single strike level (dB)	177	152	162
Distance associated with single strike level (meters)	10	10	10
Transmission loss constant	15		
Number of piles per day	20		
Number of strikes per pile	45		
Number of strikes per day	900		
Cumulative SEL at measured distance	182		

OTHER INFO Caltrans (2020) - generic example likely based on an average derived from several projects.

NOTES 0

Attenuation 5

RESULTANT ISOPLETHS
(Range to Effects)

FISHES

	ONSET OF PHYSICAL INJURY			BEHAVIOR
	Peak Isopleth	SEL_{cum} Isopleth Fish ≥ 2 g	SEL_{cum} Isopleth Fish < 2 g	RMS Isopleth
ISOPLETHS (meters)	0.1	4.3	8.0	63.1

SEA TURTLES

	PTS ONSET		BEHAVIOR
	Peak Isopleth	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	0.0	0.3	1.4

MARINE MAMMALS

	LF Cetacean	MF Cetaceans	HF Cetaceans	PW Pinniped	OW Pinnipeds
PTS ONSET (Peak isopleth, meters)	0.0	0.0	0.2	0.0	0.0
PTS ONSET (SEL_{cum} isopleth, meters)	8.0	0.3	9.5	4.3	0.3

	ALL MM
Behavior (RMS isopleth, meters)	13.6

Figure 5-3. PTS Isopleth Data for IMPACT Driving 12-in Timber Piles

VIBRATORY PILE DRIVING REPORT

PRINT IN **LANDSCAPE** TO CAPTURE ENTIRE SCREEN

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

Lower Columbia River Dredged Material Management Plan, USACE - Portland District, Primary POC: C. Littles

PROJECT INFORMATION	RMS
Attenuated Sound pressure level (dB)	162
Distance associated with sound pressure level (meters)	10
Transmission loss constant	15
Number of piles per day	20
Duration to drive pile (minutes)	25
Duration of sound production in day	30000
Cumulative SEL at measured distance	207

OTHER INFO: Caltrans (2020) - Norfolk Naval Station, VA.

NOTES: 0

Attenuation: 0

RESULTANT ISOPLETHS
(Range to Effects)

FISHES

	BEHAVIOR
	RMS Isopleth
ISOPLETHS (meters)	63.1

SEA TURTLES

	PTS ONSET	BEHAVIOR
	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	1.3	1.4

MARINE MAMMALS

	LF Cetacean	MF Cetaceans	HF Cetaceans	PW Pinniped	OW Pinnipeds
PTS ONSET (SELcum isopleth, meters)	32.7	2.9	48.4	19.9	1.4
	ALL MM				
Behavior (RMS isopleth, meters)	6309.6				

Figure 5-4. PTS Isopleth Data for VIBRATORY Driving 12-in Timber Piles

6 NUMBER OF MARINE MAMMALS THAT MAY BE AFFECTED (i.e., "TAKE")

6.1 MMPA Definitions

Harassment is a statutory term under the MMPA defined as any act of pursuit, torment, or annoyance that results in injury or disturbance of a marine mammal (16 U.S.C. 1362). Level A harassment is described as any activity that has the potential to injure a marine mammal or marine mammal stock in the wild. Level B harassment includes any form of harassment that has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavior such as migration, breathing, nursing, breeding, feeding, or sheltering, but does not result in injury (16 U.S.C. 1362). Take under the MMPA means "to harass, hunt, capture, collect, or kill, or attempt to harass, hunt, capture, collect, or kill any marine mammal (50 CFR 216.3). Incidental take is unintentional take, though not unanticipated. Thus, this LOA application is requesting incidental take based on Level A and Level B harassment that may occur as a result of pile driving activities proposed under the LCR DMMP.

6.2 Shutdown Zones

There will be a minimum 15-meter Exclusion/Shutdown Zone for all marine mammals during all pile driving activities. During impact driving of steel pipe piles, the Shutdown Zone will increase to 50-meters for phocid pinnipeds (e.g., harbor seals) only. Measures to stop work would be implemented should marine mammals be detected approaching these Exclusion Zones.

6.3 Level A Take

Figures 5-1 through 5-4 show the calculations underlying PTS isopleth distances for each marine mammal group, by the type of pile driving activity. The 15-meter Shutdown Zone would likely prevent Level A take of any marine mammals during all vibratory driving and while impact driving 12-inch timber piles. During impact driving of 24-inch steel pipe piles, Level A take is possible for harbor seals due to the larger isopleth distance calculated for phocid pinnipeds. For take calculations, we estimated the harbor seal density in the vicinity to calculate Level A take.

6.4 Level B Take

We are requesting Level B harassment authorization for harbor seals, Steller sea lions, and California sea lions. After accounting for the configuration of the channel and the proposed pile locations, propagated sound waves would hit shorelines prior to reaching the full extent of larger isopleths listed in Table 5-1. Estimates for the maximum Level B take for each species includes the take associated with vibratory and impact driving 24-inch steel pipe piles and 12-inch timber piles. We assume that driving of steel and timber piles would occur on different workdays. However, should both drivers be operated in a single day, the actual Level B take would likely still be less than the estimates included in the following section. Level B monitoring protocols outlined in Section 13 would be implemented based on the calculated distances for potential disturbance.

Should any marine mammal species for which take has not been authorized be reported passing beyond the Astoria bridge during pile driving, all protected species observers (PSOs) will be notified. Work will pause should any marine mammal species other than those for which take has been authorized in the LOA be observed approaching Tongue Point, which is just beyond the maximum Level B disturbance zone. Work will not resume until marine mammals have voluntarily left and been visually confirmed downriver of Tongue Point; or individuals have not been re-detected in 15 minutes.

Figures 6-1 through 6-20 show the areas where noise from impact driving of steel pile is expected to exceed noise thresholds for listed fish at each structure.

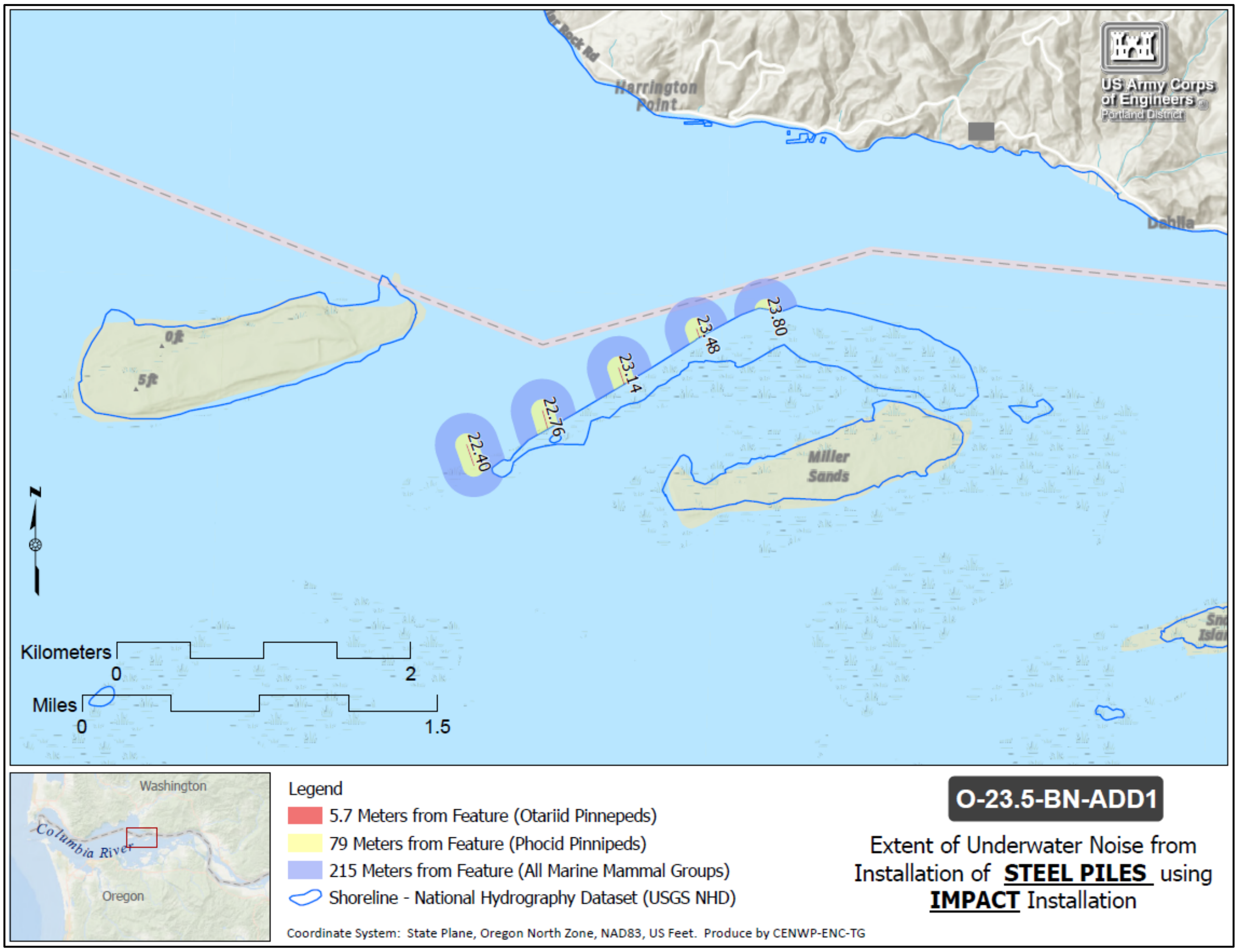

Figure 6-1. Extent of Underwater Noise Marine Mammal Disturbance from IMPACT Driving Steel Pipe Piles, O-23.5-BN-ADD1

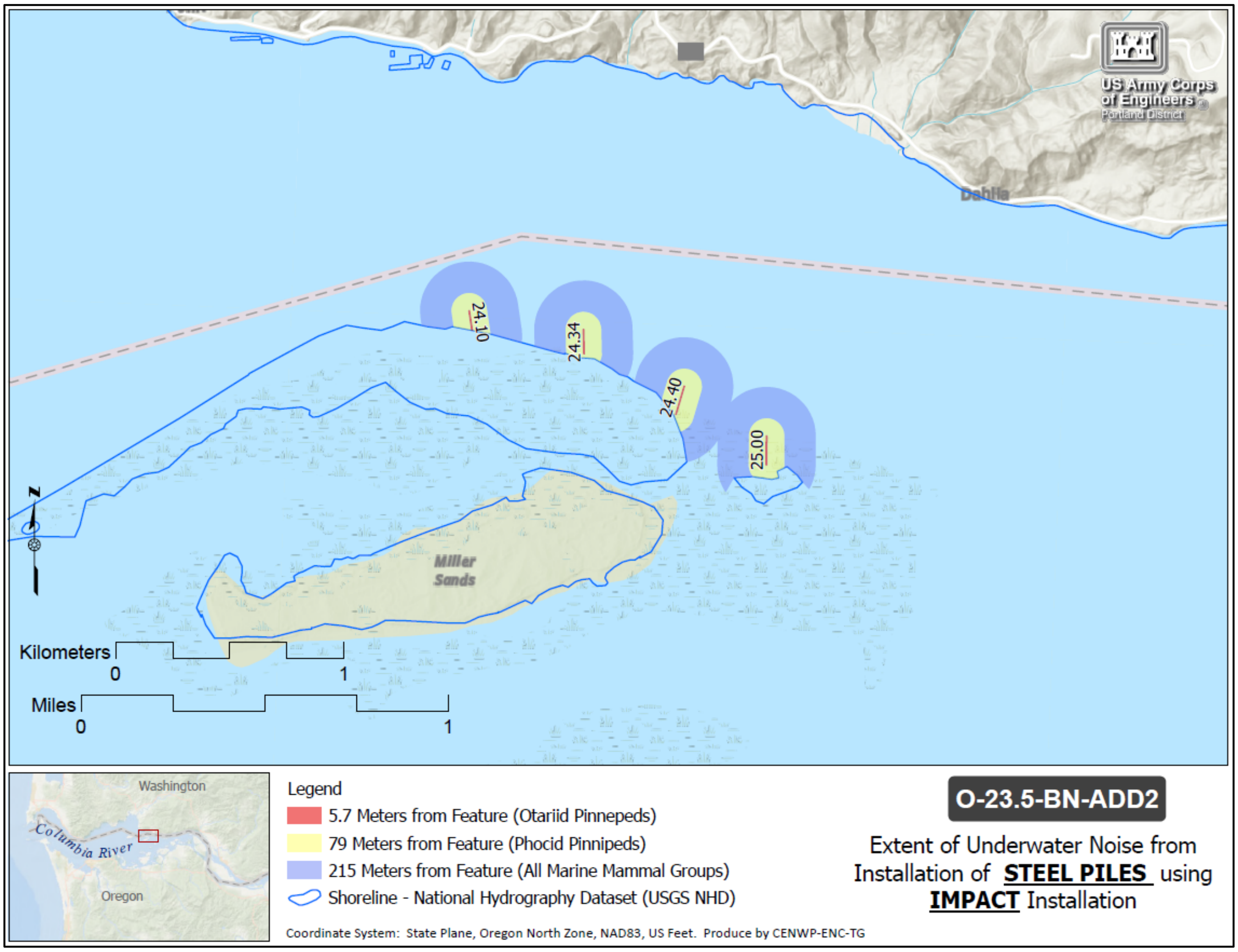

Figure 6-2. Extent of Underwater Noise Marine Mammal Disturbance from IMPACT Driving Steel Pipe Piles, O-23.5-BN-ADD2

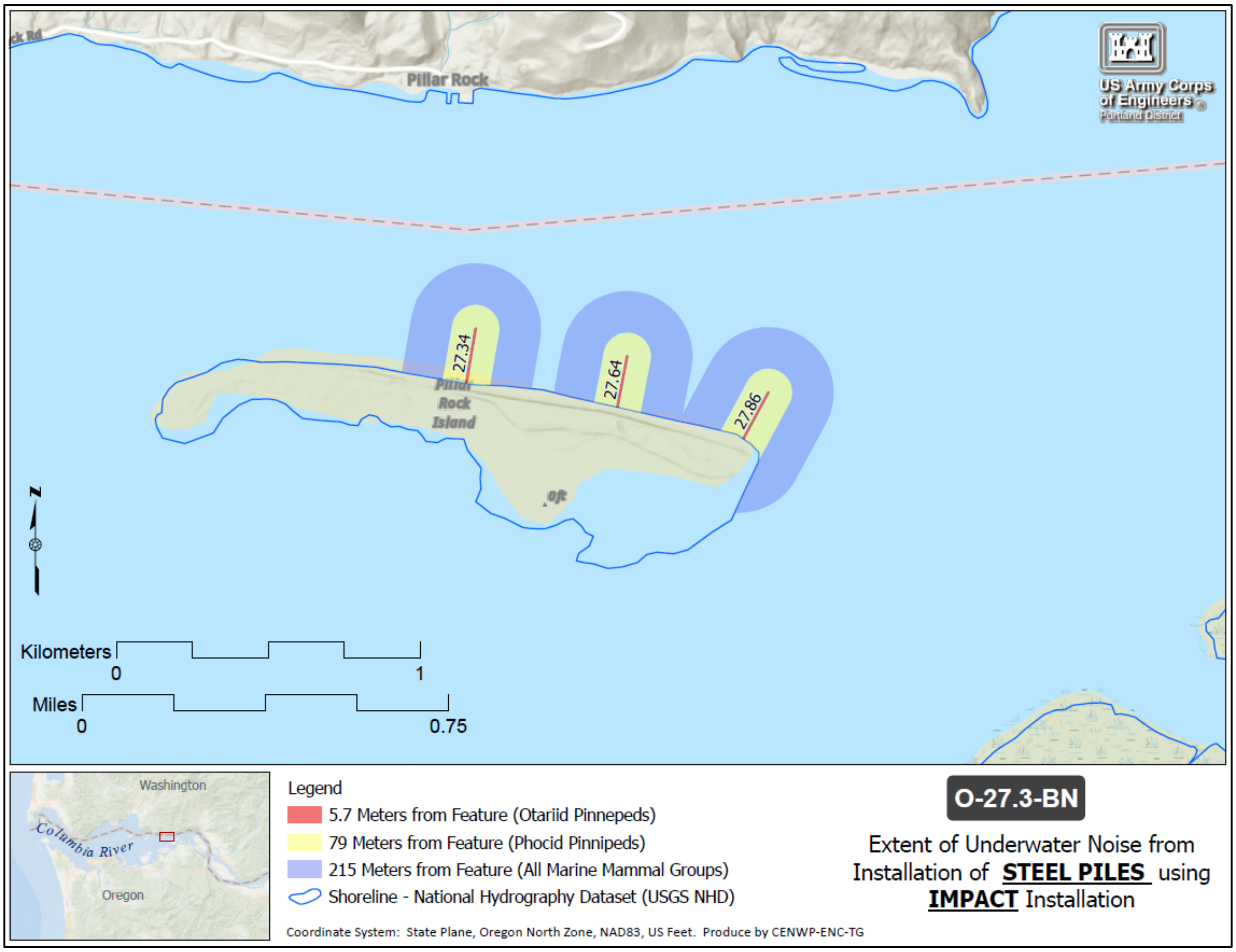

Figure 6-3. Extent of Underwater Noise Marine Mammal Disturbance from IMPACT Driving Steel Pipe Piles, O-27.3-BN

