ADDENDUM TO:

REQUEST FOR INCIDENTAL HARASSMENT AUTHORIZATION AND A LETTER OF AUTHORIZATION UNDER THE MARINE MAMMAL PROTECTION ACT

FOR

REHABILITATION OF THE JETTY SYSTEM AT THE MOUTH OF THE COLUMBIA RIVER: NORTH JETTY, SOUTH JETTY, AND JETTY A

Pacific County, Washington, and Clatsop County, Oregon
Construction October 2015 through October 2021

REVISED AND UPDATED MARINE MAMMAL MONITORING PLAN

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

Prepared by:
U.S. Army Corps of Engineers, Portland District

Revised June 2015
Addendum Prepared January 2016

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

µPa	microPascal
AMT	Adaptive Management Team
BA	Biological Assessment
BiOp	Biological Opinion
BMP	best management practice(s)
CFR	Code of Federal Regulations
Corps	U.S. Army Corps of Engineers
CV	coefficient of variation
CWA	Clean Water Act
cy	cubic yard(s)
dB	decibels
DDT	dichloro-diphenyl-trichloroethane
DFO	Department of Fisheries and Oceans (Canada)
DPS	distinct population segment
EA	Environmental Assessment
EAL	environmentally acceptable lubricant(s)
ENP	Eastern North Pacific
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FR	Federal Register
ft	foot (feet)
ft^2	square foot (feet)
Hz	hertz
IHA	Incidental Harassment Authorization
JASR	Jetty A Scheduled Repair
kHz	kilohertz
km^2	square kilometer
LOA	Letter of Authorization
MCR	Mouth of the Columbia River
MHHW	mean higher high water
MLLW	mean lower low water
MMPA	Marine Mammal Protection Act
NAVD	North American Vertical Datum
NJSR	North Jetty Scheduled Repair
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NWFSC	Northwest Fisheries Science Center

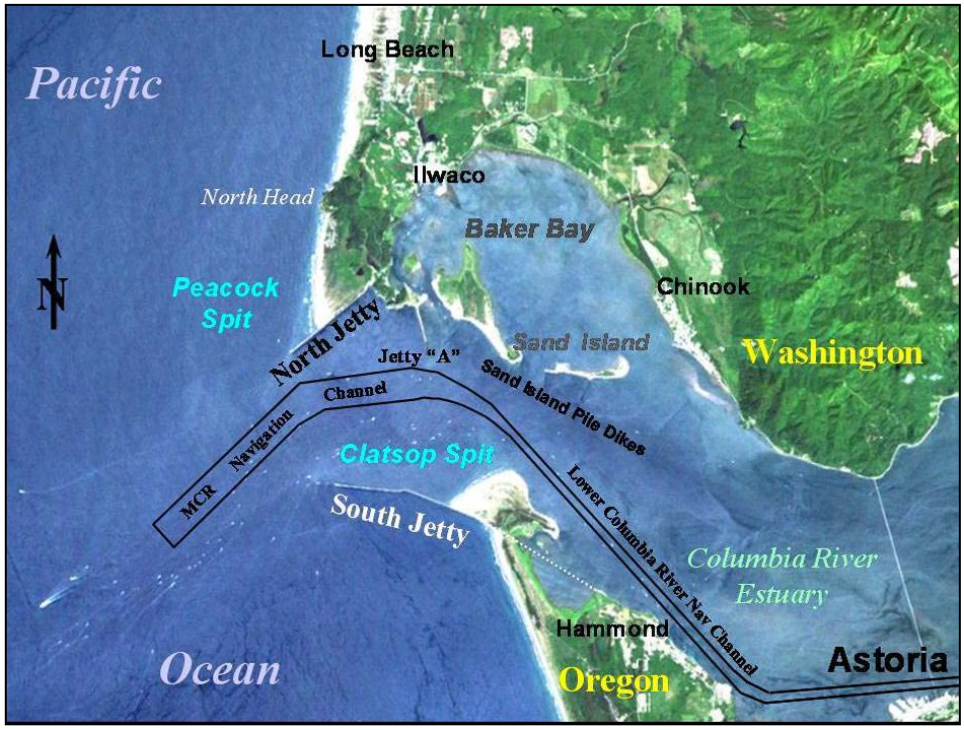
ACRONYMS AND ABBREVIATIONS (continued)

OBIS	Ocean Biogeographic Information System
ODMDS	Ocean Dredged Material Disposal Site
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
OHW	ordinary high water
Pa	Pascal
PCFG	Pacific Coast Feeding Group
rms	root mean square
SEAMAP	Spatial Ecological Analysis of Megavertebrate Populations
SEL	sound exposure level
SERDP	Strategic Environmental Research and Development Program
SJIR	South Jetty Interim Repair
SPL	sound pressure level(s)
STA	station(s)
SWFSC	Southwest Fisheries Center
TL	transmission loss
UME	unusual mortality event
U.S.	United States
U.S.C	United States Code
WDFW	Washington Department of Fish and Wildlife
WDOE	Washington Department of Ecology
WNP	Western North Pacific
WSDOT	Washington State Department of Transportation
ZOI	zone of influence

1. Description of Specified Activity

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

This section provides a detailed description of the specific class of activities that can be expected to result in incidental taking of marine mammals. The U.S. Army Corps of Engineers, Portland District (Corps) will be conducting monitoring actions, repairs, and rehabilitation of the three rubble-mound jetty structures at the Mouth of the Columbia River (MCR). The three structures are referred to as North Jetty, South Jetty, and Jetty A and are shown in Figure 1.



From 1885 to 1917, the North and South Jetties were constructed. Jetty construction realigned the ocean entrance to the Columbia River, established a consistent navigation channel that was 40-feet deep across the bar, and dramatically improved navigation through the MCR. Improvements made from 1930 to 1942 (including adding Jetty A and the Sand Island pile dikes) produced the present entrance configuration.

Figure 1. Jetty System at the MCR

The location of the jetties at the interface with the Pacific Ocean and the confluence with the Columbia River means the project occurs in the vicinity of several marine mammals, which were covered in an Environmental Assessment (EA) and under the Endangered Species Act (ESA) consultation with the National Marine Fisheries Service (NMFS). The preferred alternative (Proposed Action) was described in the 2011 NMFS Biological Opinion (BiOp) and was updated

in the 2012 Revised EA (as a reduced project scope relative to the Biological Assessment (BA) and BiOp). The EA, BA and BiOp are herein incorporated by reference.

The Proposed Action is generally composed of five categories applicable to each jetty: (1) engineered designs elements and features of the physical structures; (2) construction measures and implementation activities; (3) proposed Clean Water Act (CWA) 404 mitigation actions for impacts to wetlands and waters of the U.S., (4) proposed establishment of and coordination with an Adaptive Management Team (AMT) comprised of representatives from the Corps and appropriate federal and state agencies and, (5) active jetty monitoring at all three jetties including pedestrian, aerial, and bathymetric surveys that can occur on an annual or biennial frequency. The description of the Proposed Action provided here describes the context of the actions and all aspects that have the potential to incidentally take marine mammals, which include the engineered features and the implementation actions. The Corps is fulfilling its commitment to meet regularly with the AMT, and continues to develop its mitigation plans as designs evolve to further reduce environmental impacts. Jetty monitoring is also discussed briefly.

The Corps is requesting Incidental Harassment Authorization (IHA) specifically for the first season of pile installation at Jetty A. This would begin in May 2016, but the contract must be awarded by September 2015. The Corps is also requesting a Letter of Authorization (LOA) for pile repairs and removal actions at Jetty A, for pile installation at North Jetty, and for pile installation, construction work, and surveys at South Jetty. Because of the duration of work on the MCR jetty system, the Corps may need to request additional IHA coverage when the LOA expires. The funding stream for the jetty work is uncertain, and the Corps will be conducting work in the general order and schedule laid out here. The Corps has included a full description of work covered under its BiOp. However, NMFS found that pile driving activities for all offloading facilities and work on South Jetty were the only project elements that may cause non-lethal take of marine mammals.

The overall duration of the contracting and construction schedule is about 8 years (including dune stabilization and lagoon fill, which will or has occurred prior to work on the MCR jetties themselves). The repair designs include assumptions to meet a 50-year operational lifetime for the jetty system. Therefore, an inherent level of uncertainty exists regarding dynamic environmental conditions and actual conditions of and at each of the jetties. For this reason, in all cases where areas, weights, and volumes (tons, acres, cubic yards, etc.) or other metrics are indicated, these are best professional estimates and may vary by greater or lesser amounts within a 20% range when final designs are completed. Specific rock volumes are unknown until further into design and construction. However, maximum pile sizes, maximum number of piles, and vibratory installation methods will not change and will be included as constraints within the construction contracts. These amounts represent the Corps' best professional judgment of what the range of variability could entail as designs are further developed, and as on-the-ground conditions evolve over the construction and maintenance schedule.

This variability may also apply to the construction schedule as funding streams may not be available at the forecasted times, or additional new information may shift the repair priorities to alternate sections on or between the jetties. The Corps maintains an active jetty monitoring and surveying program that would further inform the timing and design of the Proposed Action in

order to facilitate efficient completion of the project, and whenever possible, to avoid emergency repair scenarios. This program pursues an aggressive level of monitoring, inspection frequency, and reviews in order to ensure detailed evaluations help maintain a resilient jetty system and respond with appropriate actions.

In order to deliver the large stone required to implement a durable-head[1] stabilization feature and repair prism, it is likely that the armor stone will be delivered by barge and then placed by crane for some of the work at North Jetty, all of the work at South Jetty, and possibly for the work at Jetty A. Alternatively, there is a small chance that overland trucking would be the exclusive stone delivery method, which would preclude the need for offloading facilities. The Corps included four offloading facilities in the Proposed Action as part of the EA, BA and 2011 BiOp. Actions and work at all offloading sites for the repairs at the North Jetty, Jetty A, and South Jetty will be similar and are described in a separate section.

The Corps is conducting, and will continue to conduct, repair and rehabilitation actions on the jetties in several stages dependent on availability of funding streams. Generally, the schedule is expected to proceed as follows (note that these dates reflect calendar years, which are different than the Corps' fiscal year ending September 30).

1. *South Jetty Foredune Stabilization* – **Completed** summer/fall 2013 (NMFS determined ***no IHA*** was required for these work elements).
2. *North Jetty Lagoon Fill and Culvert Replacement* – Under construction fall 2014 - to be **completed spring 2015** (NMFS determined ***no IHA*** was required for these work elements).
3. *North Jetty Critical Repairs (Terminus and Trunk)* – Stone procurement started fall 2014; construction/stone placement spring 2015; no offloading facilities (NMFS determined ***no IHA*** was required for these work elements).
4. *Jetty A Scheduled Repair (JASR) and Head Stabilization (Major Rehabilitation at Root, Trunk, and Head, Causeway)* – Head modeling and design refinements started 2014; ***need IHA*** by July 2015 for first season of work; award contract early fall 2015; construction/stone placement 2015 through 2017 (dependent on funding; likely one season of in-water work, but possibly two seasons of construction, mobilization, demobilization) requiring pile maintenance and removal in the second year; IHA required for installation of offloading facility (pile installation likely May 2016), and LOA for possible work extension into second season for maintenance and removal (through September 2017).
5. *North Jetty Scheduled Repair (NJSR) and Head Stabilization (Major Rehabilitation at Root, Trunk, and Head)* – Head design and refinements started 2014; ***need LOA*** by summer 2016; award fall 2016 (dependent on funding); procurement 2016; construction/placement 2017-2019; LOA required for offloading facility (including pile installation).