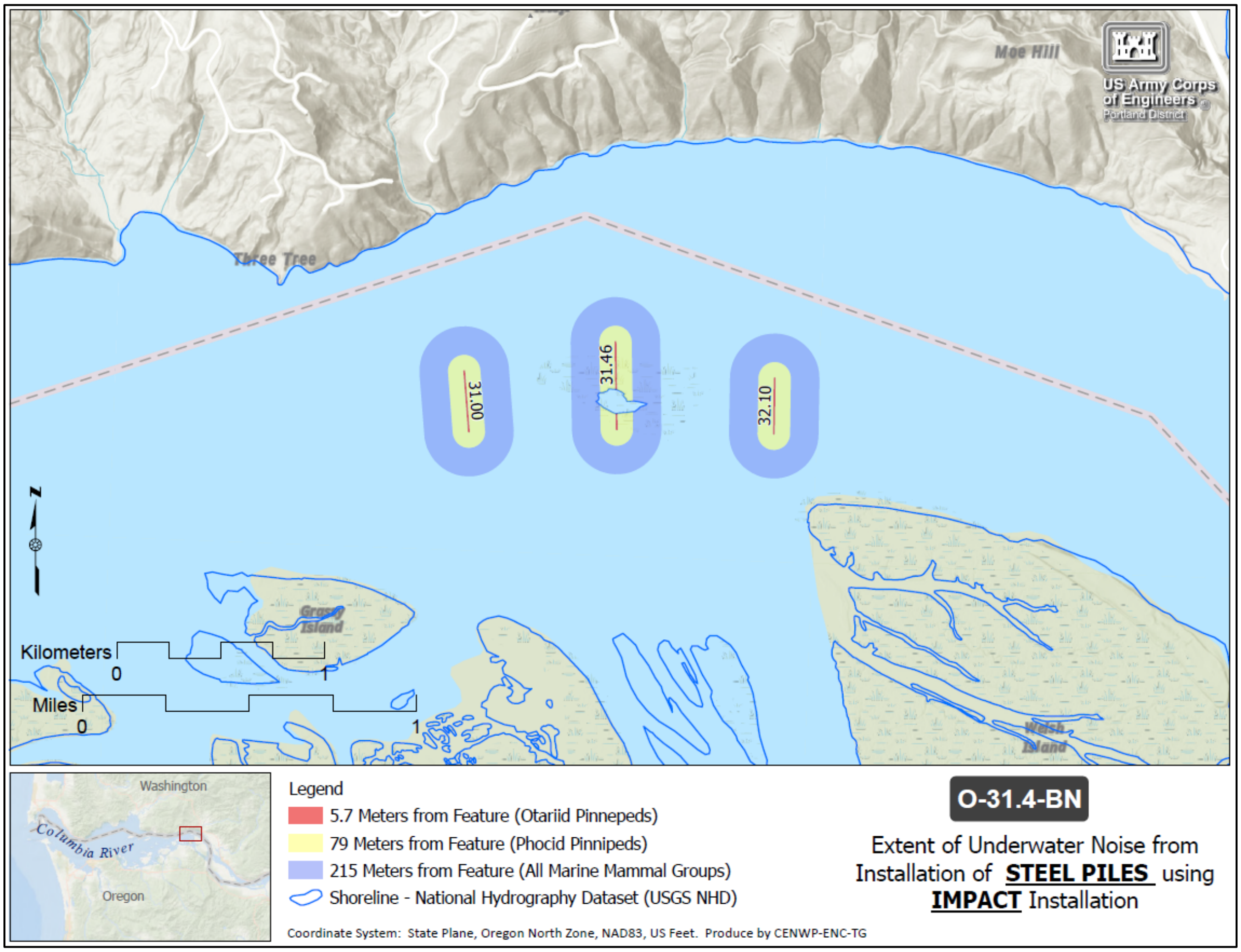

Figure 6-4. Extent of Underwater Noise Marine Mammal Disturbance from IMPACT Driving Steel Pipe Piles, O-31.4-BN

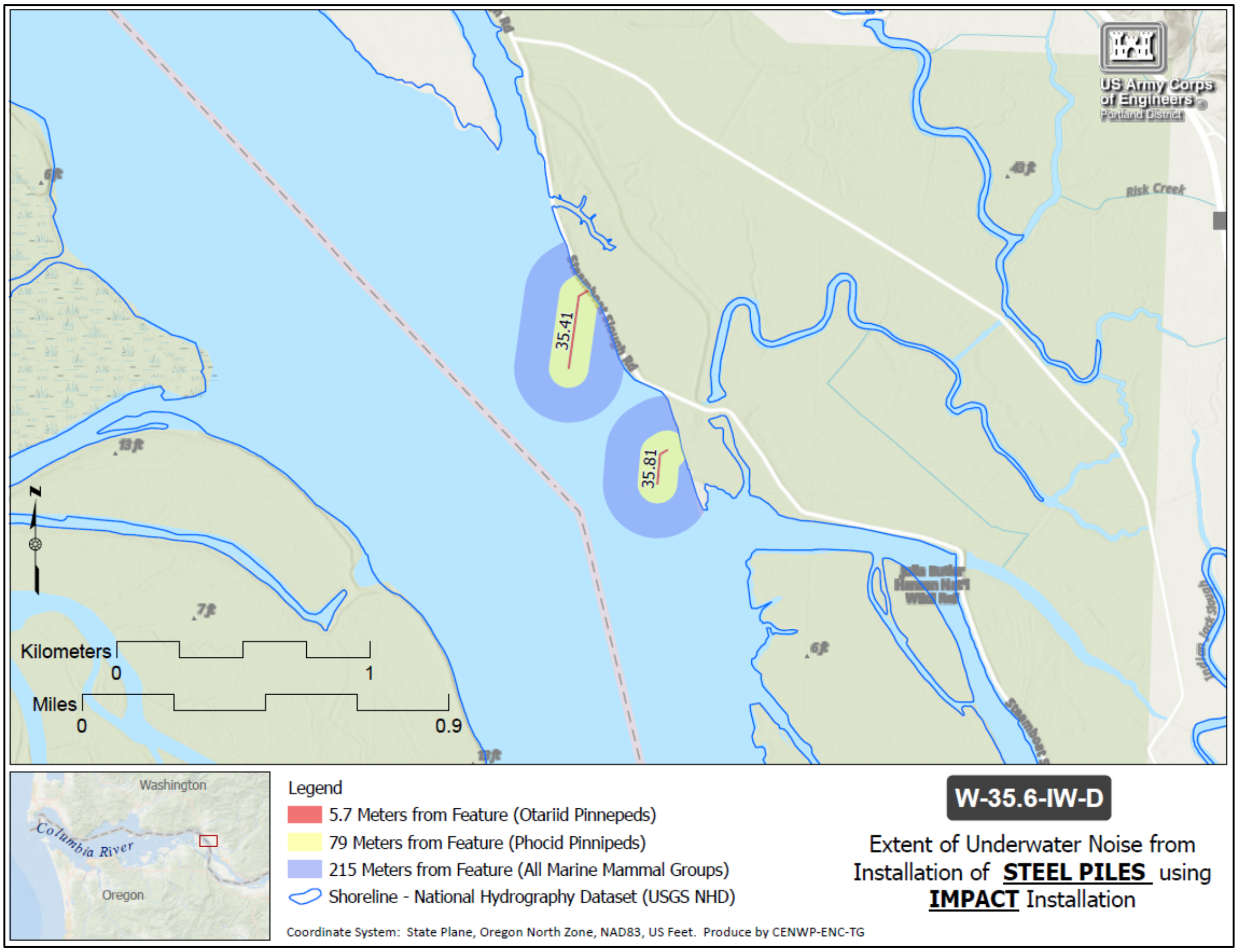

Figure 6-5. Extent of Underwater Noise Marine Mammal Disturbance from IMPACT Driving Steel Pipe Piles, W-35.6-IW-D

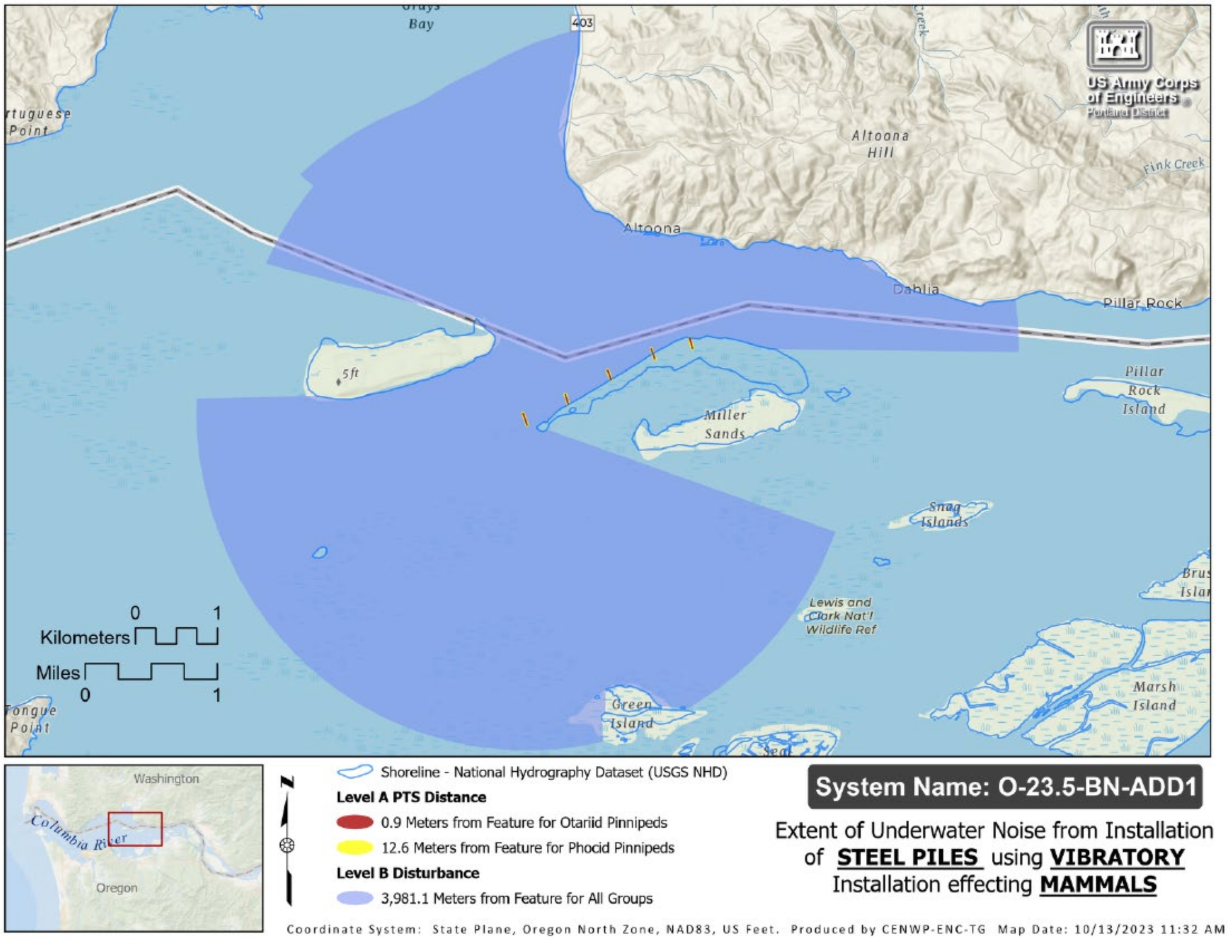

Figure 6-6. Extent of Underwater Noise Marine Mammal Disturbance from VIBRATORY Driving Steel Pipe Piles, O-23.5-BN-ADD1

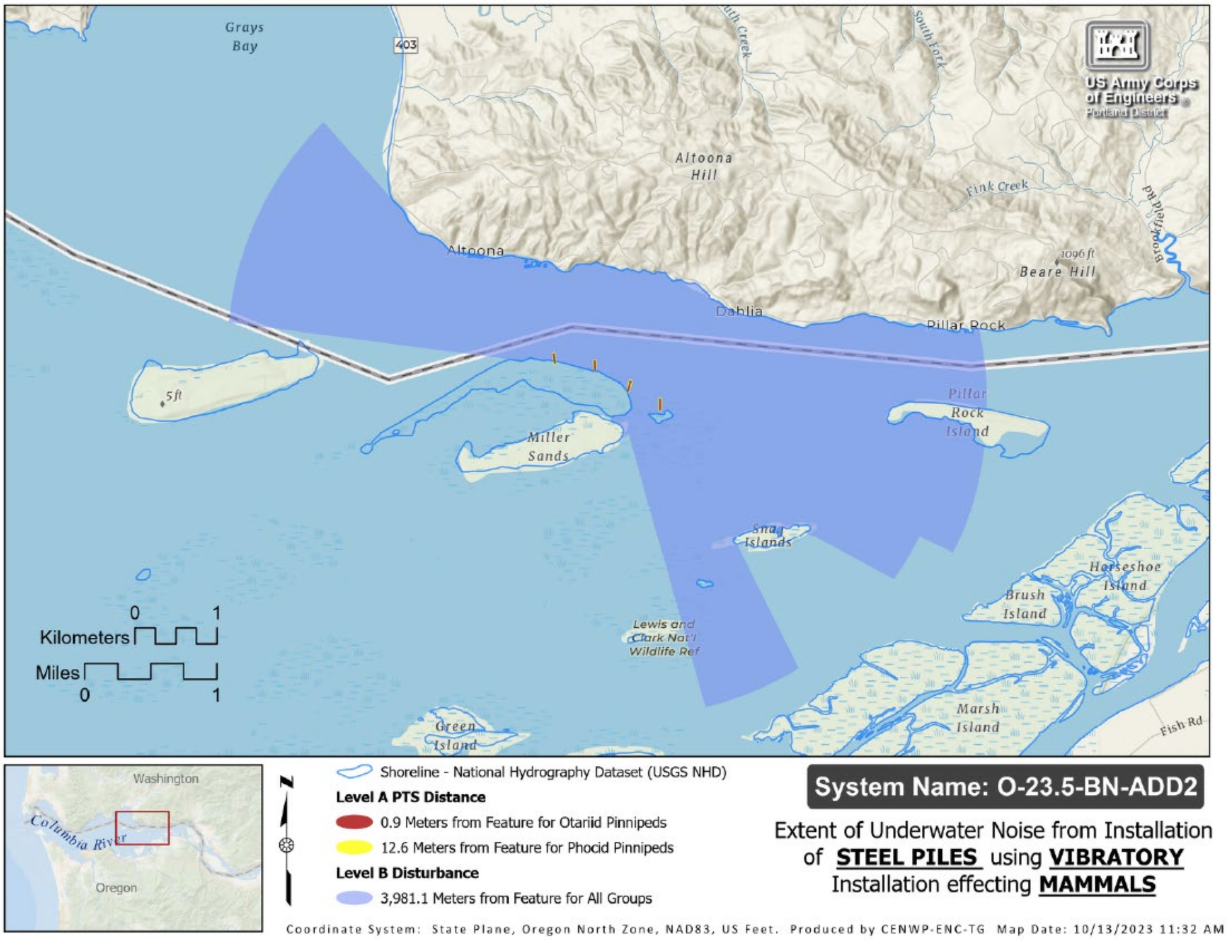

Figure 6-7. Extent of Underwater Noise Marine Mammal Disturbance from VIBRATORY Driving Steel Pipe Piles, O-23.5-BN-ADD2