[1] The head is the seaward terminus and is exposed to the most severe wave action. The trunk forms the connection from jetty head to the subtidal beach, retains subtidal shoals, and confines circulation within the inlet. The root forms the connection from the jetty trunk to the shore and prevents accreted landforms from migrating into the channel and inlet.

6. *South Jetty Interim Repair (SJIR) and Head Determination (Major Rehabilitation)* – Head design and refinements start fall 2015; ***need LOA*** by summer 2016; award early fall 2016 (dependent on funding); procurement 2017; construction/placement 2018-2021; LOA required for jetty work and two offloading facilities (including pile installation).

In most cases, the Corps requires compliance documents in-place prior to bidding and awarding a contract or contract options for related work. Therefore, the Corps is seeking IHA for the JASR work by July 29, 2015 in order to award a contract for jetty work that will occur the following summer season. The Corps is also seeking a LOA for the North Jetty Scheduled Repair work by early summer 2016 and for the South Jetty Scheduled Repair work by summer 2016.

The following subsections provide additional details for each phase of work requiring IHA or LOA for the MCR jetties. The South Jetty Dune Stabilization, North Jetty Lagoon Fill, and North Jetty Critical Repairs are related work in the greater program that *does not require* IHA/LOA documentation. However, they are described in the Corps' EA, BA, and BiOp.

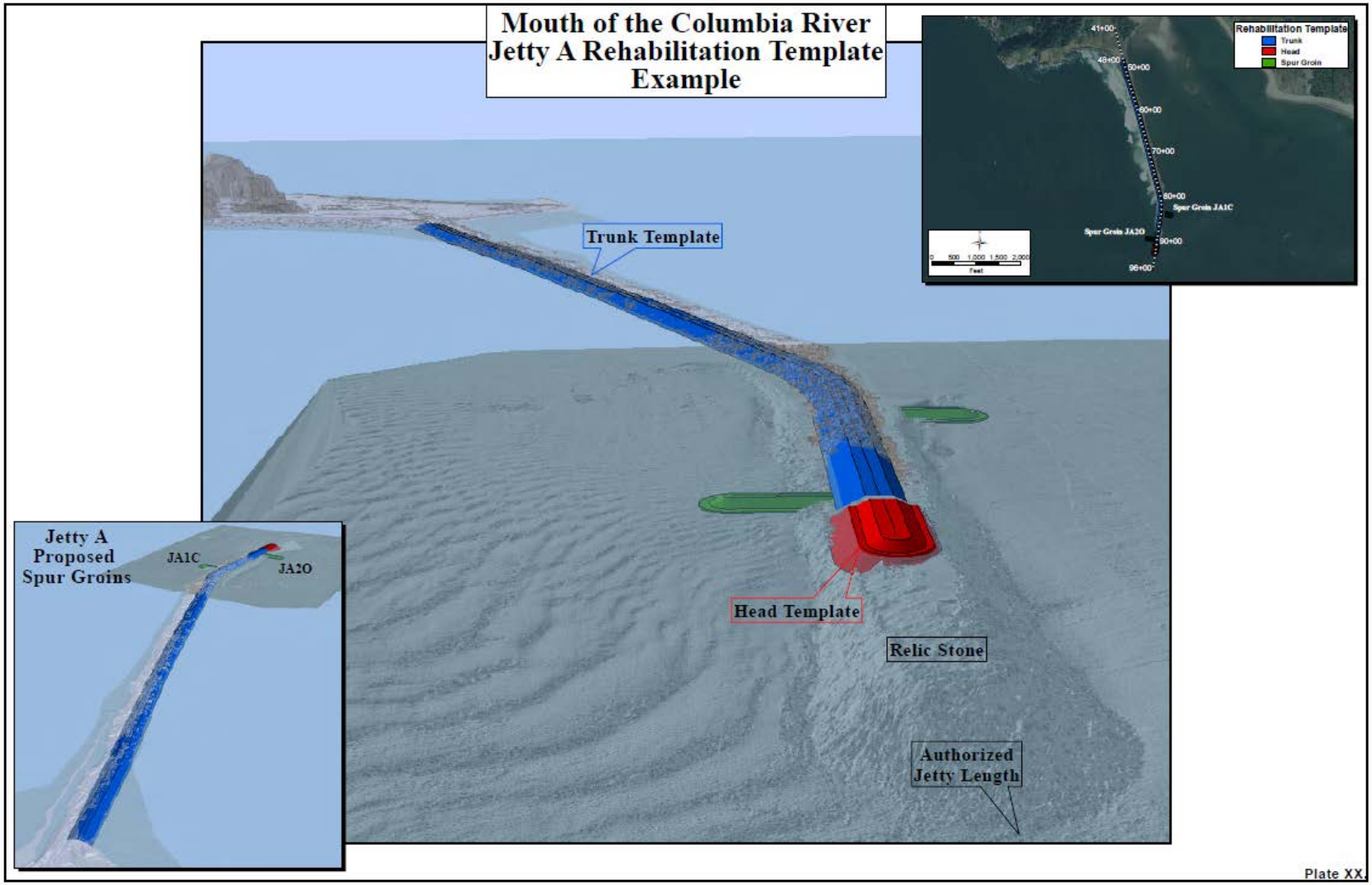
1.1. Jetty A Scheduled Repair (JASR): Head Stabilization and Major Rehabilitation at Trunk and Root, 2015-2017

The Corps is seeking an IHA for the first year of pile installation work at Jetty A related to construction and maintenance of a barge offloading facility. Depending on receipt of IHA, contract award, and contractor implementation, this could occur as early as May 2016 and would extend through September 2017. The Corps would prefer this authorization by July 2015 for contract bid schedule reasons described above. Because the work may extend to two seasons the Corps is requesting an LOA for the second year of pile maintenance and removal at Jetty A. The following project description is included for context. Because Jetty A is not a haul-out site for pinnipeds, pile installation and removal were the only activities that were identified as having potential to adversely affect marine mammals at Jetty A during consultation with NMFS.

Jetty A Scheduled Repair would occur as part of the Corps' Major Rehabilitation program for the jetties. Scheduled repairs would address the loss of cross-section, reduce future cross-section instability, and stabilize the head (terminus). Scheduled cross-section repairs are primarily above mean lower low water (MLLW), with a majority of stone placement not likely to extend below -5 feet MLLW. The jetty head (southern-most end section) would be stabilized at approximately station (STA)[2] 89+00 with large armoring stone placed on relic jetty stone that is mostly above MLLW. See Figure 2.

Work is anticipated for two seasons (spring, summer, and fall) with stone placement for head stabilization and trunk repairs starting in 2016; however, the contract may be awarded in 2015 and procurement may require an offloading facility. An approximately 20 to 30-foot wide access causeway adjacent to the jetty and an offloading facility at the terminus of the jetty also may be implemented. This offloading facility would include dredging and pile installation. There is a small chance that delivery and placement could occur exclusively via overland methods. If such were the case, the Corps would not need an IHA for JASR. However, because of the probability of overland transport is uncertain, the Corps is pursuing the IHA for JASR. The following sections separately describe the repair and causeway components of JASR. Offloading facilities are described in a different section after the specific repair work on each of the jetties.

[2] Stations (STA) indicate lineal distance along the jetty relative to a fixed reference point (0+00) located at the landward-most point on the jetty root. Numbering begins at the reference point (0+00) and increases seaward such that each station number represents that distance in feet, multiplied by 100, plus the additional number of feet indicated after the station number. For instance, station 100+17 would be 10,017 feet seaward from the reference point.

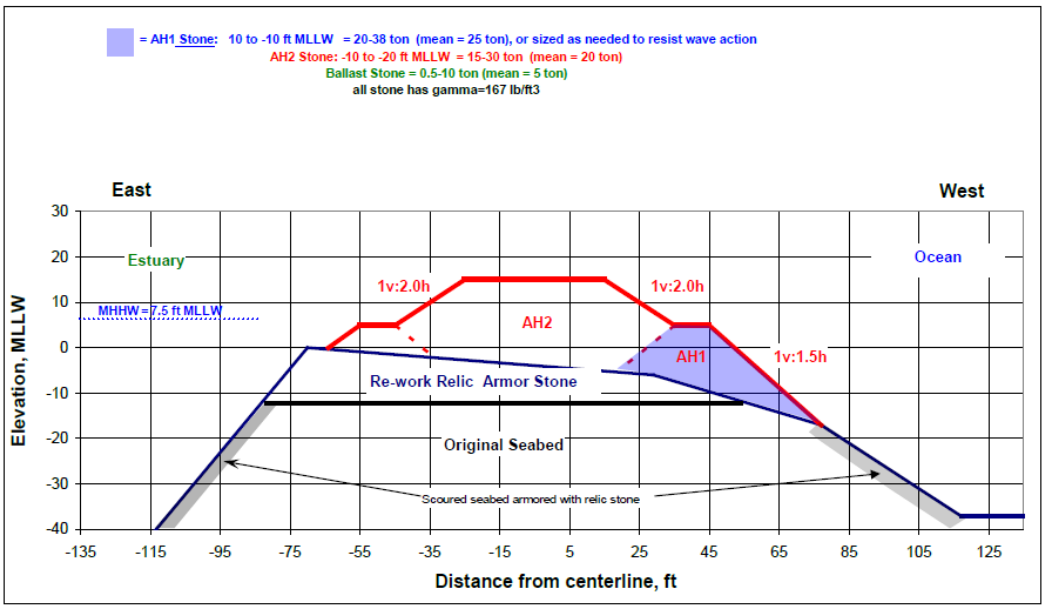


This 3-D Image is a representation of different repair strategies considered during development of Major Rehabilitation alternatives for Jetty A. The Corps is NO LONGER proposing spur groins. The offloading facility is likely to be located somewhere near the representation of the upstream spur groin near an existing scour zone. The causeway would be located immediately adjacent to the jetty on the existing relic jetty stone and previously placed remaining causeway material.

Figure 2. Example Jetty A Scheduled Repair 3-D Work Area Overview

1.1.1. Jetty A Head Stabilization

This work component *will not require IHA/LOA coverage*. The Proposed Action for Jetty A includes head stabilization at approximately STA 87+50 to 89+00 (the station represents the end of crest, the entire slope to the bottom ends at STA 91+00). See Figure 3. This is slightly shorter than that proposed in the EA and BA (STA 91+00 to 93+00). The final design of the stabilization feature is currently being modeled, but will not exceed the volumes or dimensions described in Table 1. The feature will be comprised of either large armor stone or concrete armor units.



Example of a head stabilization feature for Jetty A. Modeling efforts will refine actual design, which may be less robust than that pictured here. Large stone and concrete armor units are being modeled.

Figure 3. Jetty A Example Cross Section of Head Stabilization Feature

Table 1. Estimated Design Details for Jetty A Head Stabilization Feature

Head Stabilization Features	Jetty A
Location of cap	STA 87+50 to 89+00
Timing of construction	2016
Approximate maximum dimensions	length x width x height (feet): 200 x 160 x 40 (0.73 acres)
Stone size	30 to 40 tons
Area affected (outside of relic stone)	None
% of cap constructed on relic stone	100%
Construction method	Cranes set on the jetty to place stone; possible barge offloading facility and causeway to deliver armor stone; large haul trucks, causeway, and excavators to move stone

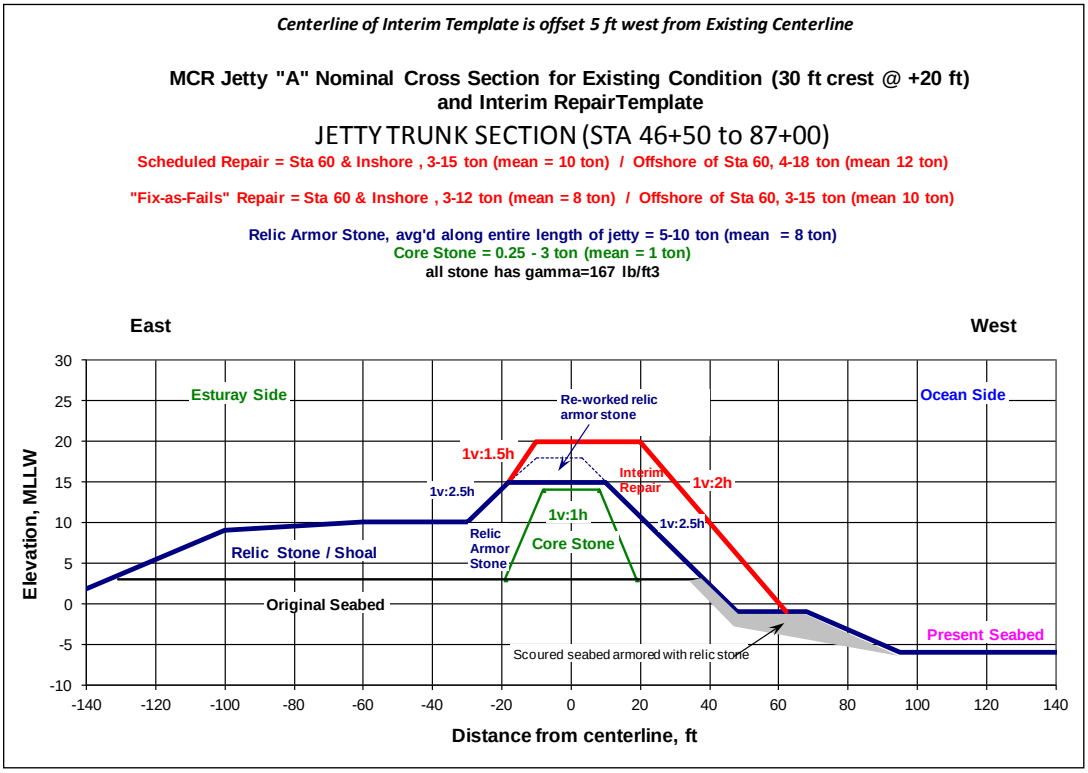
For the head stabilization feature at Jetty A, a +20-foot MLLW crest elevation and crest width of 40 feet will be constructed from a maximum of about 25,000 tons [~15,000 cubic yards (cy)] of stone or equivalent concrete armor units. For head stabilization, when dividing the maximum possible volume of material placement into elevation zones, about 44% of the maximum overall stone placement on this portion of Jetty A would be placed above mean higher high water (MHHW). About 26% of the maximum overall stone placement would be placed between MHHW and MLLW. About 30% of the maximum overall stone placement would be placed below MLLW. However, these estimates are more robust than the final head design that will be determined through modeling. Quantities and percentages may vary with the smaller proposed template but were retained to illustrate the range of placement at different elevations.

In all zones, all proposed stone placement would occur on existing base relic stone that formed the original jetty cross-section and was displaced and flattened by wave action, and does not include any modification that changes the character or increases the scope or size of the original structure design. The terminus of the head simply will be closer to shore on a shorter jetty structure. The footprint of the existing jetty mound on the flattened relic stone is approximately 0.64 acres, and the additional head stabilization on the relic stone increased the width of the mounded head prism approximately 0.09 acres, for a total head feature footprint of 0.73 acres of mounding on the existing relic stone.

1.1.2. Jetty A Trunk and Root

This work component *will not require IHA/LOA coverage*. The design template for scheduled trunk repairs at Jetty A includes a 30-foot crest width, 24-foot MLLW crest elevation, 1V:2H ocean/down-stream side slope, and 1V:1.5H up-stream side slope (Figure 4). Jetty A root and trunk repairs would extend from STA 49+00 to 87+50 (the trunk transitions to the head starting at STA 87+50 and the construction/ staging area is at STA 45+00) and would lie mostly within the existing jetty footprint based on the configuration of the original cross section, previous repair cross sections, and redistribution of jetty rock by wave action. JASR stone placement along the trunk will total about 82,000 tons. Reworked stone will be a little more than 25% of new tonnage placed, about 12,560 tons. Most of the work would occur above MLLW. Originally, the BA and consultation anticipated a higher volume of stone and a larger design template.

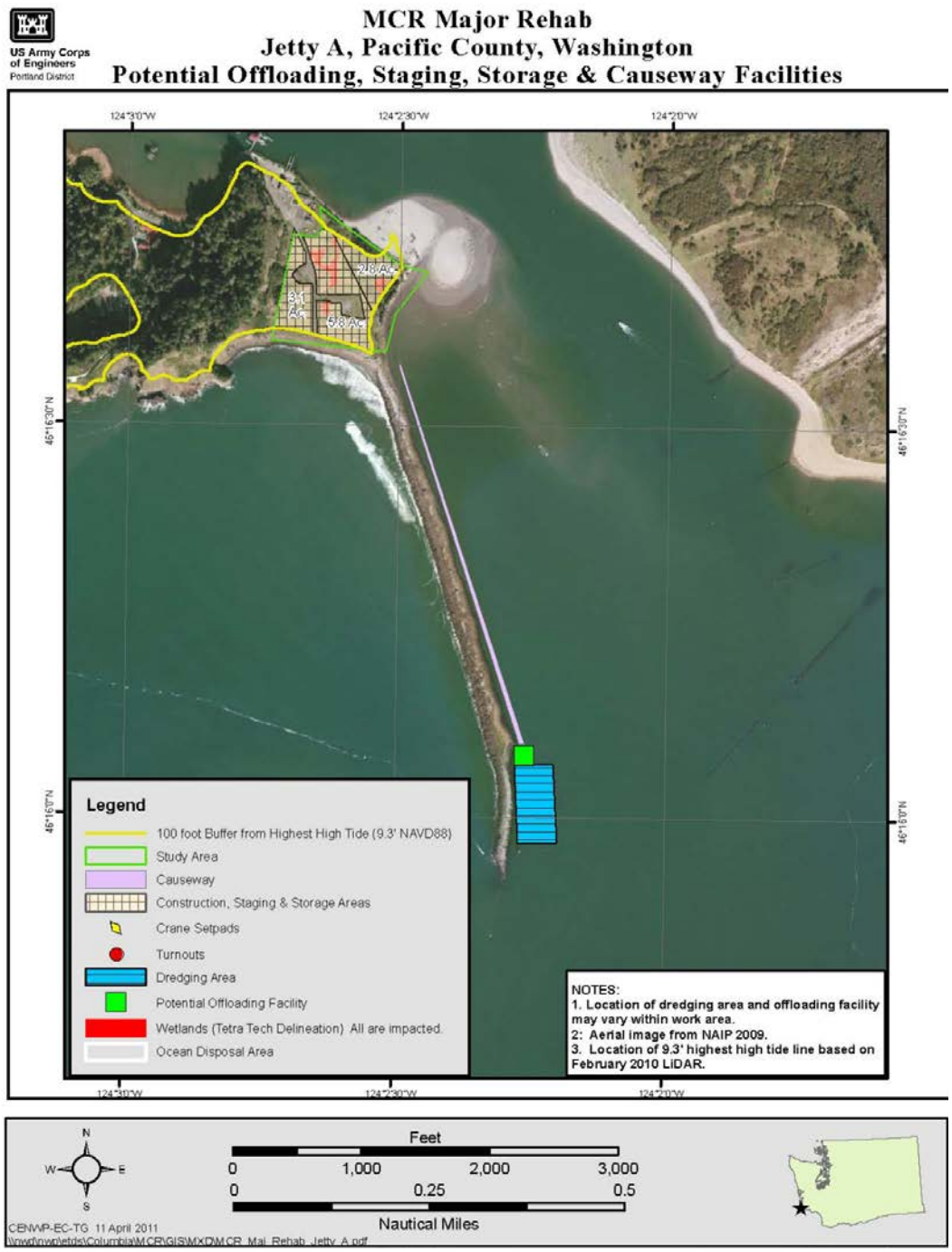
In the Corps 2010 BA, a more robust repair prism was proposed for Jetty A. As noted, refinements in the modeling resulted in selection of a smaller Scheduled Repair template. The following volume distributions are reflective of the information in the consultation and former dimensions of the more robust repair prism, but they remain somewhat representative of the anticipated percentage of volumes placed in each of the three elevation ranges. For trunk and root repairs, about 63% of the overall maximum stone placement that may occur on Jetty A would be placed above MHHW. About 29% of the overall stone placement would be placed between MHHW and MLLW, and about 8% would be placed below MLLW. In all zones, most of the stone placement would occur on existing base relic stone that formed the original jetty cross-section.



Example of a scheduled repair template for Jetty A, including zones of placement relative to MLLW. Current design crest width is 30-ft at +24-ft MLLW, which is narrower than depicted here. Design efforts will refine actual locations, stone size, and quantities, which may be less robust than that pictured here.

Figure 4. Jetty A Example Cross Section of Scheduled Repairs Template

Construction staging areas and stone storage at Jetty A are constrained to the footprint at the root and by the operating Coast Guard Station and helicopter pad. The locations for staging, storage, and offloading facilities are generally depicted in Figure 5.



This conceptual figure indicates the likely locations of the causeway and barge offloading facility. Design details remain under development, but this representation is likely to be the location and maximum extent of impact.

Figure 5. Jetty A Conceptual Causeway and Offloading Facility Locations

1.1.3. Jetty A Causeway

This work component *will not require IHA/LOA coverage*. In addition to repairs on the jetty itself, an approximately 20- to 30-foot wide causeway may be constructed along the entire length of the jetty on existing relic stone that runs adjacent to and abutting the upstream, eastern portion of the jetty. The causeway may be used as a staging, access, and work area due to the constrained conditions at the jetty root and landward location. The Jetty A causeway is estimated to be about 5,000 feet long with about 38,888 cy of stone below MLLW and a footprint of about 1.3 acres below Ordinary High Water (OHW). This causeway will remain a permanent feature, but will deteriorate due to wave and tidal action, as it is now (Figure 6). The causeway will be rebuilt on the original structure, which still exists in large part immediately adjacent to and along much of the jetty. As much as feasible, wood that has rafted up onto the jetty will be used as material for the haul road on the causeway and to provide roughened fish habitat features at the base of the causeway. Excess wood will be used as upland habitat features or will be disposed of at an approved offsite location. See Figure 5 and Figure 6.

This figure illustrates the general extent and condition of the area on the right side of the photo that will become the causeway. As noted, it is immediately adjacent to the jetty itself, which is on the left side of the photo.

Figure 6. Jetty A Existing Causeway Condition

1.2. North Jetty Scheduled Repair (NJSR): Head Stabilization and Major Rehabilitation at Trunk and Root, 2016-2019

The Corps is seeking a LOA for pile installation and removal work related to construction and maintenance of a barge offloading facility at North Jetty. The following project description is included for context. Because North Jetty is not a haul-out site for pinnipeds, pile installation and removal were the only activities that NMFS identified during consultation as having potential to adversely affect marine mammals at North Jetty.