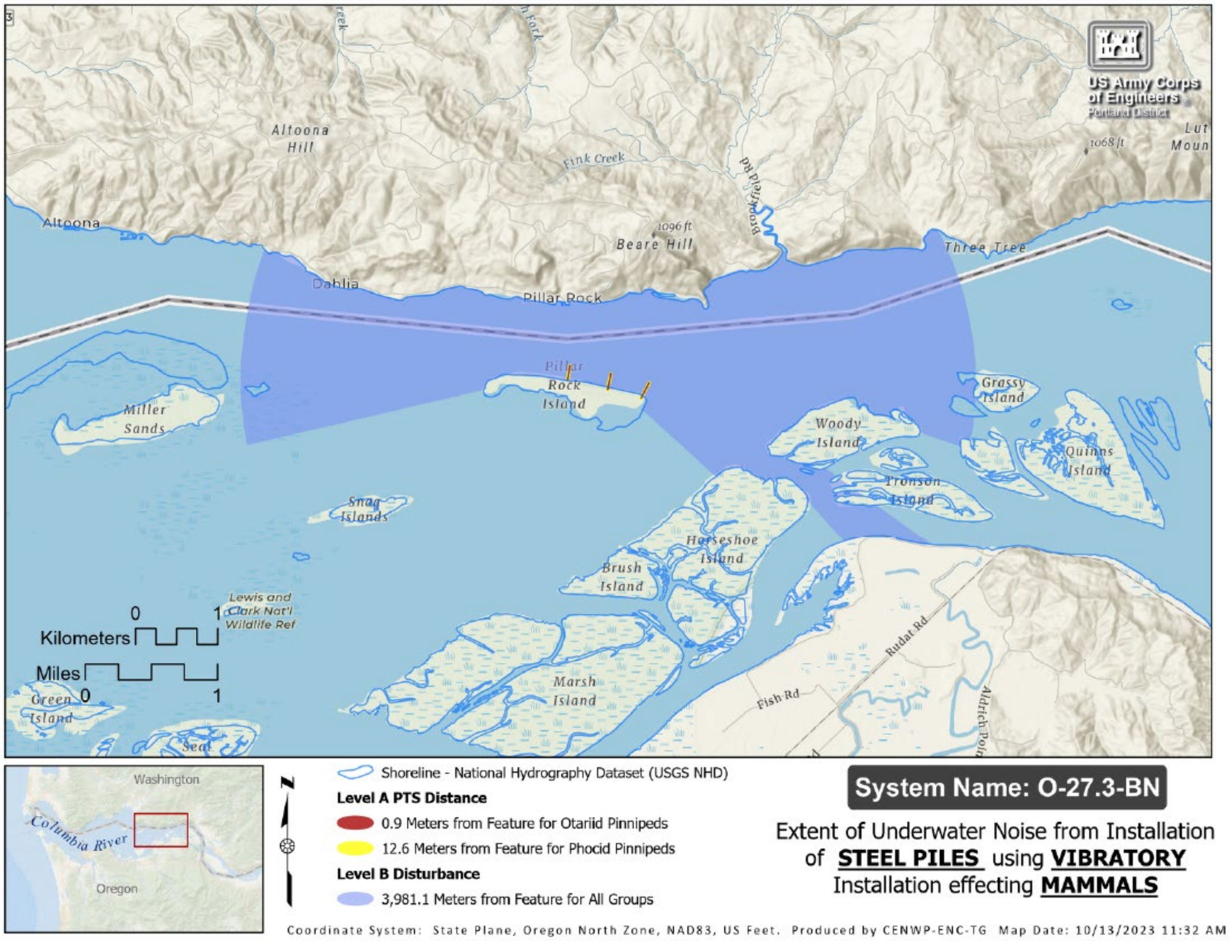

Figure 6-8. Extent of Underwater Noise Marine Mammal Disturbance from VIBRATORY Driving Steel Pipe Piles, O-27.3-BN

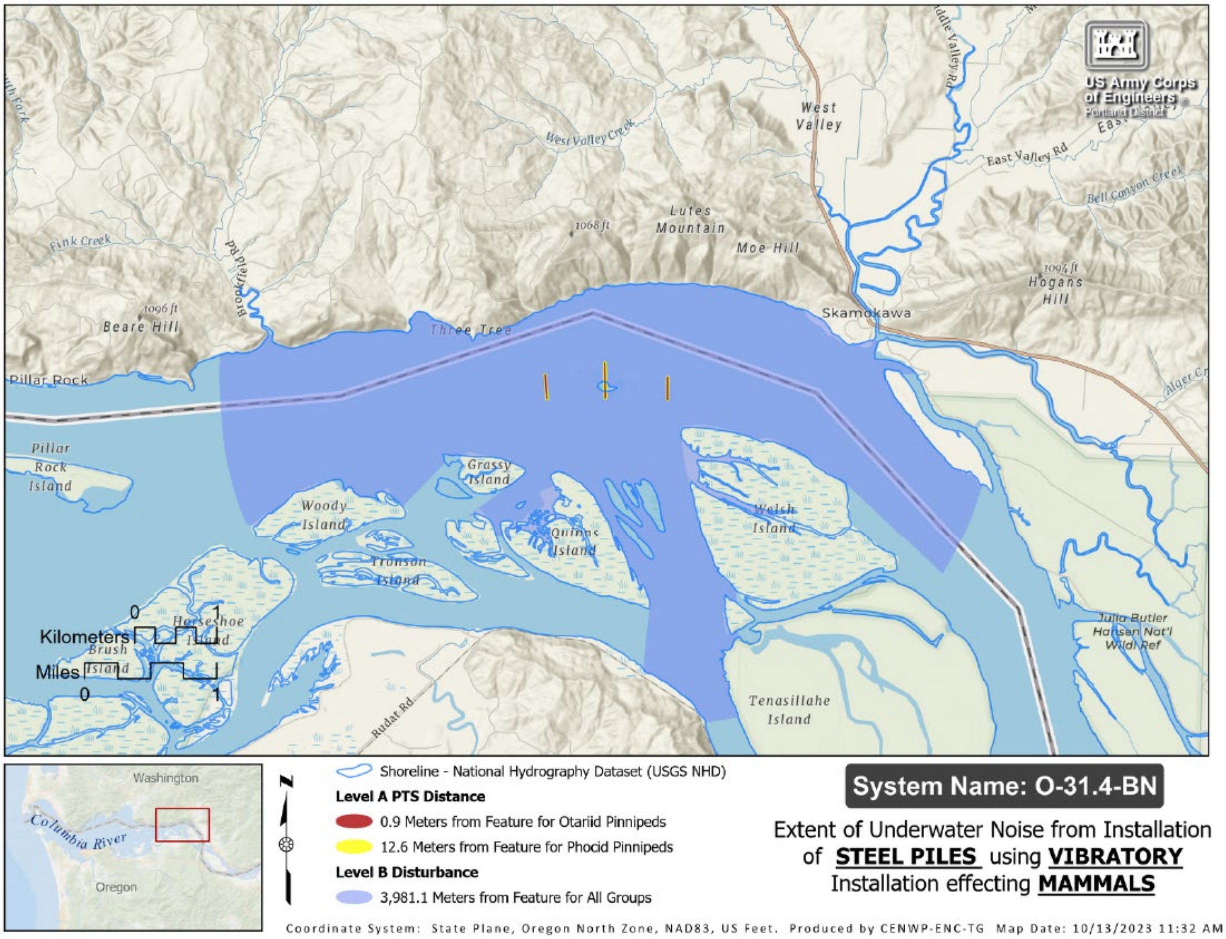

Figure 6-9. Extent of Underwater Noise Marine Mammal Disturbance from VIBRATORY Driving Steel Pipe Piles, O-31.4-BN

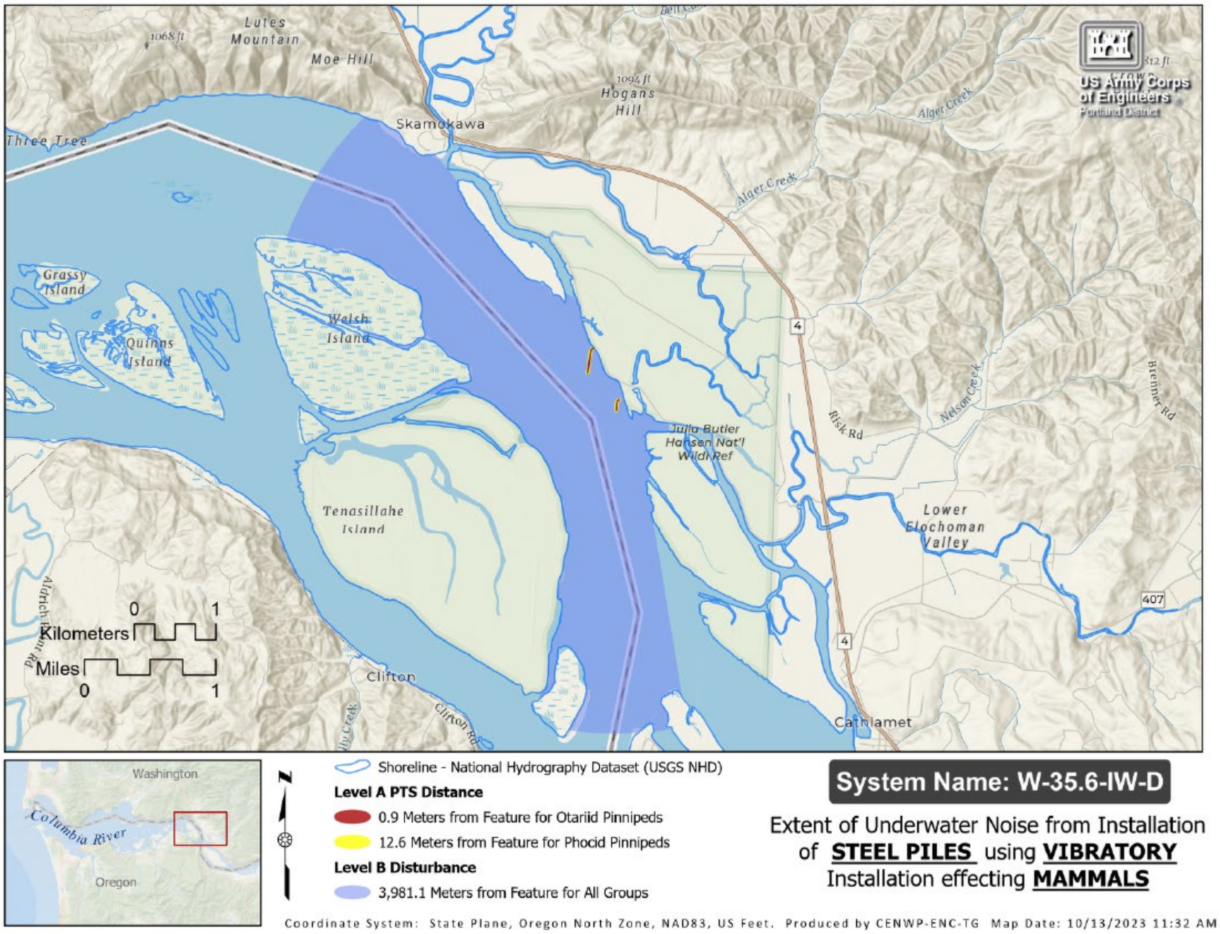

Figure 6-10. Extent of Underwater Noise Marine Mammal Disturbance from VIBRATORY Driving Steel Pipe Piles, W-35.6-IW-D

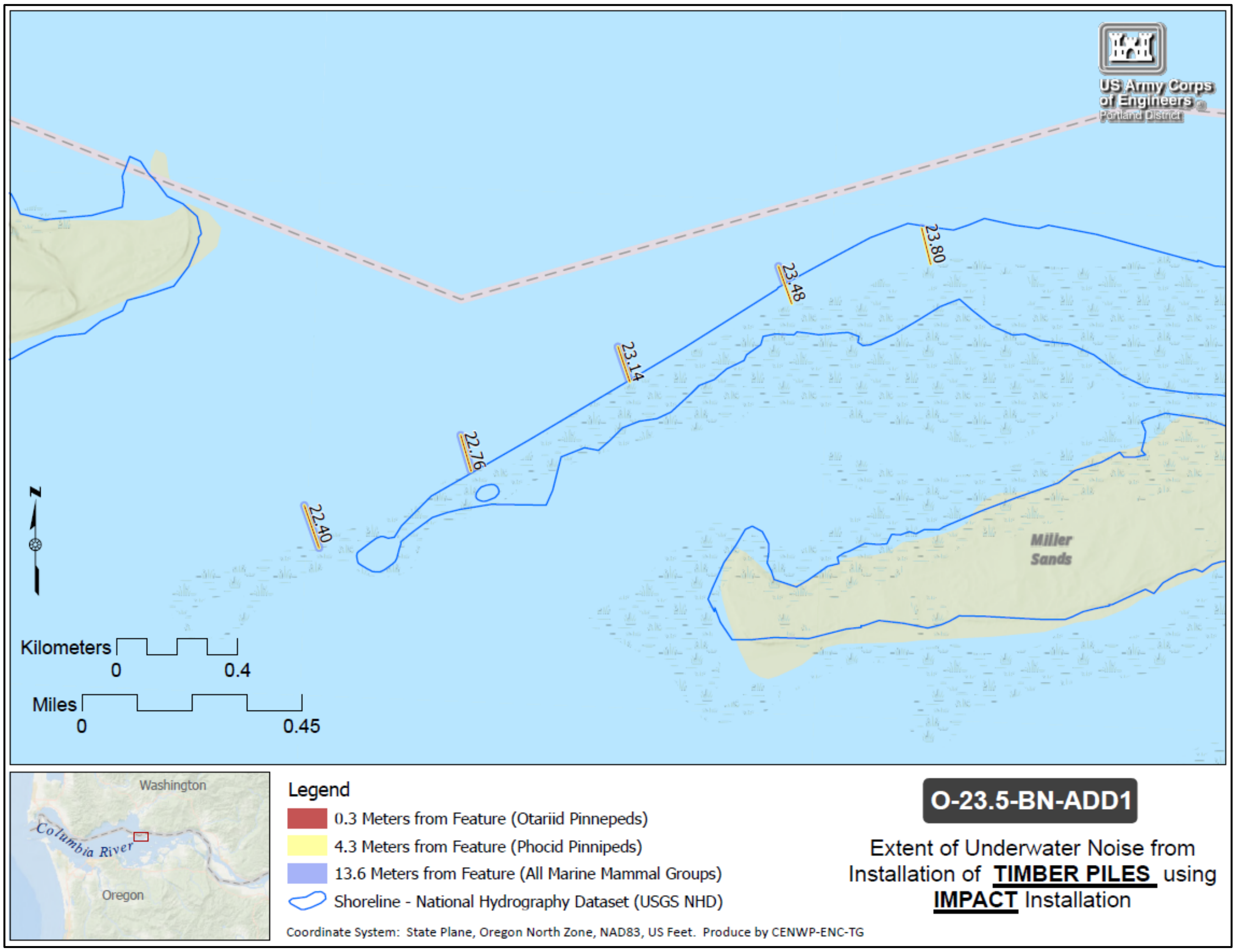

Figure 6-11. Extent of Underwater Noise Marine Mammal Disturbance from IMPACT Driving timber piles, O-23.5-BN-ADD1

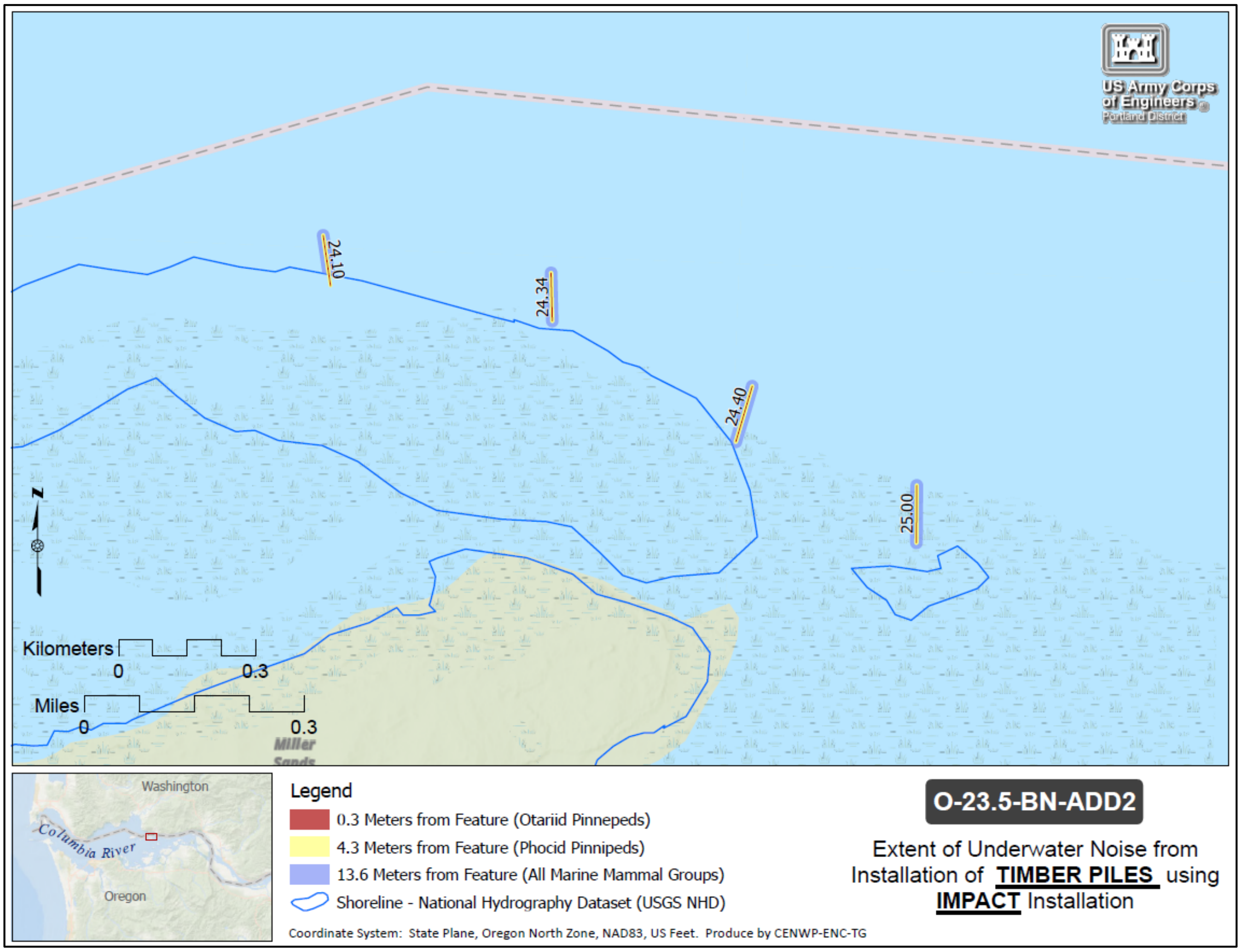

Figure 6-12. Extent of Underwater Noise Marine Mammal Disturbance from IMPACT driving timber piles, O-23.5-BN-ADD2

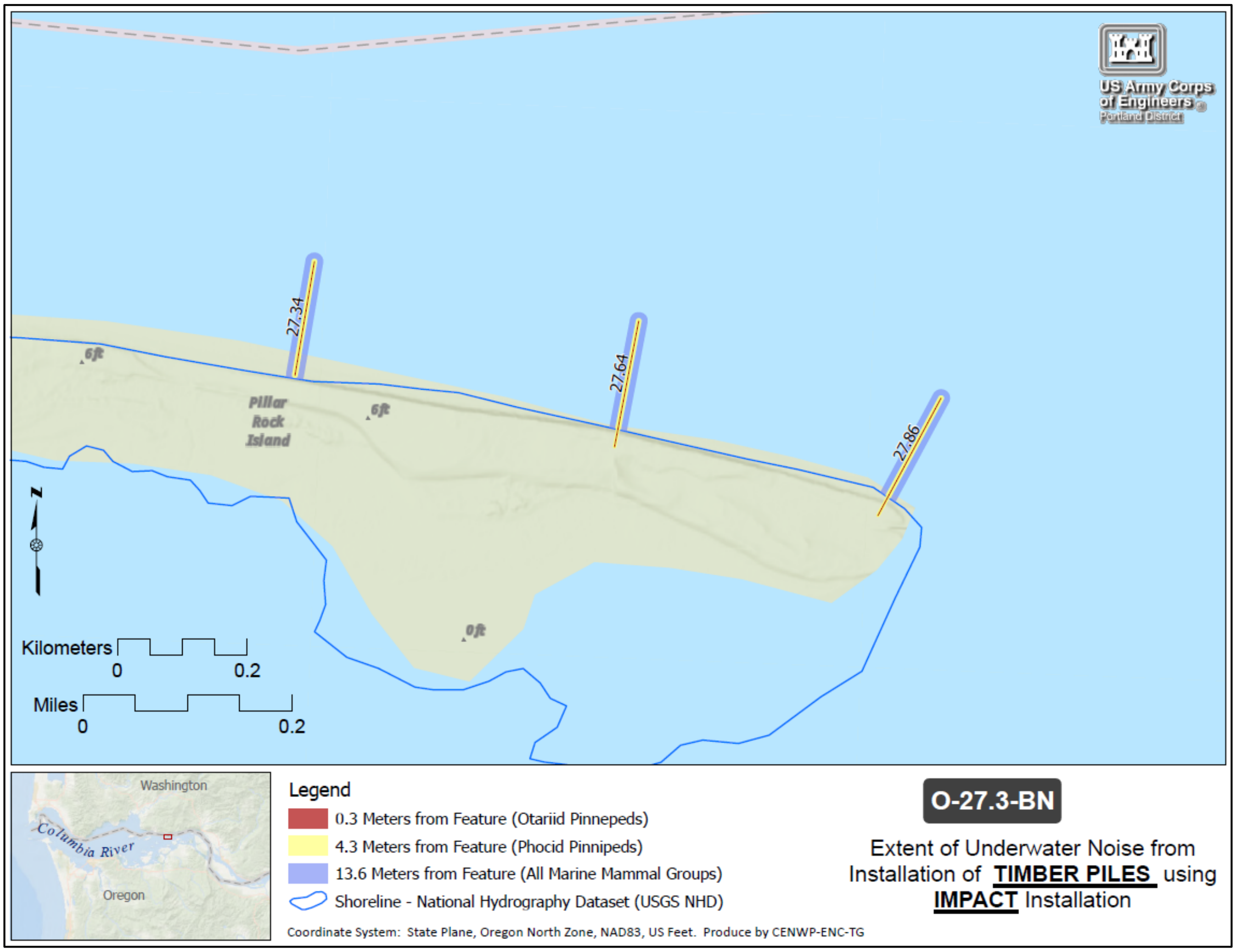

Figure 6-13. Extent of Underwater Noise Marine Mammal Disturbance from IMPACT Driving Timber Piles, O-27.3-BN

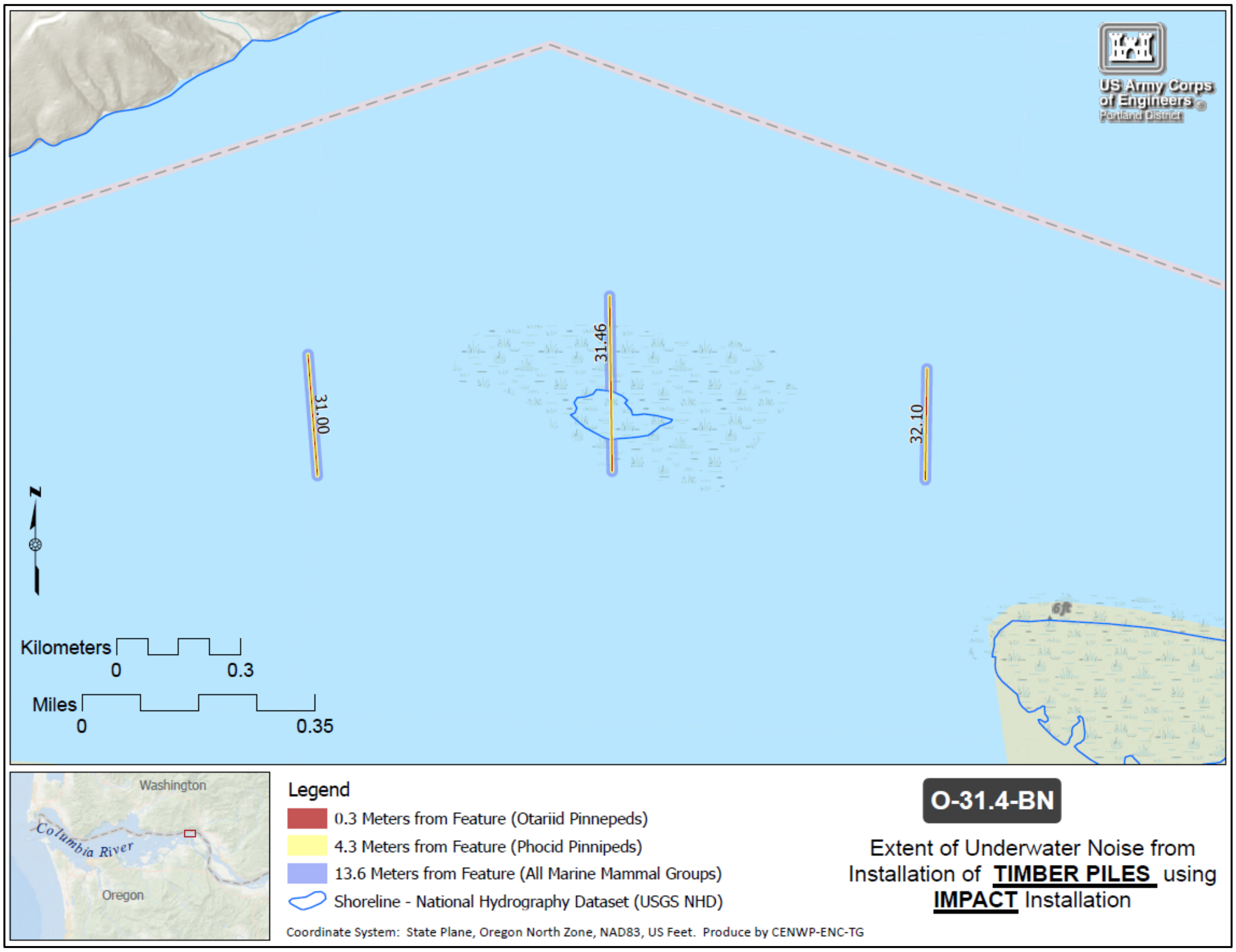

Figure 6-14. Extent of Underwater Noise Marine Mammal Disturbance from IMPACT Driving Timber Piles, O-31.4-BN

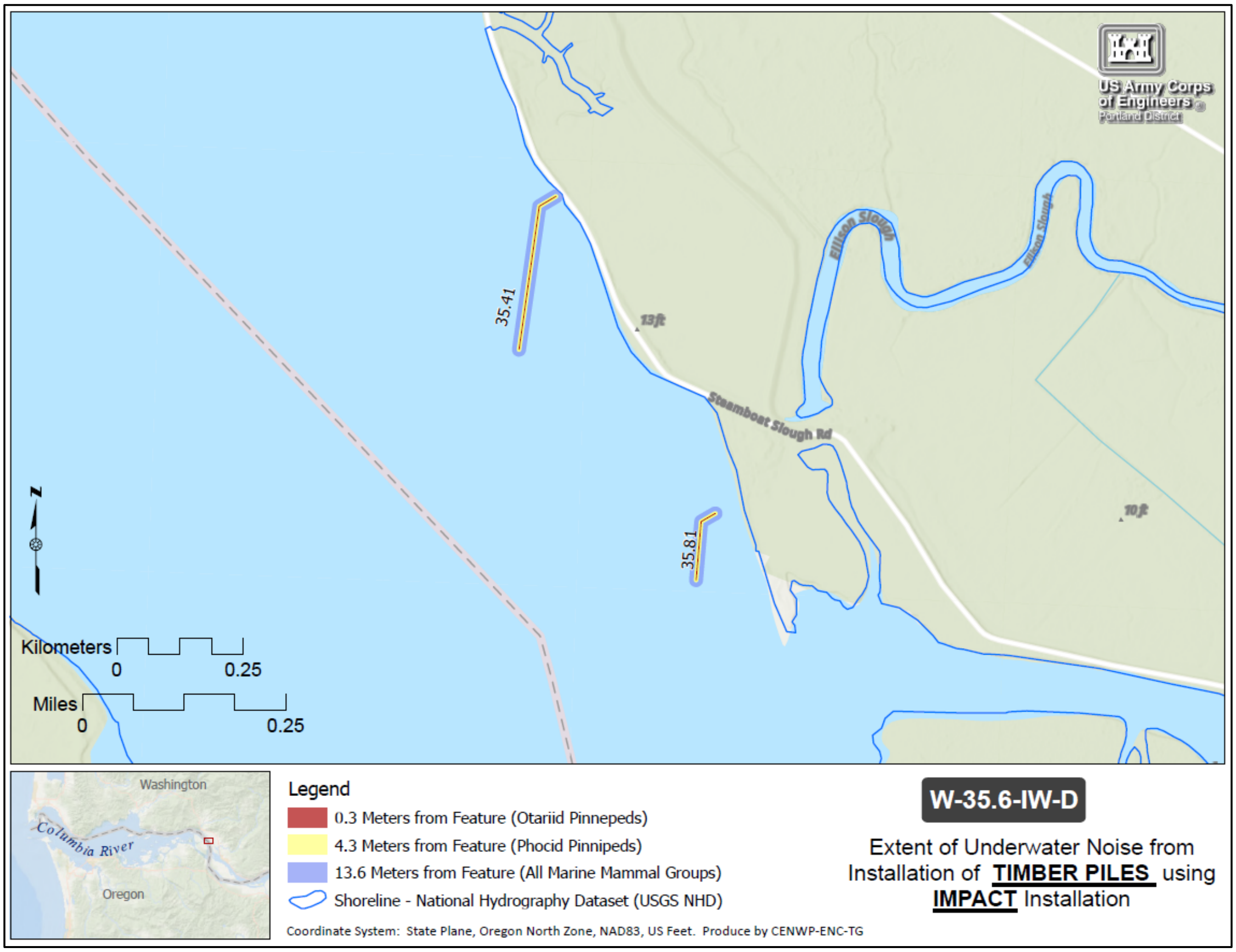

Figure 6-15. Extent of Underwater Noise Marine Mammal Disturbance from IMPACT Driving Timber Piles, W-35.6-IW-D