The NJSR would continue repair work to the jetty head, root, and trunk as part of the Corps' Major Rehabilitation program for the jetties. The NJSR would occur from STA 20+00 to 101+00 and would include head stabilization at the terminus. See Figure 7. Work is anticipated to occur during the spring, summer, and fall months in 2017 through 2019. Offloading facilities including dredging and pile installation may also be included and are described separately in their respective sections. As with Jetty A, there is a small chance that delivery and placement could occur exclusively via overland methods. If such were the case, the Corps would not need a LOA for North Jetty repairs. The following sections separately discuss the components of NJSR.

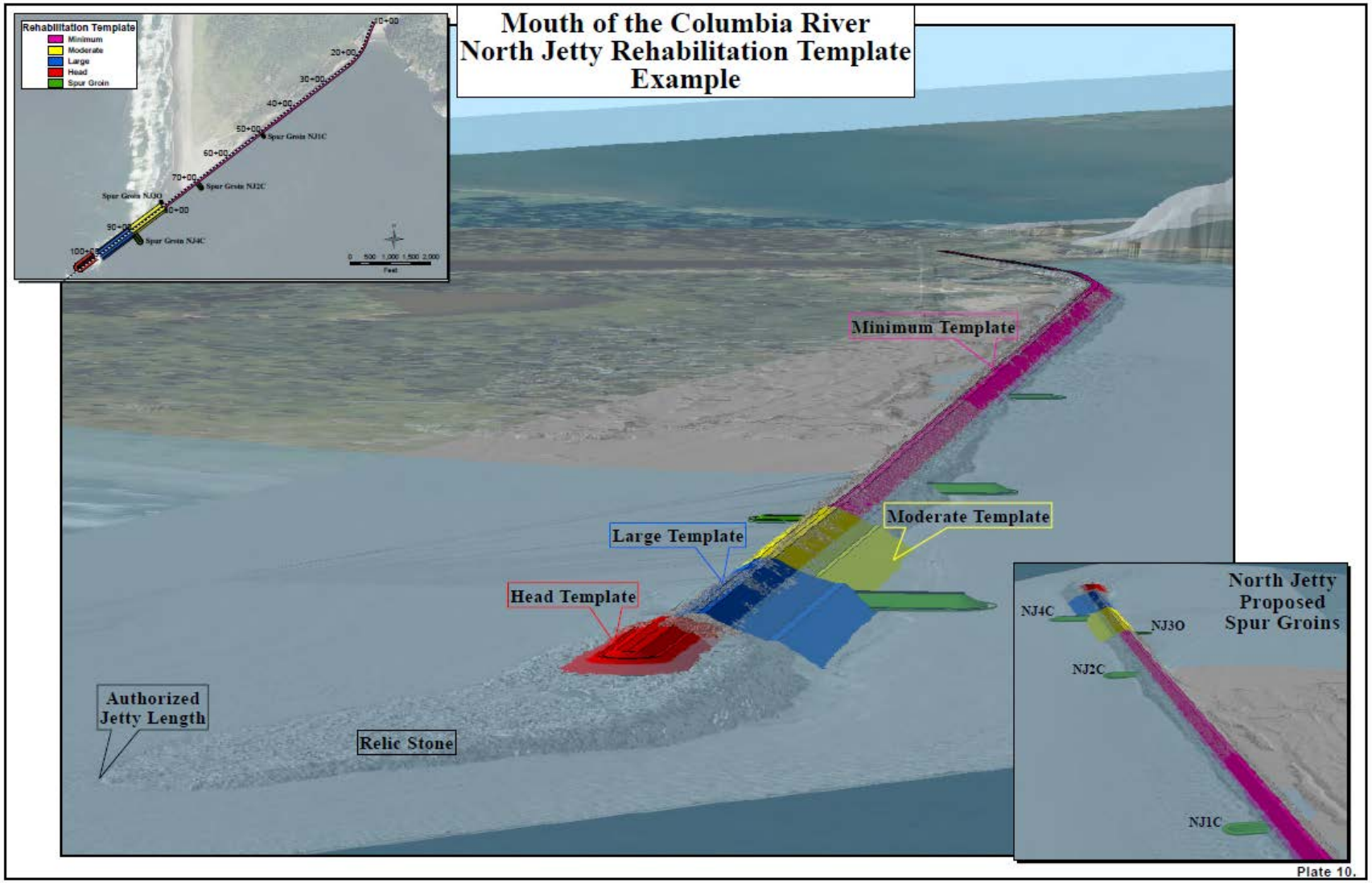
1.2.1. North Jetty Head Stabilization

This work component *will not require IHA/LOA coverage*. The NJSR and Major Rehabilitation would result in head stabilization at STA 101+00 (end of jetty crest) to minimize future cross section instability at the jetty terminus. When the jetty terminus recedes landwards, Benson Beach and Peacock Spit recede in response. This recession results in a loss of beach area and a movement of materials into the federal navigation channel. Therefore, the Corps must re-establish a stabilized head at the terminus of the North Jetty.

Preliminary design details for the head stabilization feature are provided in Table 2. In order to achieve stabilization, the pre-modeling estimate included in the BA indicated approximately 38,000 tons (~23,750 cy) of very large armor stone or concrete armor units would be placed on the relic stone to cap the jetty head at the terminus (western-most section) at STA 101+00. Physical modeling will determine the final head stabilization features. See Figure 7.

The footprint of the MCR North Jetty head stabilization feature would occur on top of the existing mound of flattened relic jetty stone, which is approximately 1.37 acres of mounding. The additional capping on the relic stone would re-establish approximately 0.80 acres of the width of the mounded head prism, for a total footprint of approximately 2.17 acres, all of which would remain on the existing relic stone. The proposal does not include any modifications that change the character or increase the scope or size of the original structure design. However, the terminus of the jetty will now be closer to shore on a shorter jetty structure relative to its original authorized design length.

Pre-modeling estimates for a more robust repair included in the BA indicated about 49% of the overall stone placement on this portion of the jetty would be placed above MHHW. About 24% of the overall stone placement on this portion of the North Jetty would be placed between MHHW and MLLW, and about 27% would be placed below MLLW. See Figure 8.

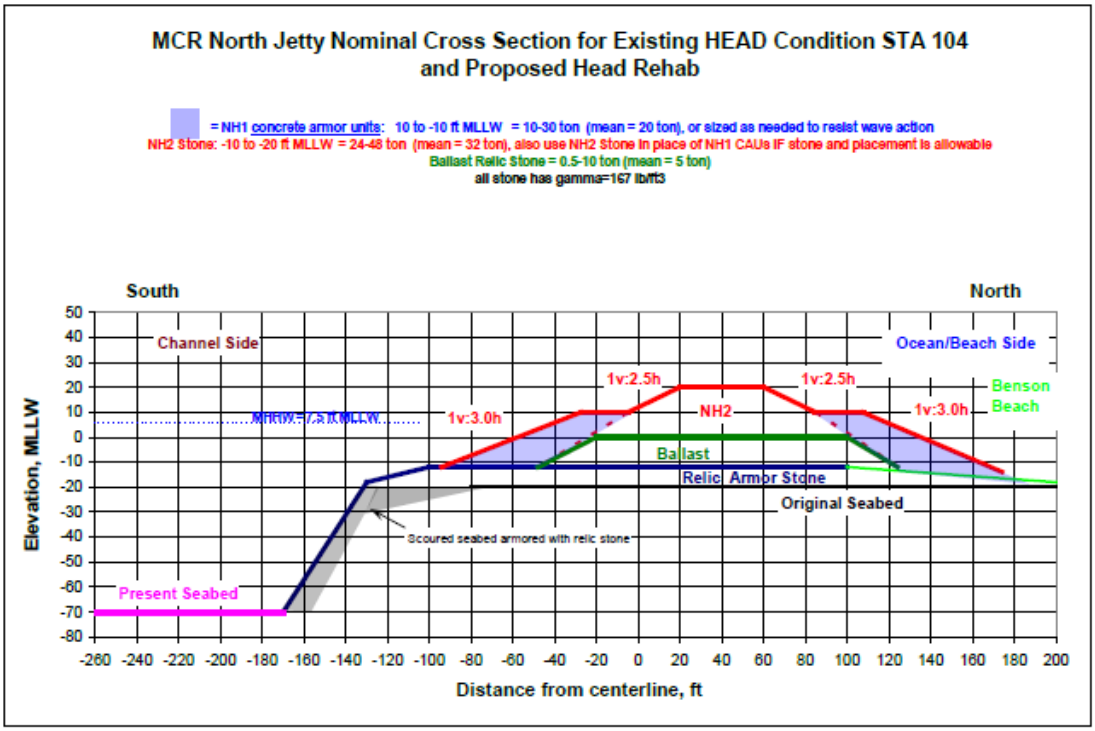


This 3-D Image is a representation of different repair strategies considered during development of Major Rehabilitation alternatives. The Corps is NO LONGER proposing spur groins. The Scheduled Repairs strategies are most closely represented by the "minimum" (purple) repair prism and the "head" (red) prism templates portrayed here.

Figure 7. Example North Jetty Scheduled Repairs 3-D Work Area Overview

Table 2. Estimated Design Details for North Jetty Head Stabilization Feature

Head Stabilization Features	North Jetty
Location of cap	STA 101+00
Timing of construction	2017
Approximate maximum dimensions	length x width x height (feet): 350 x 270 x 45 (2.17 acres)
Stone size	30 to 50 tons
Area affected (outside of relic stone)	None
% of cap constructed on relic stone	100%
Construction method	Cranes set on the jetty to place stone; possible barge offloading facility to deliver armor stone; cranes, large haul trucks and excavators to move stone



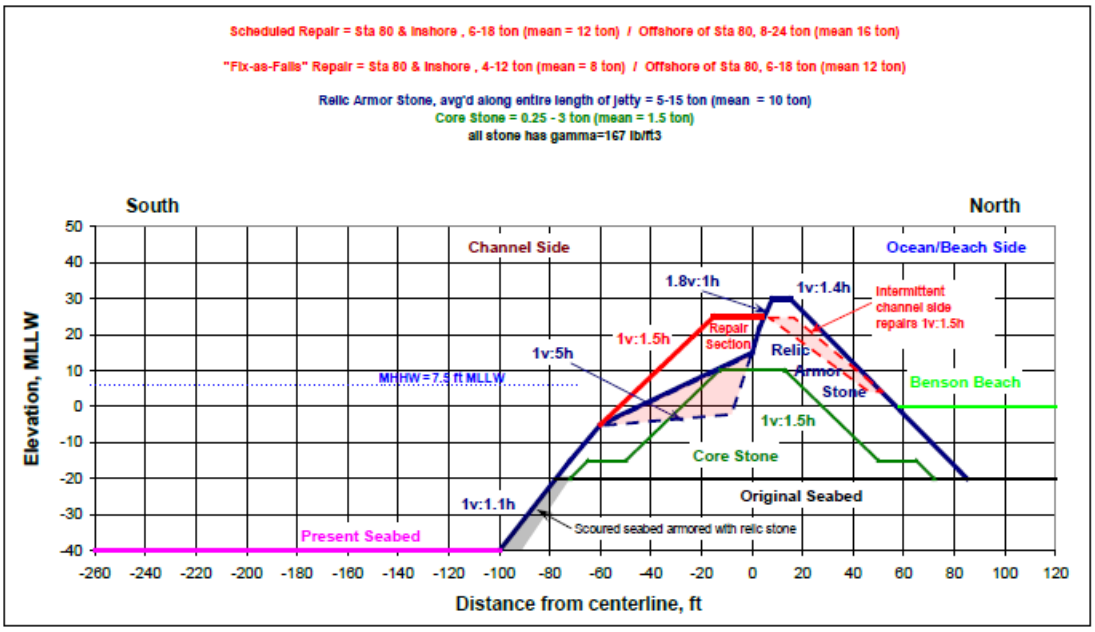
Example of a head stabilization feature. Modeling efforts will refine actual design, which may be less robust than that pictured here. Large stone or concrete armor units are being modeled.

Figure 8. North Jetty Example Cross Section of Head Stabilization Feature

1.2.2. North Jetty Trunk and Root

This work component *will not require IHA/LOA coverage*. The NJSR would further address the existing loss of the jetty cross section along the trunk and root from STA 20+00 to 99+00 (STA 99+00 to 101+00 would transition to the head feature). See Figure 9. The cross-section design from STA 20+00 to 99+00 would have a crest width of approximately 30 feet and would lie essentially within the existing jetty footprint based on the configuration of the original cross section, previous repair cross sections, and redistribution of jetty rock by wave action. The

current repair strategy for NJSR is less robust than that proposed in the BA. However, critical repairs were originally included as part of the scheduled repairs actions in the BA. Due to their higher priority, critical repairs were later separated out and sequenced earlier than scheduled repairs. Critical repairs and scheduled repairs were described in combination in the BA.



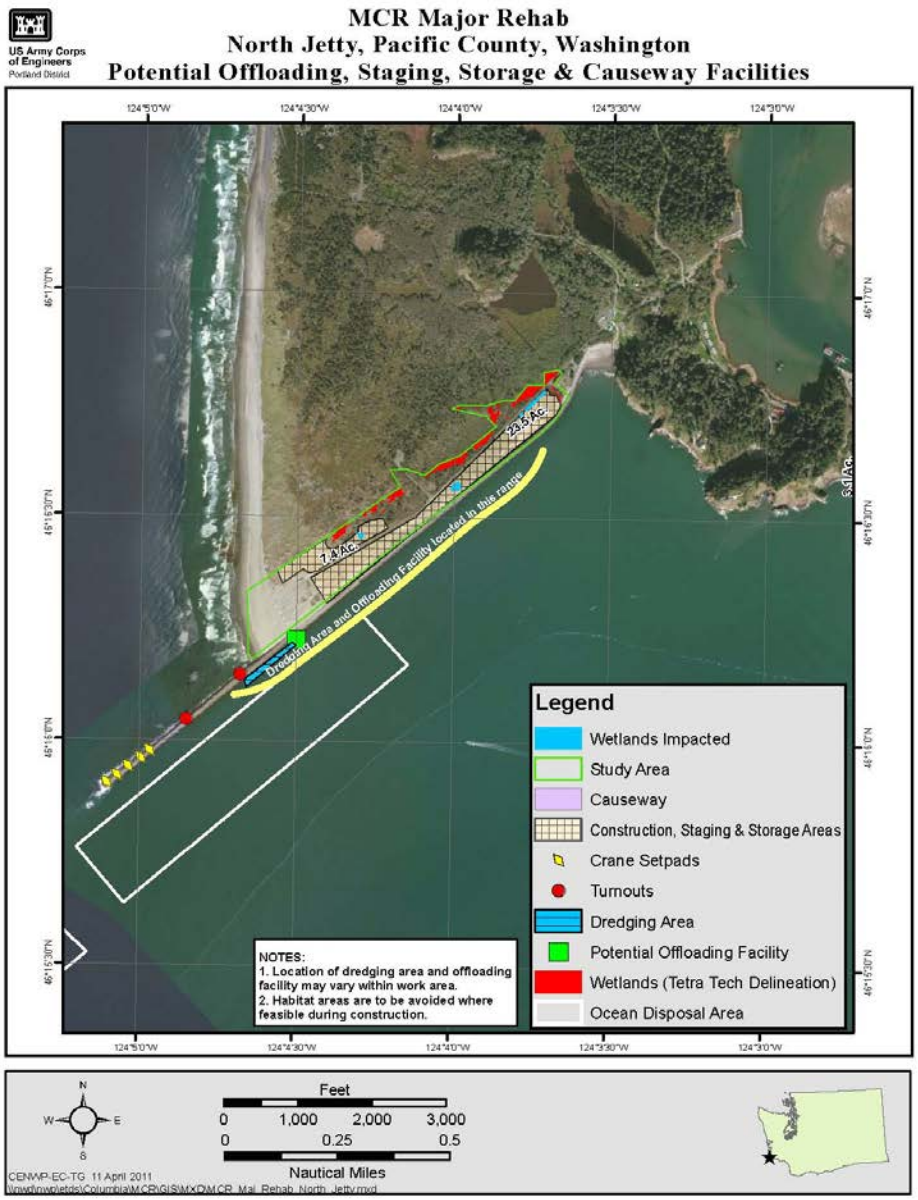
Example of a scheduled repair template, including zones of placement relative to MLLW. Design efforts will refine actual locations, stone size, and quantities, which may be less robust than that pictured here.

Figure 9. North Jetty Example Cross Section of Scheduled Repairs Trunk and Root

For the revised implementation schedule, critical repairs will be done first as described previously. Then for scheduled repairs, about 220,000 tons (~88,000 cy) of new rock will be placed on relic armor stone, with the majority of stone placement above MLLW. Each repair action is expected to cover a length range of up to 1,500 feet and include stone volumes and rework in the range of 30,000 to 60,000 tons (~12,000 to 24,000 cy) per season.

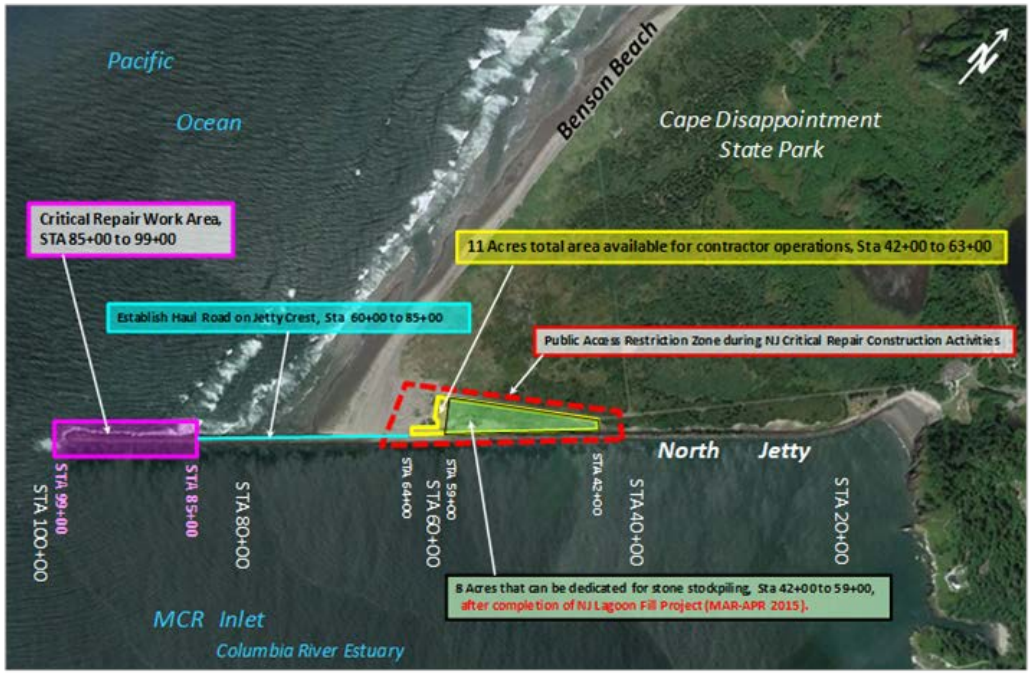
The cross-section repairs are primarily above MLLW, with a majority of stone placement not likely to extend beyond -5 feet below MLLW (only about 18% below MLLW). With placement divided into elevation zones per maximum representative repair event, about 58% of the maximum overall stone placement on these portions of the jetty would be placed above MHHW. About 25% of the overall stone placement would be placed between MHHW and MLLW, and about 18% would be placed below MLLW. The footprint of the trunk and root will remain on relic stone and within its current dimensions.

In order to conduct the scheduled repairs, the staging area used for critical repairs and the lagoon fill project will be used. The Corps will also construct a haul road on top of the jetty, as well as the possibility of one offloading facility (LOA needed, described separately). This will complement turnouts and crane set-up pads that are also needed to perform placement work. See Figure 10 and Figure 11.



This conceptual figure indicates the likely locations of the staging area and barge offloading facility. Design details remain under development, but this representation is likely to be the location and maximum extent of impact. The Corps will avoid the wetland areas at the eastern-most end of the project which were protected and restored during lagoon fill.

Figure 10. North Jetty Conceptual Staging and Offloading Facility Locations



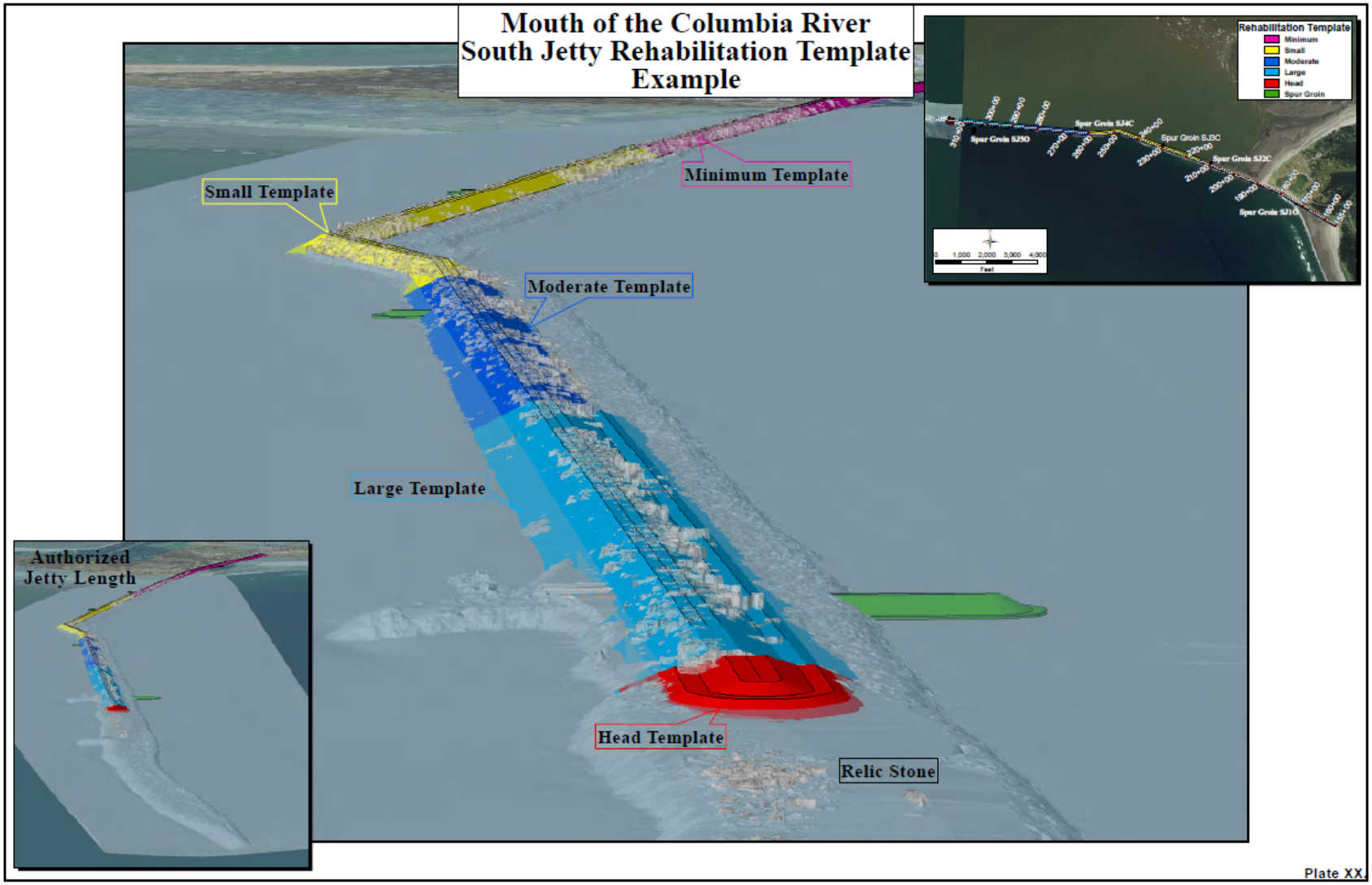
Work Area for Critical Repairs will be the same for Scheduled Repairs. Contractor's staging and stockpile areas are shown at Sta. 42+00 to 64+00. A jetty crest haul road provides a transit corridor from the staging area to the repair area. An access ramp will be constructed to provide access from the contractor's staging-stockpile area to the jetty haul road.