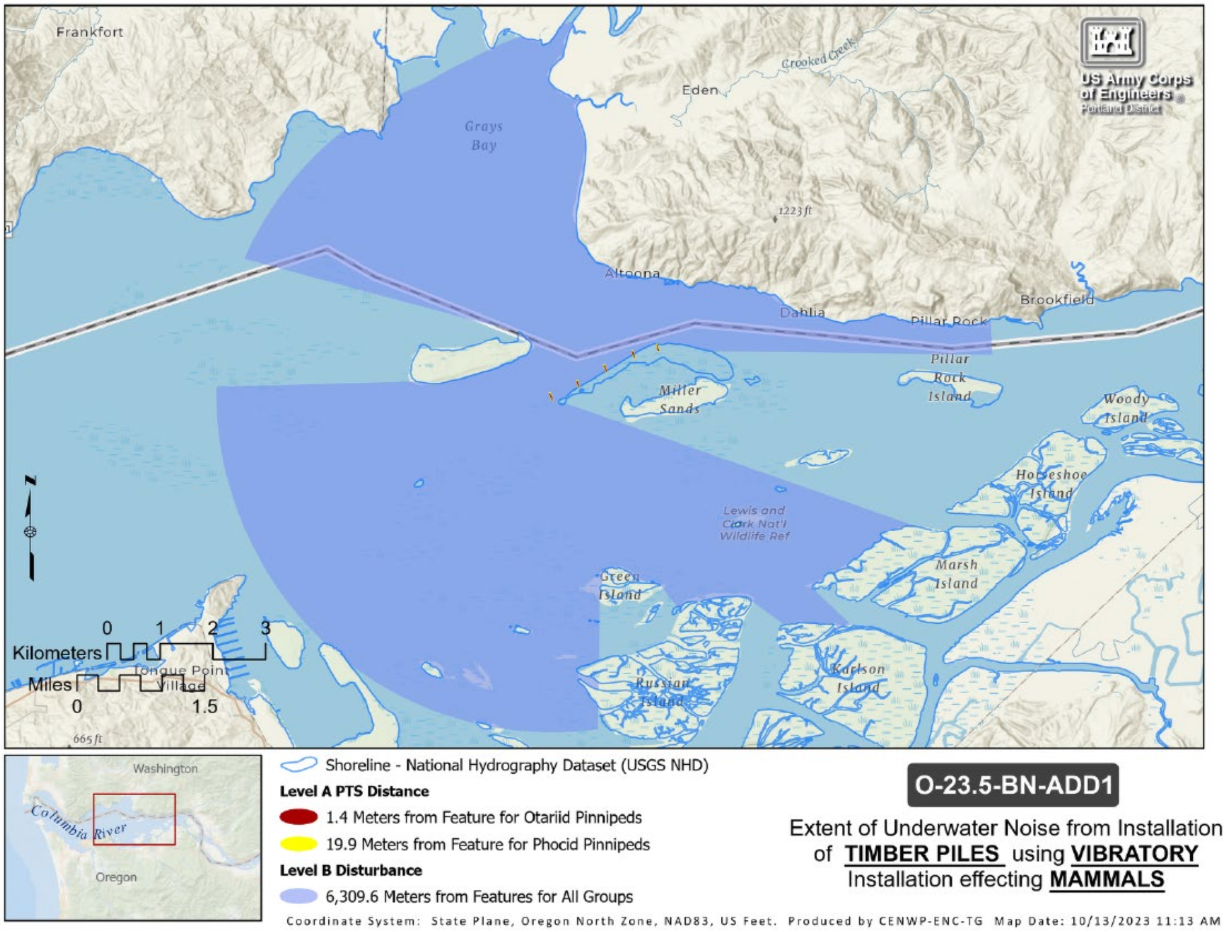

Figure 6-16. Extent of Underwater Noise Marine Mammal Disturbance from VIBRATORY Driving Timber Piles, O-23.5-BN-ADD1

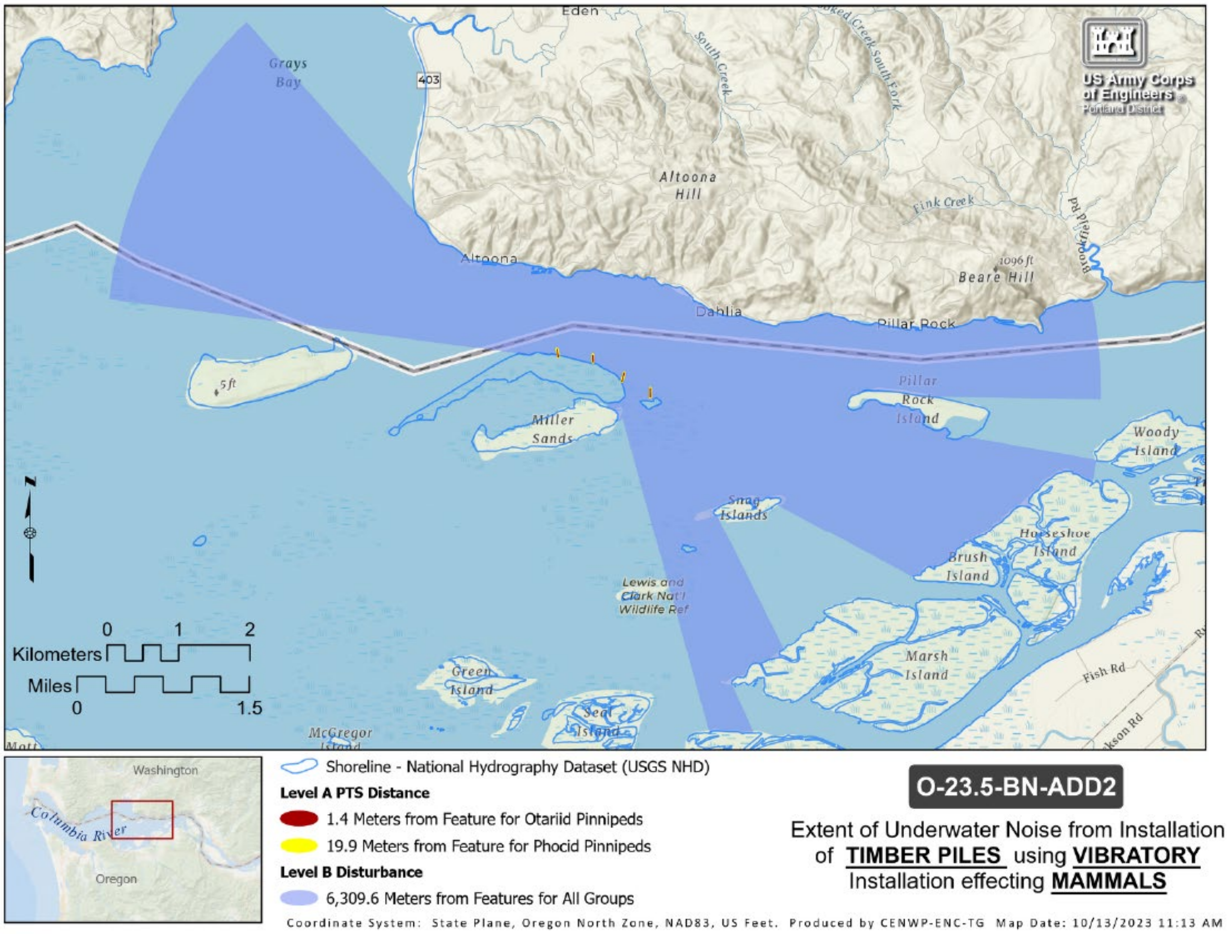

Figure 6-17. Extent of Underwater Noise Marine Mammal Disturbance from VIBRATORY Driving Timber Piles, O-23.5-BN-ADD2

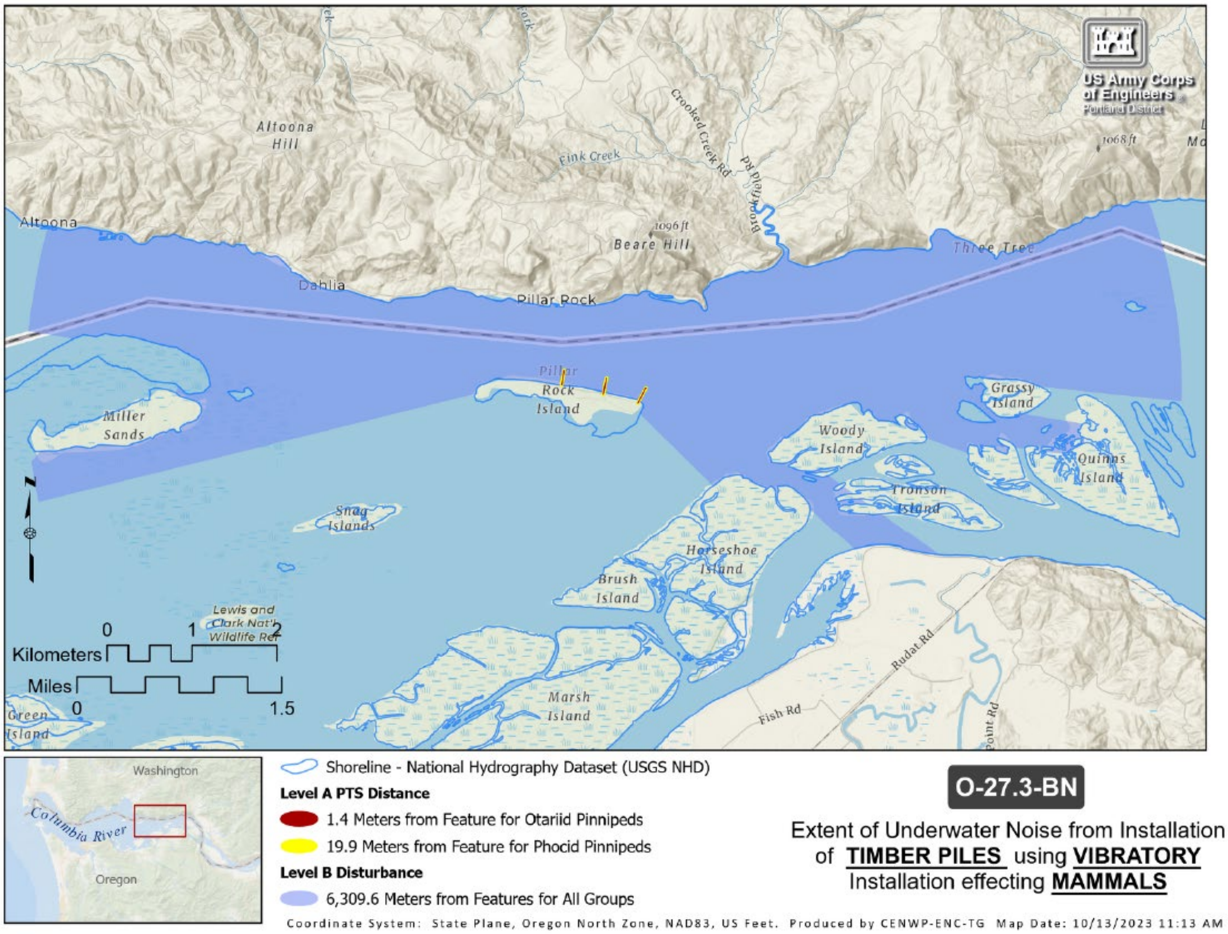

Figure 6-18. Extent of Underwater Noise Marine Mammal Disturbance from VIBRATORY Driving Timber Piles, O-27.3-BN

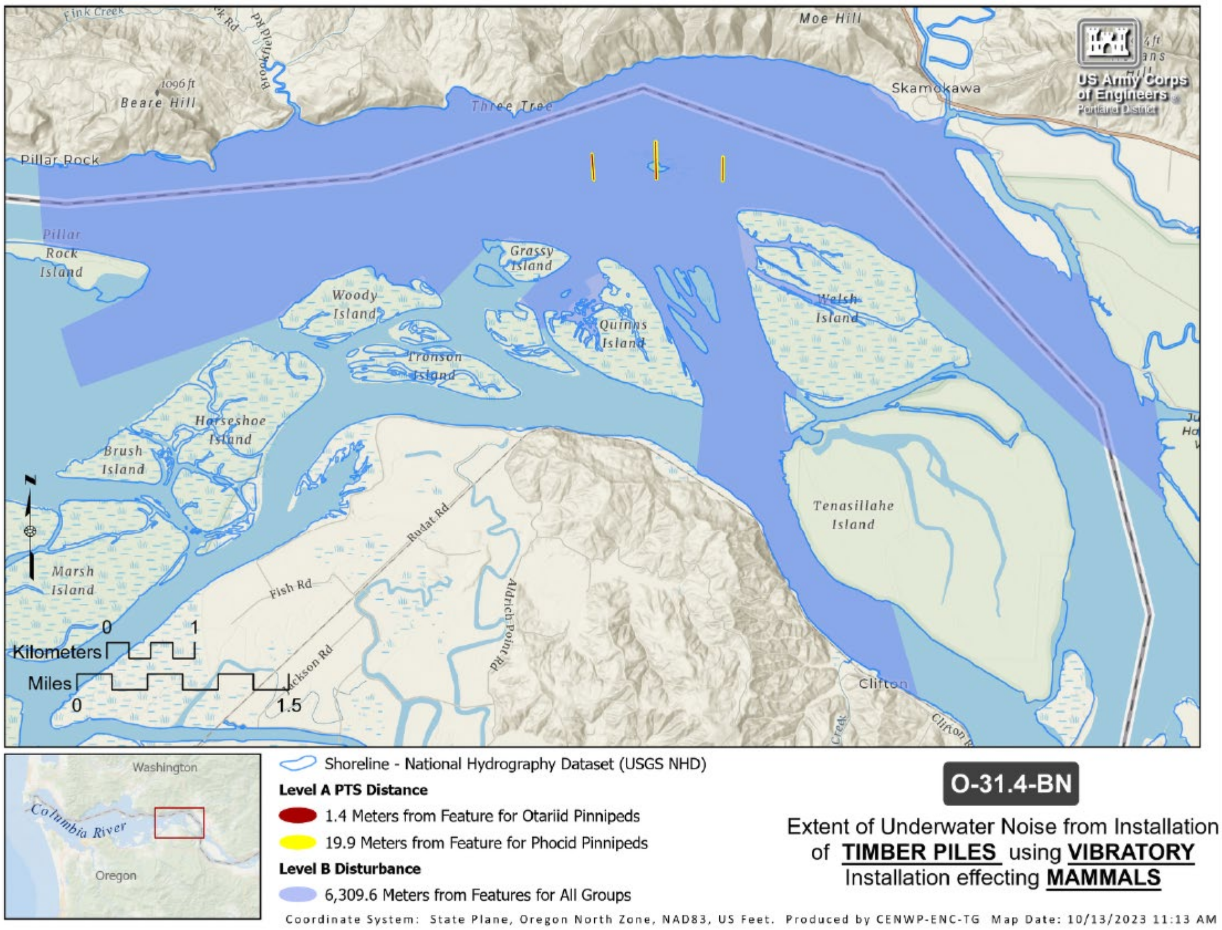

Figure 6-19. Extent of Underwater Noise Marine Mammal Disturbance from VIBRATORY Driving Timber Piles, O-31.4-BN