Figure 11. North Jetty Critical Repairs Work Area Overview (same area used for Scheduled Repairs)

1.3. South Jetty Interim Repair (SJIR): Determine Terminus Location and Maintain Trunk and Root, 2017-2021

The Corps is seeking a LOA for construction work related to repairs on top of the South Jetty proper and pile installation and removal for a barge offloading facilities. Because South Jetty is an important haul-out site for pinnipeds, both construction activities related to repairs and pile installation/removal were activities that NMFS identified during consultation as having potential to affect marine mammals.

At the South Jetty, the Corps will pursue an Interim Repair strategy. The SJIR is slightly less robust than Scheduled Repairs and may defer design and implementation of head stabilization measures. The head may recede somewhat prior to and during repairs, but the optimal terminal location remains to be determined through additional physical and numerical modeling supplemented by the Corps' extensive and more aggressive monitoring program. See Figure 12.



This 3-D Image is a representation of different repair strategies considered during development of Major Rehabilitation alternatives. The Corps is NO LONGER proposing spur groins. The Interim Repairs are most closely represented by the "minimum" (purple) and "head" (red) templates portrayed here

Figure 12. Example South Jetty Interim Repairs 3-D Work Area Overview

1.3.1. South Jetty Head Stabilization Feature

The Corps is still determining the most appropriate location and size for the terminus (or head) in order to achieve a resilient South Jetty structure (Figure 13). However, the Corps based its ESA consultation on a larger scale, head-capping feature that is bigger than what is now likely to be designed as a stabilization measure. The following discussion is retained for context relative to the information and effects evaluated in the EA and BA. The Corps will need and LOA for construction activities related to head repairs.

"Columbia River sound jetty end by bar_pana" at Google Earth accessed 1/2/2015.

Figure 13. South Jetty Terminus and Rock Islands

The terminus is likely to remain at or landward of the current station at approximately STA 313+00 (end of crest). Originally, an armor stone cap with approximately 40,000 to 74,000 tons (~25,000 to 46,250 cy) of stone or concrete armor units was proposed to be placed on the head of the South Jetty to stop its deterioration. The features of this larger-scale work are shown in Table 3, but the final design will likely be smaller in dimension and volume.

Table 3. South Jetty Head Stabilization Feature (representation of maximum)

Head Stabilization Feature	South Jetty
Location of cap	STA 313+00
Timing of construction	2018-2021
Dimensions of cap (length x width x height in ft)	350 x 290 x 45 (2.33 acres)
Stone size	30 to 50 tons
Area affected (outside of relic stone)	None
% of cap constructed on relic stone	100%
Construction method	Cranes set on the jetty or jack-up barge to place stone; likely barge offloading facility to deliver armor stone; cranes, large haul trucks and excavators to move stone

For head stabilization, when maximum placement was divided into elevation zones, about 52% of the overall stone placement on this portion of the South Jetty would be placed above MHHW. About 25% of stone would be placed between MHHW and MLLW, and about 23% of the overall stone placement on this portion of the South Jetty.

In all zones, all proposed stone placement will occur on existing base relic stone that formed the original jetty cross section and was displaced and flattened by wave action, and does not include any modification that changed the character or increased the scope or size of the original structure design. The terminus of the head will simply be closer to shore on a shorter jetty structure. The footprint of the existing jetty mound on the flattened relic stone is approximately 1.69 acres, and the additional head stabilization on relic stone may increased the width of the mounded prism approximately 0.64 acres, for a total head stabilization footprint of 2.33 acres, all of which will occur on existing relic stone.

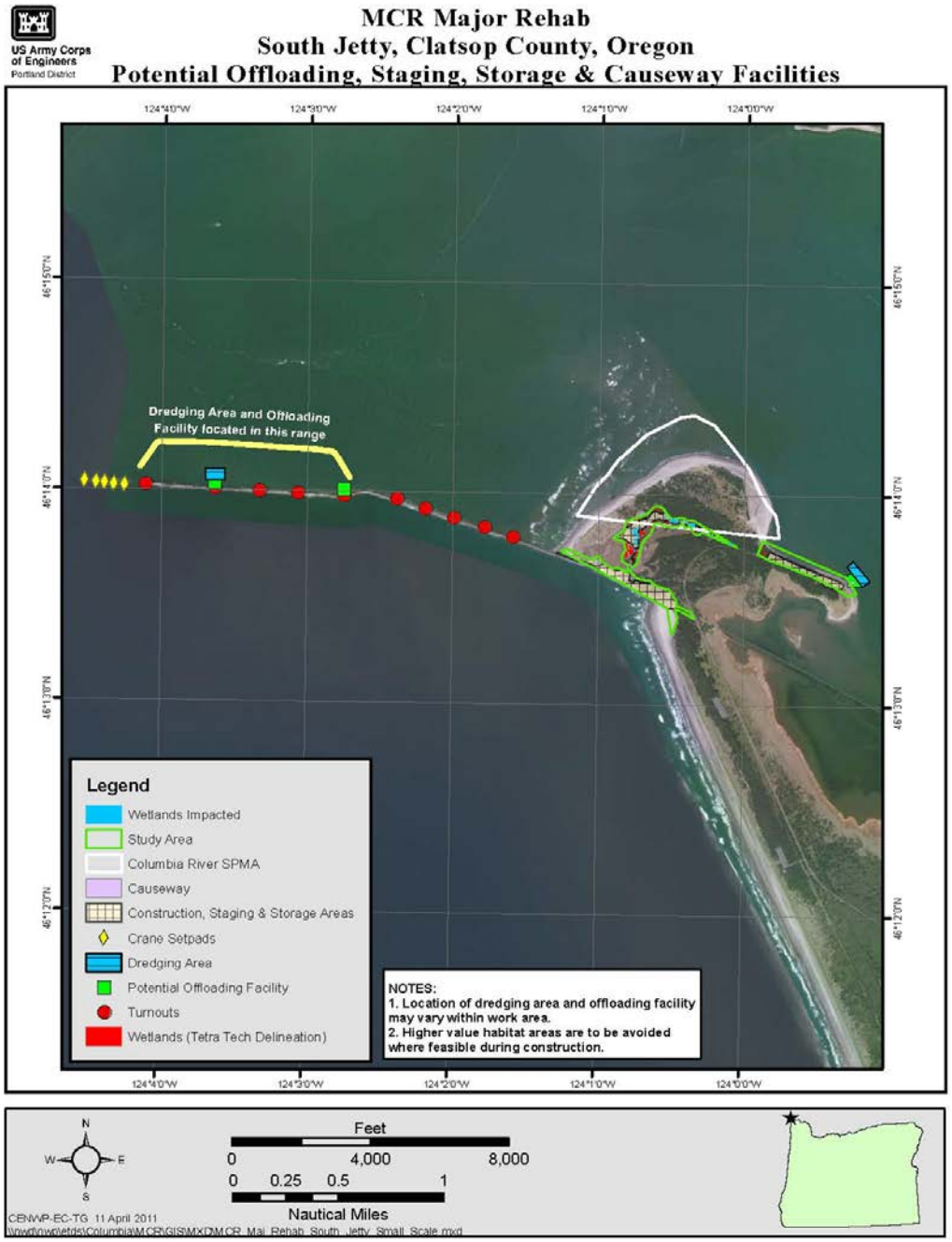
1.3.2. South Jetty Trunk and Root

This work component will require LOA coverage in case pinnipeds are hauled-out further from the head. South Jetty repairs will entail an interim repair strategy which maintains the base condition. Under the base condition scenario, the cross-section design from STA 167+00 to head (311+00 to 313+00) would have a crest width of approximately 30 feet and would lie essentially within the existing jetty footprint based on the configuration of the original cross section, previous repair cross sections, and redistribution of jetty rock by wave action. The cross-section repairs are primarily above MLLW with a majority of stone placement not likely to extend beyond -5 feet below MLLW.

The majority of the stone placement, about 344,191 tons, would be conducted above MLLW. Each repair action is expected to cover a length up to 2,300 feet and include stone volumes in the range of 50,261 to 130,353 tons per season (31,329 to 81,471 cy).

The interim repair quantities would likely be less than what follows, but the maximums are reflected here to give an idea of the placement volumes in each elevation range. When divided into elevation zones, a maximum of about 68% of the overall stone placement on these portions of the South Jetty would be placed above MHHW. About 19% of the overall stone placement would be placed between MHHW and MLLW, and about 13% of the overall stone placement would be placed below MLLW. In all zones, all proposed stone placement would occur on existing base relic stone that formed the original jetty cross section. The footprint of the trunk and root of the South Jetty would remain within its current jetty dimensions and on relic stone.

To implement SJIR, there are two possible barge offloading facilities that may be constructed and used simultaneously. *An LOA for pile installation will be required for construction, maintenance, and removal of these facilities.* They are discussed in the next section in greater detail. The conceptual location of the staging and offloading facilities are shown in Figure 14.



This conceptual figure indicates the likely locations of the staging area and 2 barge offloading facilities. Design details remain under development, but this representation is likely to be the location and maximum extent of impact.

Figure 14. South Jetty Conceptual Staging and Offloading Facility Locations

1.4. Construction Implementation and Offloading Facilities

1.4.1. General Construction

Construction measures and implementation activities for all three MCR jetties may include the following:

- Storage and staging areas for rock stockpiles and all associated construction and placement activities, such as roadways, parking areas, turn-outs, haul roads, weigh stations, yard area for sorting and staging actions, etc. *This work component will not require IHA/LOA coverage*.
- Stone delivery from identified quarries either by barge or by truck. Possible transit routes have been identified from land and water. This also includes the construction and use of temporary and permanent barge offloading facilities and causeways with installation and removal of associated piles and dolphins. *This work component will require IHA/LOA coverage (Jetty A, both IHA/LOA; and North and South Jetty, LOA coverage).*
- Stone placement either from land or water, which includes the construction, repair, and maintenance of a haul road on the jetty itself, crane set-up pads, and turnouts on jetty road. Placement by water could occur via the use of a jack-up barge on South Jetty, but North Jetty will not use jack-up barges. *This work component will require LOA coverage at South Jetty*.
- Regular dredging and disposal of infill at offloading facilities with frequency dependent on a combination of the evolving conditions at the site and expected construction scheduling and delivery. Disposal will occur at existing designated and approved in-water or flow-lane sites. *This work component will require LOA coverage at South Jetty*.

As noted, pile installation and removal were the only activities at Jetty A and North Jetty for which the Corps is requesting an IHA and LOA. At South Jetty, all work related to pile installation, stone placement, or dredging near the head could result in acoustic disturbance to both pinnipeds and marine mammals, and visual disturbance to pinnipeds.

Placement of jetty stone on the MCR jetties would be accomplished by land or limited water-based equipment. Only clean stone will be used for rock placement, where appropriate and feasible. Where appropriate, there also will be some re-working and reuse of the existing relic and jetty prism stone. Fill for the jetty haul roads will not be cleaned prior to installation. Dropping armor stone from a height greater than 2 feet will be prohibited. During placement, there is a very small chance of stone slippage down the slope of the jetty. However, this is unlikely to occur due to the size and cost of materials and placement.

For land-based rock placement, a crane or a large track-hoe excavator could be situated on top of the jetty. The placement operation would require construction of a haul road along the jetty crest within the proposed work area limits. The crane or excavator would use the haul road to move along the top of jetty. Rock would be supplied to the land-based placement operation by land and/or marine-based rock delivery. For marine-based rock, the land-based crane or excavator

would pick up rock directly from the barge or from a site on the jetty where rock was previously offloaded and stockpiled, and then place the rock within the work area. For land-based rock, the crane or excavator would supply rock via a truck that transports rock from the stockpile area. The crane or excavator would advance along the top of the jetty via the haul road as the work is completed.

In order to place stones, a haul road will be constructed on the 30-foot crest width of each jetty to allow crane and construction vehicle access. Roads will consist of an additional 3 feet of top fill material, which could also entail an additional 2 feet of width spill-over. These roads will remain in place for the duration of construction. Due to ocean conditions and the wave environment, these roads will likely need yearly repair and replacement. They will not be removed upon completion. Ramps from the beach up to the jetty road will also be constructed to provide access at each jetty.

At approximately 500 to 1,000-foot jetty intervals, turnouts to allow equipment access and passage will be constructed on the North Jetty, South Jetty and Jetty A. These will consist of about 50-foot long sections that are approximately an additional 20 feet in width. Some of this stone for these facilities may encroach below MLLW. On the North Jetty, there will be approximately two turnouts. South Jetty will have approximately eight turnouts with two additional larger-sized turnouts. These larger turnouts will be in the approximate range of 300 feet in length with an additional 20 feet in width. One of these larger turnouts will function as an offloading facility on South Jetty. At Jetty A, the causeway will function as the access route with additional turnout facilities. These turn-outs may vary in length and dimension depending on the equipment procured by the contract. The overall area of the final design turnouts are likely to be within the ranges above.

Towards the head of each jetty, additional crane set up pads will be constructed at approximately 40-foot increments to allow crane operation during the placement of the larger stabilization stones. Set-up pads will roughly entail the addition of 8 feet on each side of the crest for a length of about 50 feet.

Another approach to water-based rock placement would be via a jack-up barge. This would only be applicable at the South Jetty. For armor stone and rock placement at the head, a jack-up barge with crane could be used to serve as a stable work platform (Figure 15). Once into place, the jack-up barge would be jacked up on approximately six legs so that the deck is at the same elevation as the jetty. The legs are designed to use high-pressure water spray from the end of the legs to agitate the sand and sink the legs under their own weight. The jacking process does not use any lubricants that contain oils, grease, and/or other hydrocarbons. The stone and rock will be barged to the jack-up barge and offloaded onto the jetty head. The jack-up barge will keep moving around the head of the jetty to complete the work. A jack-up barge would not be used on the North Jetty or Jetty A to minimize interference with navigation of fishing boats and crab and fish migrations.

Figure 15. Typical Jack-up Barge

1.4.2. Barge Offloading Facilities

The Corps is requesting an IHA for the first year of pile installation related to construction of a barge offloading facility at Jetty A, an LOA for the second year of pile maintenance and removal at Jetty A, and LOA coverage for the same type of offloading facilities at the North Jetty and South Jetty.

Stone delivery by water could require up to four barge offloading facilities that allow ships to unload cargo onto the jetty so that it can then be placed or stockpiled for later sorting and placement. The range of locations for these facilities is shown in Figure 5, Figure 10 and Figure 14. Depending on site-specific circumstances, offloading facilities may be partially removed and rebuilt, may be permanently removed, or may remain as permanent facilities upon project completion. Facility removal will depend on access needs and evolving hydraulic, wave, and jetty cross-section conditions at each offloading locations. The final design of the facilities will be dependent on the contractor's needs, but the Corps will include specific constraints in the contract.

For this analysis, the Corps assumed that construction of the four barge offloading facilities combined will require approximately up to 96 piles with a maximum diameter of 24-inches, and up to 373 sections of Z-piles to retain rock fill. They will be located within 200 feet of the jetty structure and will be installed via vibratory installation. The original diameter proposed in the BA was 12-16 inches diameter. Subsequently, the Corps determined this diameter *may* not be sufficient for anticipated equipment and stone weights. The Corps will continue to consult with NMFS about the potential ramifications of this possible project description change. For the purposes of this take estimate request, the Corps has conservatively used a 24-in proxy pile size. This is due to a paucity of information about sound effects from smaller pile sizes, and this larger

diameter provides a more conservative estimate of the related potential acoustic Zone of Influence (ZOI). Assumptions and methods for estimating acoustic impacts are discussed later in this analysis.

If existing barge facilities are not available or do not have adequate capacity to provide access, barge offloading facilities could be constructed at each jetty as described below.

- North Jetty: Between STA 50+00 and 70+00, a barge offloading facility will be constructed in the reach such that wave conditions allow safe offloading. Generally, this offloading facility may require 4-8 dolphins of 3 piles each for vessel tie-up, and sheet-pile installation will be required to shore-up and retain rock at the offloading point.
- Jetty A: An offloading facility will be sited somewhere between STA 77+00 and 85+00 (vs. STA 81+00 due to recent discovery of existing pile dike structure that must be avoided), at the upstream portion of the jetty near the head. This offloading facility may require piles for vessel tie-up, and sheet-pile installation will be required to shore-up and retain rock at offloading point.
- South Jetty: The South Jetty could have up to two associated offloading sites. One will be located at Parking Area D near the northeastern-most corner of the spit. The second will be located along the jetty and will resemble an extra large turn-out facility. It is likely to be located somewhere on the northern, channel-side of the jetty and west of STA 270 in order to take advantage of deeper bathymetry and subsequently less need for dredging. The facility at Parking Area D may be removed after 5 or more years depending on hydraulic impacts of the structure and spit. The facility along the jetty will likely be partially removed and rebuilt after each repair to avoid the potential for wave-focusing on the jetty. Otherwise, it will remain in place. Each offloading facility may require 4 to 8 dolphins of 3 piles each for vessel tie-up, and sheet-pile installation will be required to shore-up and retain rock at offloading point. However, the exact design, dimension, and elevation of each facility is yet to be determined and will remain within the constraints of the overall number, installation method, and size of piles indicated.

1.4.2.1. Fill Acreage and Volume for Offloading Facilities

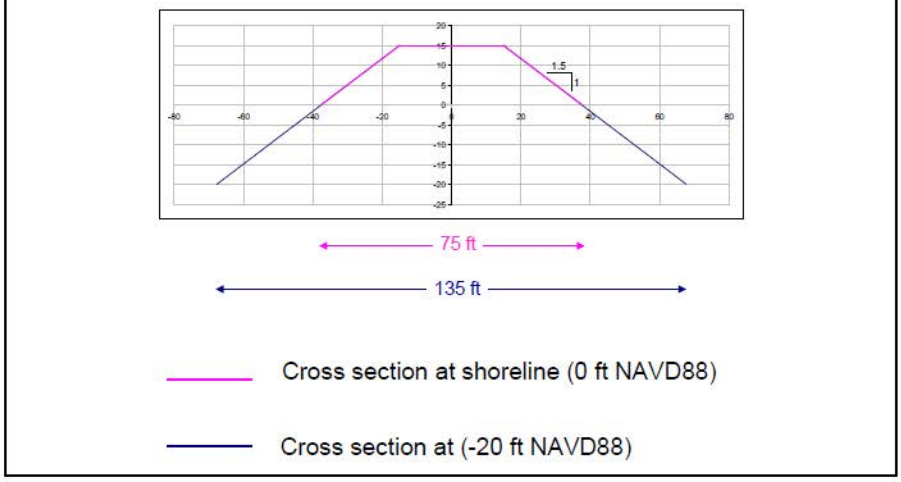
The following information represents conceptual dimensions and designs, which may vary upon final contract designs. However, the number, size, and installation method will not vary outside of the scope indicated.

Offloading facilities will range from approximately 200- to 500-feet long and 20- to 50-feet wide, which ranges from about 0.48 to 2.41 acres in total fill area for each facility. For initial construction of all four offloading facilities combined, approximately up to 96 piles that are between 12 and 24 inches in diameter could be installed as pile tie-ups or as part of the retaining structure, and up to 373 sections of Z-piles installed to retain rock fill.

Figure 16 and Figure 17 show a cross-section diagram for stone access ramp at potential barge offloading facilities and photos illustrating typical barge offloading facilities. Facilities may have a North American Vertical Datum (NAVD) crest elevation of 15 to 30 feet (the 15-foot elevation mentioned in the EA and BA was in error) and may be installed at channel depths between -20 and -30 feet NAVD. Removal and replacement of the facilities could occur within the duration of the construction schedule. Volume and acreage of fill for these facilities are shown in Table 4. This table is included to illustrate the minimal magnitude of impacts offloading facilities will have on aquatic habitat.

Table 4. Rock Volume Fill and Area of Barge Offloading Facilities and Causeways

Offloading Facility Location	Approximate Length (ft)	Approximate Rock Volume (cy) below 0 MLLW	Total Approximate Rock Volume (cy)	Approximate Square Feet	Acres
North Jetty	200	7,778	29,640	21,000	0.48
Jetty A near head	200	7,778	29,640	21,000	0.48
Jetty A mid-section causeway	5,000	38,888	38,888	105,000	2.41
South Jetty Parking Area D	450	17,417	33,688	47,250	1.08
South Jetty along jetty turn-out	200	--	18,640	21,000	0.48



Conceptual cross section of stone access ramp at potential barge offloading facilities at east end of Clatsop Spit near Parking Area D; and photos of typical barge offloading facilities.

Figure 16. Conceptual Cross Section and View of Typical Barge Offloading Facility

Figure 17. Additional Views of Typical Barge Offloading Facilities

1.4.2.2. Dredging Acreage, Volume and Disposal

This work component *will require LOA coverage for visual disturbance only at the South Jetty*. Transport of rock would most likely be done by ocean-going barges that require deeper draft (20-22 feet) and bottom clearance when fully loaded than river-going barges. Therefore, dredging will be required to develop each of the barge offloading facilities. Under-keel clearance should be no less than 2 feet. The elevation at barge offloading sites should have access to navigable waters and a dredge prism with a finish depth no higher than -25 feet MLLW, with advance maintenance and disturbance zone depths not to extend below -32 feet MLLW. These facilities should also provide for a maneuvering footprint of approximately 400 feet x 400 feet. The depth along the unloading sites would be maintained during the active period for which the rock barges will be unloaded.