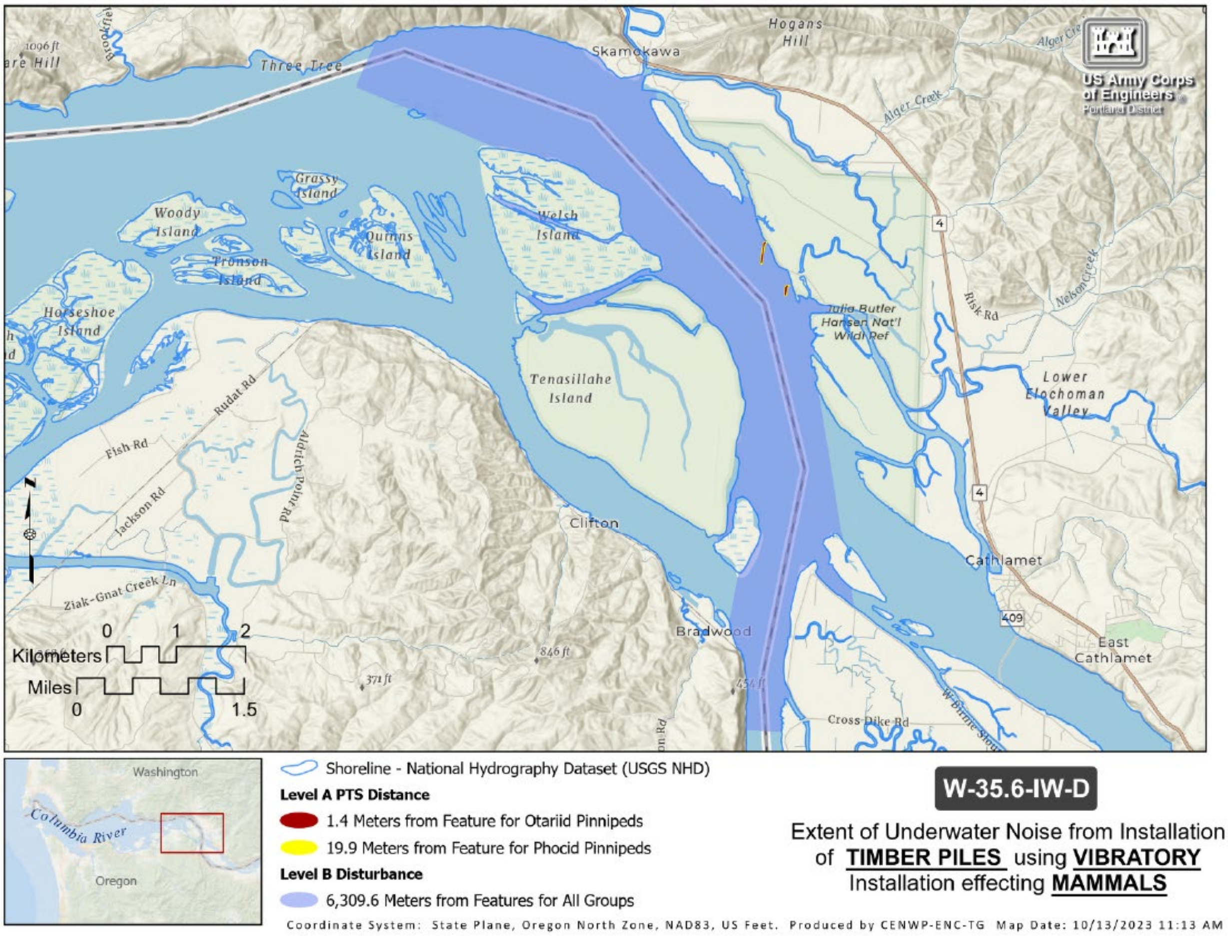

Figure 6-20. Extent of Underwater Noise Marine Mammal Disturbance from VIBRATORY Driving Timber Piles, W-35.6-IW-D

6.5 Reference Marine Mammal Abundances

The Oregon Department of Fish and Wildlife (ODFW) conducts periodic counts of pinnipeds at haul out sites along the Oregon coast and in the Columbia River. The Washington Department of Fish and Wildlife (WDFW) has also collected recent anecdotal evidence of pinniped abundance at haul out sites in the Columbia River near the confluence of the Cowlitz River. We used the proximal count estimates from Oregon ODFW and WDFW to estimate the number of harbor seals, Steller sea lions, and California sea lions that could transit or occupy the project area during proposed pile driving in winter (i.e., November through February). For sea lions, we estimated the maximum number of animals likely to be encountered in a single day based on the maximum number of animals detected at haul out sites within 5-miles of proposed pile driving, as well as the closest haul out sites upstream or downstream. For harbor seals, we estimated the harbor seal density using the approximate span of river where they have been observed at haul out sites (i.e., see Figure 4-1). All estimates are conservative and likely over-estimate the number of animals likely to be in the direct project vicinity. The Level A and Level B take estimates are likely much higher than the actual number of pinnipeds that may be harassed or disturbed during proposed pile driving activities.

Harbor seals

The latest harbor seal aerial surveys were conducted by ODFW during the 2021 summer pupping season. The average, maximum daily count of harbor seals counted across all haulout sites in the project vicinity in May and June was 837 (pups and non-pups combined) (B.E. Wright, personal communication, 15 May 2023). After applying the Huber et al. (2001) correction factor of 1.53, used to account for likely imperfect detection during surveys, the adjusted number of harbor seals that may have been present during the 2021 surveys was approximately 1,281 individuals. However, that estimate is not necessarily representative of the number of harbor seals that may be present in winter. Jeffries et al. (1984) synthesized survey data collected by the state of Washington to document pinniped abundance and distribution in the Columbia River between 1980 and 1983. Table 6-1 summarizes the harbor seal count by month detected over that roughly 3-year study period (Jeffries et al. 1984).

We used the information from Jeffries et al. (1984) included in Table 6-1 to calculate the average, maximum total count observed across all haulout sites in the project vicinity of harbor seals to estimate the proportion of animals present Nov – Feb relative to counts observed May – June. The average harbor seal count observed between November and February was approximately 618 animals, whereas the average count for May and June was roughly 464. The count of harbor seals in winter was 1.33 times the number counted in May and June. Thus, to account for this seasonality, the most recent estimate of 1,281 harbor seals in the project vicinity during the pupping season, based on ODFW counts, could equate to a maximum of 1,706 harbor seals in the project vicinity each day in winter. While the seasonal correction factor we imposed is based on data that is over 40 years old, all recent surveys have focused solely on the summer pupping season and there is no winter data corresponding to those counts. Thus, we relied on available data from a historic study that included counts for multiple seasons in the same year.

Table 6-1. Maximum monthly counts of harbor seals detected during low-tide aerial surveys at haulout locations in the lower Columbia River Estuary between 1980 and 1983 (adapted from Jeffries et al. 1984).

Month	South Jetty	Baker Bay	Desdemona Sands	Taylor Sands	Grays Bay	Miller Sands	Green Island	N. of Woody Is.	TOTAL
January	0	0	566	444	1	381	0	72	1464
February	0	NS	NS	NS	NS	200*	NS	55	255
March	1	0	650*	548	0	82	0	3	1284
April	0	20*	884	260	20*	137	0	18	1339
May	0	1	568	4	4	0	16	0	593
June	1	0	273	22	11	1	26*	0*	334
July	0	0	525	21	10	0	38	0	594
August	3	7	378	0	0	32	35	0	455
September	4	11	563	7	12	0	26	0	623
October	0	25*	223	59	0	6	0	0	313
November	NS	NS	230*	NS	NS	NS	NS	NS	230
December	0	0	301	174	0	46	0	0	521

NS = Not Surveyed
*Count based on visual estimate from airplane, boat, or jetty

California and Steller sea lions

The ODFW counted sea lions during recent aerial surveys of three key haulout locations in the lower Columbia River. All sea lions detected in winter are nonpup males and average counts of both California and Steller sea lions observed during surveys between 2019 and 2022 are shown in Table 6-2. Sites correspond to the locations shown in Figure 4-2. The haulout at East Mooring Basin (EMB) is just south of the project area and likely downstream of pile driving noise disturbance isopleths. However, we are using the average counts observed there as a proxy for sea lions that may be present during pile driving. We used the average across all winter months as our proxy for the number of sea lions in the project area. Based on counts of sea lions at the EMB site (Table 6-2), we estimated 182 California sea lions and 3 Steller sea lions per day in the project vicinity.

Table 6-2. Average counts of California and Steller sea lions detected at haulout locations depicted in Figure 4-2 during ODFW winter aerial surveys, 2019-2022 (B.E. Wright, 15 May 2023).

Haulout Site	Month	Average of CSL	Average of SSL
East Mooring Basin (EMB)	November	128	0
	December	234	3
	January	166	4
	February	197	5
Rainier	November	0	0
	December	0	0
	January	55	27
	February	213	42
Coffin Rock	January	0	17
	February	3	15

*CSL = California Sea Lion; SSL = Steller Sea Lion

6.6 Take Calculations

Take estimates for California and Steller sea lions were calculated based on Equation 4 and work assumptions listed in Table 2-2.

(Equation 4)

$$Level\ B\ Exposure = N\ animals\ per\ day * total\ pile\ driving\ workdays$$

There could be 25 total days of noise exposure from pile driving during year 1 (YR-1); 34 days in YR-3; 30 days in YR-4, and up to 51 days in YR-5. Noise exposure from pile driving would be discontinuous over the in-water work window. Only enrockment will be placed in YR-2 so there is no estimated take associated with in-water pile driving. The number of animals, *N*, in the monitoring zone (or project area) is based on general assumptions about their likely daily abundance in the vicinity (i.e., see Section 6.1.5). For harbor seals only, the Level A and Level B take is calculated based on Equations 5 and 6, respectively. We assumed the maximum winter abundance of 1,706 individuals and an even distribution of animals throughout the span of river between the river mouth and the upstream end of Tenasillahe Island (Figure 6-21). The hatched area in the figure is roughly 377 km^2 which yielded an approximate daily harbor seal density of 5 individuals per square kilometer in the project area. The Level A take is likely an overestimate because the likelihood of a harbor seal coming within 79 meters of the pile during the brief period of potential impact driving that could be needed to reach the last ~5 feet of embedment depth is fairly low. In addition, we assume the Level A isopleth area of the longest pile dike at each site, when in actuality, some sites have shorter structures and a pile dike is composed of multiple individual piles with much smaller noise isopleths.

(Equation 5)

$$Level\ A\ Exposure = HS\ density * Level\ A\ isopleth\ area * steel\ pile\ driving\ workdays$$

(Equation 6)

$$Level\ B\ Exposure\ (steel\ piles) = HS\ density * Level\ B\ \text{vibratory}\ isopleth\ area * \text{steel}\ pile\ driving\ workdays - Level\ A\ Take\ (HS\ only)$$

or

$$Level\ B\ Exposure\ (timber\ piles) = HS\ density * Level\ B\ \text{vibratory}\ isopleth\ area * timber\ pile\ driving\ workdays$$

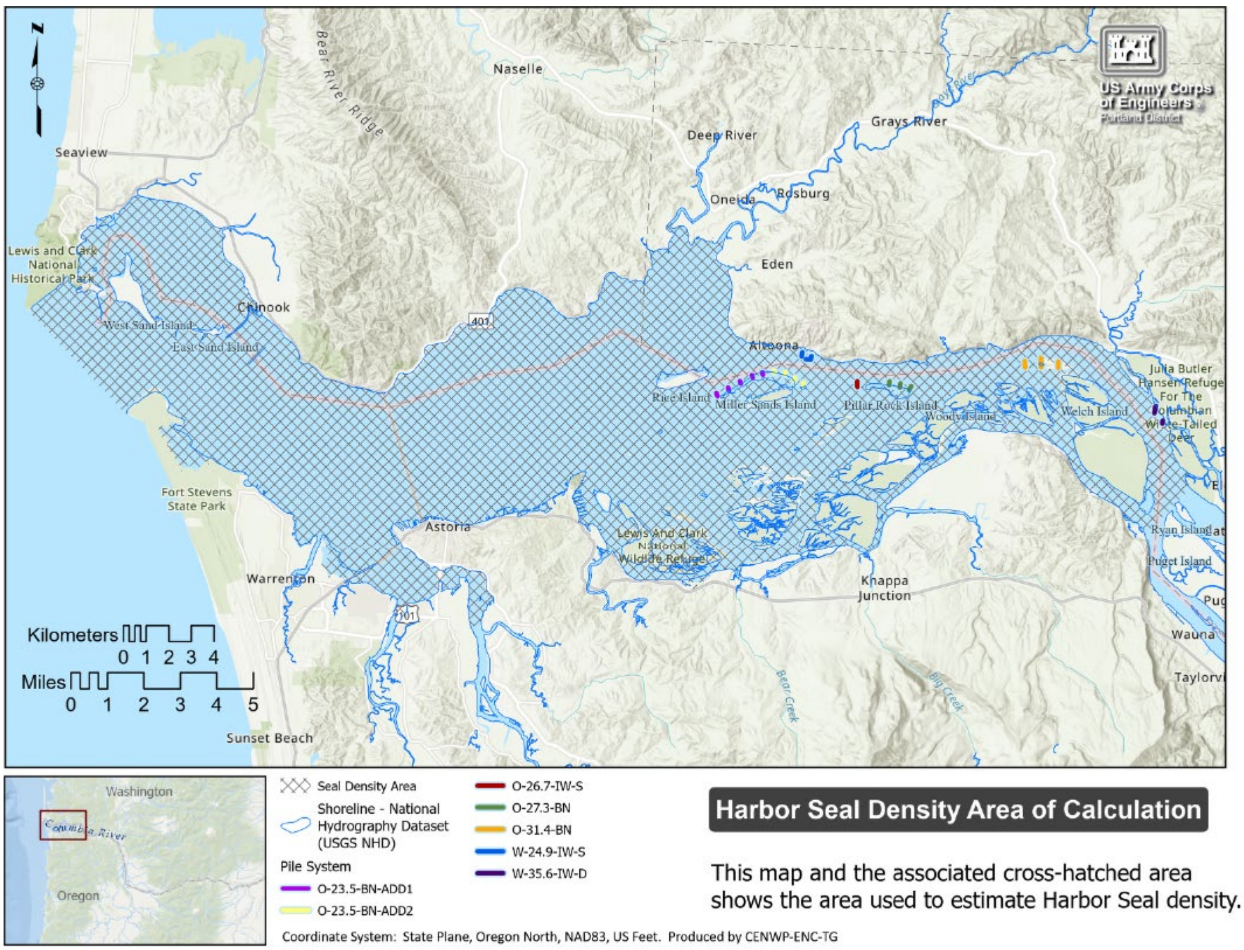

Figure 6-21. Approximate area of harbor seal distribution in the lower river, based on observed haul out sites, that was used for estimating harbor seal density in the project vicinity.

The estimated isopleth areas associated with the longest pile dike at each site are presented in Table 6-3. These inputs were used in Equations 5 and 6, to first estimate the number of harbor seals possible within those isopleths each day (Table 6-4), then calculate the overall level of incidental take based on the number of workdays projected in each year (Table 6-5). The take levels for California and Steller sea lions were based on assumed daily abundances in the project area, not estimated densities, and are presented in Table 6-6. Lastly, we estimated the percentage of each stock that could be affected by pile driving noise, when stock size estimates were available (Table 6-7).

Table 6-3. Isopleth areas used to estimate harbor seal incidental take.

Site	Pile Dike (approximate)	Phocids Level A (km^2) 24-in Steel Impact	All Marine Mammals Level B (km^2) 24-in Steel Impact	All Marine Mammals Level B (km^2) 24-in Steel Vibratory	All Marine Mammals Level B (km^2) 12-in Timber Vibratory
O-23.5-BN-ADD1	22.40	0.043	0.20	37.29	81.45
O-23.5-BN-ADD2	25.00	0.037	0.15	18.06	30.79
O-27.3-BN	27.86	0.038	0.17	13.52	22.97
O-31.4-BN	31.46	0.073	0.31	17.97	26.33
O-35.6-IW-D	35.41	0.062	0.21	10.70	16.51

Table 6-4. Harbor seals estimated in each isopleth area per day.

Site	Installation Timeframe	HS* in Level A Isopleth Area 24-in Steel Impact	HS in Level B Isopleth Area 24-in Steel Impact	HS in Level B Isopleth Area 24-in Steel Vibratory	HS in Level B Isopleth Area 12-in Timber Vibratory
O-23.5-BN-ADD1	LOA YR-3	1	1	187	408
O-23.5-BN-ADD2	LOA YR-1	1	1	91	154
O-27.3-BN	LOA YR-4	1	1	68	115
O-31.4-BN	LOA YR-5	1	2	90	132
O-35.6-IW-D	LOA YR-2	1	2	54	83

*Approximate number of harbor seals (HS) within each isopleth area, rounded to the next highest whole number, based on multiplying the areas in Table 6-3 by the estimated HS density of 5 animals per square kilometer.

Table 6-5. Level A and Level B Take requested for harbor seals likely to be in the project vicinity during pile driving activities each year.

	Site	*Steel* Pile Driving Workdays	*Timber* Pile Driving Workdays	Level A HS* (steel piles)	Level B HS (steel piles)	Level B HS (timber piles)
YR-1	O-23.5-BN-ADD2	13	12	13	2418	4896
YR-2	O-35.6-IW-D	1	0	1	90	0
YR-3	O-23.5-BN-ADD1	17	17	17	1139	1955
YR-4	O-27.3-BN	15	15	15	1335	1980
YR-5	O-31.4-BN	26	25	26	1378	2075

*Approximate number of harbor seals (HS) subject to incidental take each year based on the number of steel or timber driving workdays and estimated HS abundances within Level A and Level B isopleths areas (Table 6-4). Level B HS take used the steel vibratory area abundance and subtracted the Level A take. Separate Level B take was not allocated to steel impact driving because impact driving to reach pile embedment depth would occur on the same day as vibratory driving, which has a much larger isopleth.

Table 6-6. Level B Take requested for California and Steller sea lions likely to be in the project vicinity.

	Total Pile Driving Workdays	Level B CSL[1]	Level B SSL[2]
YR-1	25	4,550	75
YR-2	1	182	3
YR-3	34	6,188	102
YR-4	30	5,460	90
YR-5	51	9,282	153

[1]Approximate number of California sea lions (CSL) is based on an estimated maximum abundance of 182 CSL/day.
[2]Approximate number of Steller sea lions (SSL) is based on an estimated maximum abundance of 3 SSL/day.

Table 6-7. Summary of Effects of Level A and B Take on affected marine mammal stocks.

Marine Mammal Stock Effects	Stock Abundance[1]	Year 1 Take[2] (% of stock)	Year 2 Take (% of stock)	Year 3 Take (% of stock)	Year 4 Take (% of stock)	Year 5 Take (% of stock)
Harbor seal (*Phoca vitulina richardii*) Oregon and Washington Coast Stock	unknown	Level A: 13 Level B: 7,314	Level A: 1 Level B: 90	Level A: 17 Level B: 3,094	Level A: 15 Level B: 3,315	Level A: 26 Level B: 3,453
Steller sea lion (*Eumetopias jubatus*) Eastern U.S. Stock	43,201 (minimum)	Level B: 75 (0.17%)	Level B: 3 (<0.01%)	Level B: 102 (0.24%)	Level B: 90 (0.21%)	Level B: 153 (0.35%)
California sea lion (*Zalophus californianus*) U.S. Stock, Pacific Temperate Population	233,515 (minimum)	Level B: 4,550 (1.9%)	Level B: 182 (0.08%)	Level B: 6,188 (2.6%)	Level B: 5,460 (2.3%)	Level B: 9,282 (4.0%)

[1]Stock abundance was estimated using latest population estimate from most recent NOAA stock assessments (see Table 4-1).
[2]Estimates combine potential take for installing steel pipe piles and timber piles. Estimated take likely represents repeated take of the same individual(s) and the actual percentage of the stock taken is probably much lower than the values in parentheses.

7 ANTICIPATED IMPACT ON SPECIES OR STOCKS

Proposed work could cause incidental Level A harassment to harbor seals, but potential adverse effects over the duration of construction would be intermittent and likely affect fewer individuals than projected given the limited use of impact hammers. Effects to harbor seals during impact pile driving could include a temporary threshold shift (TTS, i.e., a temporary reduction in hearing sensitivity), PTS, or other non-serious injury. Given that the size of the Level A noise isopleth for phocids is over 100 meters smaller than the Level B harassment isopleth, seals in the vicinity are unlikely to continue traveling toward the source of sound and be subject to PTS or injury. None of the Level A harassment isopleths would obstruct the entire channel, thus marine mammals could still transit up and downriver to forage or engage in other activities without being subject to Level A harassment. No Level A take is requested for California or Steller sea lions because the minimum Shutdown Zone of 15-meters is larger than the largest isopleth (~7 meters) whereby a Level A PTS could occur to otariid species present. No Level A or B take is requested for killer whales or any other large cetaceans due to the low likelihood that they would enter the Columbia River and travel beyond the Astoria Bridge. Should any cetaceans enter the bay and travel beyond Tongue Point during pile driving, shutdown procedures would be implemented to avoid take.

There will likely be incidental Level B disturbance to 3 marine mammal stocks (Table 6-7). These effects would be limited to a period of less than 60 days of in-water pile driving each year. Marine mammal behavioral responses could include avoidance or altered foraging patterns, though these changes would likely be temporary. The greatest levels of Level B harassment would be associated with vibratory pile driving. Level B harassment take would be greatest for the more abundant pinniped populations. Harbor seals would be most affected by proposed actions (Table 6-5). However, it should be noted that these estimates are conservative and likely overestimate the number of individuals that would actually be affected, since the same individuals would likely be subject to take multiple times over the course of work. Proposed work would have negligible, temporary effects on pinnipeds considered, as estimated take would affect less than 1% of the Steller sea lion stock and 4% or less of the California sea lion stock (Table 6-7).

8 ANTICIPATED IMPACT ON SUBSISTENCE USE

The LCR is located within the traditional homeland of the Chinookan-speaking people, based on historical accounts and ethnographic data (Harrison 1989, Silverstein 1990). The Chinook had several divisions that could be distinguished based on cultural-geographics and linguists. Ethnographic groupings that historically relied on LCR resources included Lower Chinook, Willapa/Shoalwater, Wahkiakum, Clatsop, and Kathlamat, Klatskanie, and Cowlitz peoples (Harrison 1989).

The chief occupation of the Chinook people was fishing, for both consumption and trade, but the resource rich environment also provided them with elk, shellfish, various berries, roots, and waterfowl. Salmon was the primary staple, but sturgeon, eulachon, smelt, and herring were also consumed. Lower Chinook peoples also hunted harbor seals, fur seals, sea lions, and sea otters for both food and clothing. Game such as deer and elk, and waterfowl were hunted among the numerous marshes, lakes, and streams in the area. Wapato, cattail, skunk cabbage, horsetail rush, seaside lupine, and various fruits and berries were commonly gathered in low-laying, shoreline, and marsh areas of the LCR for numerous purposes (Harrison 1989). The traditional significance of the cultural plants and animals are well rooted in the customs, beliefs, and practices of the Chinook. They are evident through the traditional patterns of land use, with little distinction between natural and cultural resources (Silverstein 1990).

Subsistence fishing for salmonids and numerous other fish still occurs in the Columbia River. The Columbia River Inter-Tribal Fish Commission (CRITFC) is comprised of four Columbia River treaty tribes (i.e., Nez Perce, Umatilla, Warm Springs, and Yakama) that exercise fishing rights between Bonneville and McNary dams, otherwise known as Zone 6 (Figure 8-1). While non-commercial sports fishers can still utilize Zone 6, commercial fishing is limited to the tribes. Within Zone 6, CRITFC operates and maintains 31 fishing sites for the exclusive use of fishers from the four CRITC member tribes. Fish species that may be caught for subsistence use include all salmon species, steelhead, shad, yellow perch, bass, walleye, catfish, carp, and sturgeon. Although the DMMP project area is below Bonneville Dam, species listed above transit the LCR during migratory periods and may also use the lower estuary for juvenile rearing habitat or foraging.

Figure 8-1. Columbia River fishing zones, with Zone 6 recognized as an exclusive treaty Indian commercial fishing area (https://critfc.org/about-us/columbia-river-zone-6/).

Below Bonneville Dam, the Lower Chinook people are represented by the Chinook Indian Nation (not federally recognized), the Shoalwater Bay Tribe, the Confederated Tribes of the Grand Ronde, the Confederated Tribes of Siletz Indians, and the Cowlitz Indian Tribe. The Chinook Indian Nation, consisting of people that did not move reservations, but rather stayed on their homelands, were briefly recognized by the federal government from 2001-2002. In 1954, the Grand Ronde Reservation was terminated by the United State government and the Siletz Reservation in 1955. Both regained federal recognition in 1983 and 1977, respectively. For those people whose traditional homeland includes the project area, the connection to the land has never ceased or been lost, despite removal to reservations. LCR tribes engage in subsistence fishing and hunting to varying degrees and some are actively engaged in habitat restoration initiatives to improve salmonid habitat. Most, if not all, tribes in the Columbia River hold First Salmon feasts or ceremonies to celebrate their cultural heritage and native people's historic and continued reliance on salmon.

A coarse-level review of available information and maps of proposed confined aquatic placement locations did not reveal any prominent subsistence use sites between RM 23 and RM 36. An evaluation of specific subsistence use areas that may occur along the approximate 100 miles of river spanning the DMMP project area was beyond the scope of our more programmatic assessment of potential effects at this stage of DMMP planning. However, Nation-to-Nation coordination will be sought with LCR tribes prior to project implementation. Should key subsistence use sites be revealed within close proximity of pile driving or placement activities, the Corps will work with tribes to establish BMPs and conservation measures to minimize potential adverse effects at the site scale.

Proposed work to install piles in support of new confined aquatic placement sites could have short-term adverse effects on fish that may be disturbed by pile driving noise. The Corps is in active consultation with NMFS to minimize potential adverse effects to salmon and steelhead. Conservation measures including the use of bubble curtains during impact driving and avoiding peak migration periods will greatly reduce the scope of effects. Effects to subsistence use would likely be negligible over the 5-year LOA duration. In addition, new shallow water placement may actually result in improved habitat conditions in the long-term as placement in deeper areas could facilitate vegetation growth and associated structural and prey benefits for juvenile salmon.

9 ANTICIPATED IMPACTS ON HABITAT

Proposed pile installation and material placement would cause temporary, short-term disturbance to aquatic and benthic fauna in the vicinity. The effects to in-water habitat are primarily due to river hydraulics, sedimentation, and site morphology. For this phase of planning, it was assumed that no post-placement grading of the sites would be conducted. The post-placement terrain of a given site would be similar to the pre-placement condition, except that the site would have a uniform "lift" of dredged material added to pre-placement terrain. Inundation for each candidate site was estimated for the Base Condition, during a typical spring freshet high river flow condition (6 weeks, mid-May through June) and typical late summer low river flow condition (4 weeks, September). Depending on the current site conditions, these changes would affect subtidal and intertidal habitat conditions and cause a shift in the distribution and abundance of flora and fauna over the short or long-term, in comparison with pre-placement conditions.

Once new piles are installed and material is placed, flows and associated sediment transport would be reduced within the area. Assuming structures function as intended, flow toward the FNC would increase in comparison to existing conditions. Further detail on the behavior of confined aquatic placement sites is provided using two representative site examples (i.e., O-26.7-IW-S and O-27.3-BN) along Pillar Rock Island, Oregon near RM 27. Both sites would include construction of new structures (shown in red) to increase the retention of dredged material to be placed and stabilize the adjacent morphology. Existing pile dikes (black) are assumed fully functional and also serve to stabilize existing morphology and increase stability of newly proposed dredged material placement. Figure 9-1 illustrates the hydraulic effects for the two shore-attached confined aquatic placement sites.

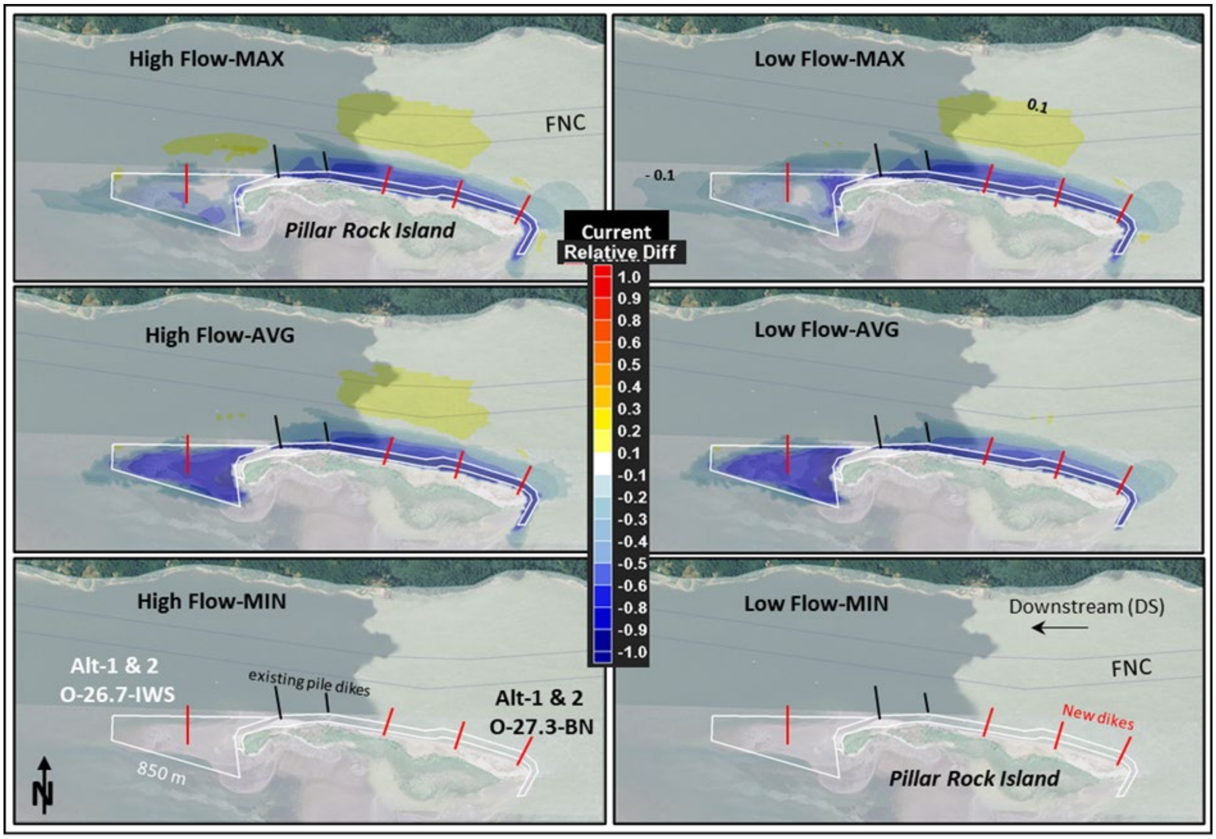

Figure 9-1. Hydraulic effects of two confined aquatic placement sites, O-26.7-IW-S and O-27.3-BN.

Site O-26.7-IW-S is located along the upstream (west) end of Pillar Rock Island and is intended to be roughly 335 m wide and 850 m long encompassing 65 acres. The present riverbed elevation within the proposed IW-S site varies from -2 to 1 m NAVD. Approximately 1.5 m (5 ft) (lift) of dredged material would be placed within this IW-S site totaling 630 kcy. A new approximately 260 m (850 ft) structure would be constructed as part of the feature's implementation to reduce currents within the site, prevent transport of the placed dredged material, and confine the material within the site. Fully implemented, this feature would stabilize the downstream end of Pillar Rock Island, improve current alignment with the river's thalweg, and reduce the transport of mobilized sediment into the FNC. Areas of this IW-S site could provide additional emergent-shallow water habitat.

Beach nourishment site O-27.3-BN is located along the north-facing shore of Pillar Rock Island adjacent to an existing upland placement site. O-27.3-BN is intended to be approximately 110 m wide and 240 m long encompassing 32 acres. The present bed elevation within the proposed BN site varies from -6 m to 2 m NAVD. Between 3.7-6.1 m (12-20 ft) (lift) of dredged material would be placed within this BN site totaling 600 kcy. Three new structures would be constructed as part of the feature's implementation to reduce currents within the site, prevent transport of the placed dredged material, and confine the material within the site. Fully implemented, this feature would stabilize the upstream end of Pillar Rock Island, divert currents away from the present eroding north side of Pillar Rock Island, increase current magnitude, improve current alignment within the river's thalweg, and reduce shoaling within the FNC.

Implementation of O-26.7-IW-S & O-27.3-BN will have a moderate long-term effect on seasonally-averaged river current within each site (currents will be decreased by ≥40% within 40 m of the site). Within 100 m of O-26.7-IW-S, the site will have a minor-moderate effect (20-40% reduction) on river current; beyond 100 m the site will have negligible effect (<10%) on seasonally-average currents. Within 100 m of O-27.3-BN, the site will have a significant effect on river current (40-60% reduction). Within 100-300 m of O-27.3-BN, the site will have a moderate effect (20-40% reduction) on river current; beyond 300 m the site will have negligible effect on seasonally-average currents. For the maximum currents (top two insets in Figure 9-1), implementation of O-26.7-IW-S & O-27.3-BN will have a minor long-term effect on increasing current within the river thalweg and FNC (by 10-20%), 300-500 m north of each site. This effect on maximum current is due to the riverward encroachment of each site to reduce current within the feature and displace flow toward the river thalweg. Increased current velocity within the main channel is not anticipated to have significant adverse effects to habitat in the channel. Fish swimming speeds could be affected as fish moving against the current might need expend slightly more energy to compensate for higher flow rates when transiting adjacent to the feature. However, slower currents closer to the placement site may favor juvenile fish seeking rest or refuge as they move downstream.

The effect of adding 5 ft of dredged material to the Base Condition riverbed of a candidate IW-S site, or 20 ft to a candidate BN site, will make the site's riverbed emergent, significantly reducing or eliminating water flow over the IW-S or BN surface as compared to the Base Condition. This is why the affected area for either site has a negative relative change for currents. As the implemented IW-S or BN surface encroaches on the river's flow-way, there is a minor increase in current riverward of the feature footprint, within the FNC. Meaningful net erosional loss of placed dredged material from within either feature is not expected, as the position of the existing and new structures help to stabilize the site's morphology. The above assessment applies to both high- and low-flow scenarios. During periods when river current speed is at/near minimum values, the feature is not expected to alter river hydraulics within or beyond the site.

The relative changes in river current shown in Figure 9-1 indicate that there may be minor to moderate long-term changes in sediment transport, sedimentation, or morphology for locations within 100-300 m of each feature. Sediment transport will be decreased within affected areas resulting in increased deposition. Sediment transport may be slightly increased within the river thalweg (300-500 m north) as a result of implementing O-26.7-IW-S and O-27.3-BN; but a minor decrease in FNC shoaling is anticipated. Within the footprint of each feature, there could be additional deposition of sediment at localized areas, but the morphology of each feature is expected to be stable over the long-term. Four of the five confined aquatic placement sites included in this LOA application are BN sites that would have similar dynamics as discussed for O-27.3-BN. The remaining enrockment site (i.e., W-35.6-IW-D) involves initial placement in deeper water, but the overall structure would functions similarly to other proposed structures, with an anticipated increase in shallow-water habitat comparable to O-26.7-IW-S.

Physical injury or mortality to benthic organisms will likely occur during material placement. This can cause a slight, temporary reduction in prey species for aquatic animals such as pelagic fish (e.g., ESA-listed salmon, etc.). Recolonization of disturbed habitat can take up to one year or longer depending on the site, sediments, and diversity of organisms present pre-placement (Hitchcock et al. 1996). Disturbance tolerant species would recolonize the area first and more rapidly, within a few months (Pemberton and MacEachern 1997). They are usually more mobile and/or rapid builders or burrowers, such as crabs, sand dollars, bristle worms and tube worms. BMPs listed under Section 1.6 of this document would further reduce potential adverse effects to habitat. Long-term, new pile structures and material placement will increase the area of shallow-water habitat that may be preferred by juvenile fish and benthic fauna.

10 ANTICIPATED IMPACTS OF HABITAT LOSS OR MODIFICATION ON MARINE MAMMALS

The effects of new confined aquatic placement supported by pilings may cause a temporary disruption to habitat availability, as pinnipeds may avoid the area during construction. However, the long-term effects may be positive as an increase in shallow water habitat area may contribute to a greater prey base for migrating salmonids. In addition, beach nourishment sites may provide more locations for seals and sea lions to haulout. Overall, proposed work and associated habitat changes will likely have negligible short-term adverse effects and potentially positive long-term effects on marine mammals, specifically pinnipeds, that transit or occupy waters of the LCR.

11 MITIGATION MEASURES

In addition to the BMPs outlined under Section 1.6, the following measures will be implemented to reduce potential adverse effects to marine mammals and habitat during proposed construction activities.

- PSOs would be employed and positioned on barges or along existing island shoreline with good sight lines to the main channel. The Corps contractor would monitor the project area to the maximum extent possible based on the required number of PSOs, monitoring locations, and environmental conditions.
- Monitoring would take place from 30 minutes prior to initiation of pile driving activity (i.e., pre-start clearance monitoring) through 30 minutes post-completion of pile driving activity.
- If a marine mammal is observed entering or within the Shutdown Zones indicated in Section 6.2, pile driving activity must be delayed or halted. Pile driving must be commenced or resumed as described in Chapter 13 of this LOA.
- Pre-start clearance monitoring must be conducted during periods of visibility sufficient for the lead PSO to determine that the Shutdown Zones indicated in Section 6.2 of this IHA are clear of marine mammals. Pile driving may commence following 30 minutes of observation when the determination is made that the Shutdown Zones are clear of marine mammals.
- If pile driving is delayed or halted due to the presence of a marine mammal, the activity would not commence or resume until either the animal has voluntarily exited and been

visually confirmed beyond the Shutdown Zone indicated in Section 6.2 of this IHA or 15 minutes have passed without re-detection of the animal.

- The Corps contractor would use soft start techniques when impact pile driving. Soft start requires contractors to provide an initial set of three strikes at reduced energy, followed by a 30-second waiting period, then two subsequent reduced-energy strike sets. A soft start must be implemented at the start of each day's impact pile driving and at any time following cessation of impact pile driving for a period of 30 minutes or longer.
- Bubble curtains will be deployed during impact driving to minimize noise levels. Bubble curtain specifications include the following:
    - The bubble curtain must distribute air bubbles around 100 percent of the piling circumference for the full depth of the water column.
    - The lowest bubble ring must be in contact with the substrate for the full circumference of the ring, and the weights attached to the bottom ring shall ensure 100 percent substrate contact. No parts of the ring or other objects shall prevent full substrate contact.
    - Air flow to the bubblers must be balanced around the circumference of the pile.
- The Corps would conduct briefings between construction supervisors and crews, the marine mammal monitoring team, and Corps staff prior to the start of all pile driving activity in order to explain responsibilities, communication procedures, marine mammal monitoring protocol, and operational procedures.
- For all in-water construction (e.g., rock placement, use of barge-mounted excavators, placement of material), if a marine mammal comes within 10 m, contractor(s) would cease operations.
- Should a marine mammal come within 10 m of a vessel in transit, the boat operator would reduce vessel speed to the minimum level required to maintain steerage and safe working conditions.
- Pile driving would only be conducted during daylight hours from sunrise to sunset when it is possible for PSOs to visually monitor marine mammals.
- For all pile driving, shutdown and disturbance zones would be monitored according to specifications outlined in Section 13.

12 MITIGATION MEASURES TO PROTECT SUBSISTENCE USES

There are no known subsistence uses of marine mammals in the project vicinity, thus no measures proposed to protect those uses. Should subsistence use be revealed during pending Nation-to-Nation coordination with potentially affected tribes in the region, the Corps will work with tribes to identify measures to minimize adverse effects and protect those uses to the maximum extent practicable.

13 MONITORING AND REPORTING PLAN

The Corps would conduct one pinniped monitoring count a week prior to each year's construction and report the number of sea lions and seals (by species if possible) present within a mile radius of proposed construction in a given season, along with any other marine mammals observed. The Corps would provide yearly monitoring reports to NMFS that included a summary of the numbers of marine mammals that may have been disturbed as a result of construction activities that year.

Multiple observers would likely be required to detect marine mammals within the Level B disturbance zone. During all pile driving, two marine mammal observers would be present. One would be located on the closest shoreline or construction barge adjacent to proposed pile driving and another observer could be stationed on a publicly accessible shoreline with a different vantage point of the disturbance area or be boat-based. Due to the relatively large size of the Level B harassment zone during vibratory driving, monitors would estimate the proportion of the Level B zone that could be effectively monitored from each vantage point at the onset of monitoring. Reports would provide distance/bearing from source of any species sighted, dates, time, tidal stage, maximum number of marine mammals and any observed disturbances. The Corps also would provide a description of construction activities at the time of observation.

Upon completion of pile installation at a given site, a marine mammal observer would conduct two post-construction monitoring events, with one approximately 4 weeks after construction, and another at 8 weeks post construction. These post-construction marine mammal surveys would help to determine recolonization of the channel islands. The Corps would submit a final report to the NMFS and the AMT within 90 days of completion of proposed pile driving across all sites, or at the end of the 5-year LOA, whichever comes first. The Corps would designate biologically trained on-site PSOs to carry out the monitoring and reporting.

13.1 Monitoring

The Corps is proposing the following monitoring protocols.

Visual monitoring would be conducted by qualified, trained PSOs. Visual monitoring would be implemented during all pile installation activities and at the jetty. A qualified PSO will be someone who has prior training and experience conducting marine mammal monitoring or

surveys, and who has the ability to identify marine mammal species and describe relevant behaviors that may occur in proximity to in-water construction activities.
PSOs would be present during all pile driving and meet the following qualifications.
PSOs must be independent (i.e., not construction personnel) and have no other assigned tasks during monitoring periods.
At least one PSO must have prior experience performing the duties of a PSO during construction activity pursuant to a NMFS-issued incidental take authorization.
Other PSOs may substitute other relevant experience, education (degree in biological science or related field), or training for prior experience performing the duties of a PSO during construction activity pursuant to a NMFS-issued incidental take authorization.
Where a team of three or more PSOs is required, a lead observer or monitoring coordinator must be designated. The lead observer must have prior experience performing the duties of a PSO during construction activity pursuant to a NMFS-issued incidental take authorization.
PSOs must be approved by NMFS prior to beginning any activity subject to this LOA.
Each PSO would meet the above list of qualifications for marine mammal observers to be considered qualified; or undergo training to meet the qualifications before the start of pile driving.
Trained observers would be placed at a minimum of two vantage points to monitor for marine mammals and implement shutdown/delay procedures when applicable by calling for the shutdown to the hammer operator.

- PSOs would use a hand-held GPS device or rangefinder to verify the required monitoring distance from the project site.
- PSOs would scan the waters within the Level A harassment and Level B harassment zones using binoculars (10x42 or similar) or spotting scopes (20-60 zoom or equivalent) and make visual observations of marine mammals present.
- For all pile driving, shutdown and disturbance zones would be monitored as follows:
    - Monitoring would take place from 30 minutes prior to initiation through 30 minutes post-completion of pile driving.
    - A minimum 15-meter Shutdown Zone will be implemented during all pile driving.
    - During impact pile driving, the Shutdown Zone will increase to 50-meters for phocid pinnipeds (e.g., harbor seals) only.
    - During all pile driving, operations will cease if a marine mammal for which take has not been requested (e.g., all cetaceans) is observed passing beyond Tongue Point. Pile driving will not resume until the marine mammal is confirmed beyond the Level B harassment zone or has not been re-detected for 15 minutes.
    - If a Shutdown Zone is obscured by fog or other weather/sea conditions that restrict the observers' ability to observe, pile driving would not be initiated or would cease until the entire Shutdown Zone is visible so that monitoring may resume.
    - Prior to the start of pile driving, the Shutdown Zone would be monitored for 30 minutes to ensure that the Shutdown Zone is clear of marine mammals. Pile driving would only commence once observers have declared the Shutdown Zone clear of marine mammals.

  - If a marine mammal approaches or enters a Shutdown Zone, work would be halted and delayed until either the animal has voluntarily left and been visually confirmed beyond the disturbance zone; or the animal has not been re-detected in 15 minutes.

13.2 Reporting

- PSOs would use a marine mammal observation sheet to record the species, date, and time of any marine mammal sightings. Observers would also note the type of activity underway; marine mammal behavior; shutdown or delay procedures implemented; and any further communication between the observer and the contractor during pile driving.
- If an Observer detects any stranded, dead, or dying marine mammal species in the action area, regardless of known cause, the Corps (or Corps contractor) would report the incident to the Office of Protected Resources (OPR), NMFS (PR.ITP.MonitoringReports@noaa.gov and analystname@noaa.gov) and to the West Coast Marine Mammal Stranding Network (1-866-767-6114) as soon as feasible. If the death or injury was clearly caused by the specified activity, the Corps (or Corps contractor) would immediately cease the activities until NMFS OPR is able to review the circumstances of the incident and determine what, if any, additional measures are appropriate to ensure compliance with the terms of this LOA. In-water work would not resume until notified by NMFS.
- The report of a stranded, dead, or dying marine mammal would include the following information:
  - Time, date, and location (latitude/longitude) of the first discovery (and updated location information if known and applicable);
  - Species identification (if known) or description of the animal(s) involved;
  - Condition of the animal(s) (including carcass condition if the animal is dead);
  - Observed behaviors of the animal(s), if alive;
  - If available, photographs or video footage of the animal(s); and
  - General circumstances under which the animal was discovered.
- If a marine mammal is observed in the Level B harassment zone or Level A harassment zone (*i.e., for harbor seals, Northern elephant seals, and harbor porpoises only*), but not approaching or entering the Shutdown Zone, a “take” would be recorded and the work would be allowed to proceed without cessation. Marine mammal behavior would be monitored and documented.
- Per NMFS Requirements, the marine mammal report would include the following details:
  - Dates and times (begin and end) of all marine mammal monitoring
  - Date and time that pile removal and/or installation begins and ends.
  - Construction activities occurring during each observation period.
    - The number and type of piles that were driven and the method (e.g., impact, vibratory, down-the-hole)
    - Total duration of driving time for each pile (vibratory driving) and number of strikes for each pile (impact driving)

- Environmental conditions during monitoring periods (at beginning and end of PSO shift and whenever conditions change significantly), including Beaufort sea state and any other relevant weather conditions including cloud cover, fog, sun glare, and overall visibility to the horizon, and estimated observable distance.
- Upon observation of a marine mammal, the following information would be recorded:
  - Name of PSO who sighted the animal(s) and PSO location and activity at time of sighting
  - Time of sighting
  - Marine mammal species
  - Estimated number of animals (min/max/best estimate)
  - Estimated number of animals by cohort (adults, juveniles, neonates, group composition, etc.)
  - Animal's closest point of approach and estimated time spent within the harassment zone
  - Marine mammal behavior patterns observed, including bearing and direction of travel,
  - 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.
- Number of marine mammals detected within the harassment zones, by species
- Detailed information about implementation of any mitigation (e.g., shutdowns and delays), a description of specific actions that ensued, and resulting changes in behavior of the animal(s), if any.

14 SUGGESTED MEANS OF COORDINATION

NMFS would be apprised of the Corps work and results of the monitoring efforts. In addition, all marine mammals detected would be recorded each day of pile driving. Results of monitoring, including the information outlined in sighing forms (i.e., see Section 13), would be compiled into a final report. This report would be provided to NMFS within 90 days of the completion of monitoring or 60 calendar days prior to the requested issuance of any subsequent LOA for construction activity at the same location, whichever comes first. A final report would be prepared and submitted within 30 calendar days following receipt of any NMFS comments on the draft report. If no comments are received from NMFS within 30 calendar days of receipt of the draft report, the report would be considered final.

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