A clamshell dredge would likely be used for all dredging. It has been determined that a pipeline dredge would not be feasible at North or South Jetty due to ocean and river conditions. The material to be dredged is medium to fine-grained sand, typical of MCR marine sands. Disposal of material would occur in-water at an existing, previously evaluated and designated, or other approved disposal site. The volume of material to be dredged is shown in Table 5; these estimates are based on 2012 bed morphology and may change. Also, maintenance dredging to a finish depth of -25 feet MLLW will be needed before offloading during each year of construction. Dredging is likely to occur on a nearly annual basis for the duration of the project construction period, but this will be intermittent per jetty, depending on which one is scheduled for construction in a particular year.

Table 5. Estimated Dredging Volumes for Barge Offloading Facilities

Location*	Estimated Dredging Volume (cy)		Approximate Acres
	Initial	Estimated Maintenance**	
North Jetty	30,000	30,000	3.73
Jetty A	60,000	None (1 year only)	3.73
South Jetty – Along Jetty	20,000	20,000	4.19
South Jetty – Parking Area D	20,000	20,000	4.19

* Some of the locations will not be used on an annual basis; it depends on the construction schedule for each jetty.
**All dredging will be based on surveys that indicate depths shallower than -25 feet MLLW.

Clamshell dredging uses a bucket operated from a crane or derrick that is mounted on a barge or operated from shore, in this case the jetty. Sediment removed from the bucket is generally placed on a barge before disposal. This type of dredge is typically used in shallow-water areas.

The following overall impact minimization practices and best management practices (BMPs) will be used for all maintenance dredging for offloading facilities.

- To reduce the potential for entrainment of juvenile salmon or green sturgeon, the cutter-heads on pipeline dredges will remain on the bottom to the greatest extent possible and

only be raised 3 feet off the bottom when necessary for dredge operations. It is unlikely that this type of dredge would be used.

- To reduce turbidity, if a clamshell bucket is used, all digging passes shall be completed without any material, once in the bucket, being returned to the wetted area. No dumping of partial or half-full buckets of material back into the project area will be allowed. No dredging of holes or sumps below minimum depth and subsequent redistribution of sediment by dredging dragging or other means will be allowed. All turbidity monitoring will comply with State 401 Water Quality Certification conditions.
- If the Captain or crew operating the dredges observes any kind of sheen or other indication of contaminants, he/she will immediately stop dredging, follow the appropriate protocols, and notify the Corps' environmental staff.
- If routine or other sediment sampling determines that dredged material is not acceptable for unconfined, in-water placement, then a suitable alternative disposal plan will be developed in cooperation with the NMFS, U.S. Environmental Protection Agency (EPA), Oregon Department of Environmental Quality (ODEQ), Washington Department of Ecology (WDOE), and other appropriate agencies.

Dredged material disposal would likely occur on an annual basis originating from one or more of the offloading facilities. The duration of disposal will be limited to daylight hours for a few days out of the year and will likely occur earlier in the construction season in the spring or summer prior to use of offloading facilities when ocean and wave conditions permit safe operations. All disposal of dredged material will be placed in previously evaluated and EPA-approved Ocean Dredged Material Disposal Site (ODMDS) or other approved CWA Section 404 or flow lane disposal sites.

Two dredged material disposal sites, the Shallow Water Site and the North Jetty site, are located near the North Jetty. There is also a Deep Water Site further offshore, west of the North Jetty and a new South Jetty disposal site. The Shallow Water Site was originally considered as the most likely sites to be used for disposal of dredged material. However, it is now anticipated that dredged material would be placed either as flow lane disposal or at the EPA-designated Deep Water Site. The material disposal location is limited by dredge equipment constraints due to the proximity of the jetty and depths which limit both the type of dredge methods that can be used, as well as the level of barge and disposal control achievable. Excavator and scow maneuverability preclude the ability to do a thin-layer of placement required at the Shallow Water Site, and proximity to the jetty precludes the ability to use a hopper dredge.

These disposal sites have been previously vetted through the appropriate regulatory agencies, were evaluated for their effects, and were subsequently designated or approved after such review. The current Proposed Action and use of the Deep Water Site or other designated disposal site will maintain compliance with approved use. This will likely be covered in the Annual Use Plan, which includes a request for use and is approved by the EPA. This involves a request for concurrence that the Corps' proposed Annual Use Plan is in compliance with the Site Monitoring and Management Plan.

For duration of dredging, typical clamshells fill 3 to 5 scows a day, but could be as few as 2.5 scows per day if disposal is at the Deep Water Site (EPA designated), which is much farther than flow lane sites. Flow lane placement might be closer to 4 loads per day. The Corps assumed a typical scow load volume of about 1,000 cy. This also assumes that there is lag time waiting for the scow to return from the disposal site so that dredging is not continuous. However, some contractors will use two scows and work continuously, but these dredging quantities are so low that it may not worth bringing that much equipment. Given these assumptions, the dredging duration for each facility during each creation or maintenance event would be close to the following estimates:

- North Jetty: Estimating 30,000 cy - 12 days.
- Jetty A: Estimating 60,000 cy - 24 days (EA quantity); however, current estimates are being refined and may be less depending on actual location.
- South Jetty (along Jetty): Estimating 20,000 cy - 8 days.
- South Jetty (Parking Area D): Estimating 20,000 cy - 8 days.

1.4.2.3. Pile Installation and Removal

This work component will require IHA coverage at Jetty A and LOA coverage at all jetties. For initial construction of all four offloading facilities combined, approximately up to 96 wood or steel piles could be installed and up to 373 sections of Z-piles, H-piles, and sheet pile to retain rock fill. It is unlikely but not impossible that the contractor would use wood piling with installation via vibratory hammer. A vibratory hammer will be used for pile installation and only untreated wood will be used, where applicable. They will be located within 200 feet of the jetty structure. Because the sediments in the region are soft (sand), use of a vibratory driver to install piles is feasible and will be used when necessary. The presence of relic stone may require locating the piling further from the jetty so that use of this method is not precluded by the existing stone. The dolphins/Z- and H-piles would be composed of either untreated timber or steel piles installed to a depth of approximately 15 to 25 feet below grade in order to withstand the needs of off-loading barges and heavy construction equipment. Because vibratory hammers will be used in areas with velocities greater than 1.6 feet per second, the need for hydroacoustic attenuation is not an anticipated issue. Piling will be fitted with pointed caps to prevent perching by piscivorous birds to minimize opportunities for avian predation on listed species. Some of the pilings and offloading facilities will be removed at the end of the construction period.

1.5. Best Management Practices, Mitigation and Impact Minimization Measures

Best management practices are generally described here, in Section 13, and in pertinent subsections above. Besides those BMPs already included (turbidity minimization, pile installation via vibratory hammer, etc.), additional BMPs will be implemented. The bulk of these were incorporated in the Corps' EA and BA.

To protect water quality, the Corps will also require the use of environmentally acceptable lubricants (EALs) for equipment working on the jetties and below OHW. Equipment will be fueled and lubricated only in designated refueling areas at least 150 feet away from the MHHW with the following exceptions: when in a confined barge; or when in-place refueling stationary equipment on the jetty will be done via the Wiggins fast-fuel system, or an equivalent. This type of system uses a sealed vehicle tank with automatic shut-off fuel nozzle to reduce leaks during fueling of cranes and other equipment in-place on the jetties. Generators, cranes, and any other stationary power equipment operated within 150 feet MHHW will be maintained as necessary to prevent leaks and spills from entering the water. Vehicles/equipment will be inspected daily for fluid leaks and cleaned as needed before leaving staging and storage area for operation within 150 feet of MHHW. Any leaks discovered will be repaired before the vehicle / equipment resumes service. Equipment used over or below MHHW will be cleaned before leaving the staging area, as often as necessary to remain grease-free. Also, spill pans will be mounted under the crane and monitored daily for leaks.

The Corps committed to the use of vibratory hammers for pile installation and will implement a soft-start procedure. The Corps also is limiting the installation window to on or after May 1 in order to avoid exposure of Southern Resident killer whales (*Orcinus orca*) and will avoid installation or removal after September 30.

The Corps anticipates that the new IHA/LOA permit would entail requirements similar to those in the previous permit for repair of the South Jetty to minimize take of pinnipeds, and has included those activities in the Proposed Action for work at the South Jetty, North Jetty, and Jetty A as appropriate.

Conservation measures that will be implemented to minimize disturbance to pinnipeds include the following. During land-based rock placement, contractor vehicles and personnel will avoid as much as possible direct approach towards pinnipeds that are hauled out. If it is absolutely necessary for the contractor to make movements towards pinnipeds, the contractor shall approach in a slow and steady manner to reduce the behavioral harassment to the animals as much as possible. Additional measures are included in Section 11. The current proposal mirrors previous requirements, including monitoring and reporting described in Section 13.

2. Dates and Duration, Specified Geographic Region

The date(s) and duration of such activity and the specified geographical region where it will occur.

The activities are located at the three MCR jetties in Pacific County, Washington, and Clatsop County, Oregon. The scheduled program of repair and rehabilitation priorities were described and illustrated in Section 1 and then more specifically described in the Proposed Action for each jetty (Subsections 1.1 to 1.3). To recap, the sequence and overall timing for remaining work requiring IHA/LOA at the three MCR jetties includes:

1. Jetty A Scheduled Repairs and Head Stabilization (IHA/LOA for pile installation related to offloading facility). Need IHA by July 29, 2015 for the award of contract and first season of installation; construction/stone placement 2016 and 2017; (dependent on funding); likely one season of in-water work, but possibly two seasons of construction, mobilization, demobilization. The Corps is requesting an LOA covering a second season of pile maintenance and removal in case in-water work continues past 1 year.
2. North Jetty Scheduled Repair and Head Stabilization (LOA for pile installation and removal at offloading facility). Need LOA by summer 2016; construction/placement 2016 or 2017-2019 (dependent on funding); three placement seasons.
3. South Jetty Interim Repair and Head Determination (LOA for pile installation and removal at two facilities, and construction activities on trunk near head). Need LOA by summer 2016 to award contract; procurement/construction/placement 2017-2021; four placement seasons.

The MCR in-water work window for fish occurs from November 1 to February 28. However, adverse wave and inclement winter weather conditions at the MCR often preclude safe working conditions during the in-water work window to protect fish; thus, it is unlikely that barge offload structures and other project elements could be built safely during this time. Generally, work on the jetties themselves is limited by the ocean and river conditions, especially on the more exposed portions of North and South jetties. Crew safety and construction feasibility will require project actions to occur during fair weather months outside of the in-water work window. Therefore, the work season *generally* extends from April through October, with extensions, contractions, and additional work windows outside of the summer season varying by weather patterns. Work on haul roads, causeway, site preparation, staging, mobilization, and dredging for offloading facilities could start sooner than armor stone placement work, depending on weather and sea conditions. As noted previously, to avoid the timing and presence of Southern resident killer whales, their primary season of feeding, and their potential presence at the MCR plume, the Corps will prohibit pile installation for offloading facilities from October 1 until on or after May 1. Installation could occur from May 1 to September 30 each year. Dredging will be prohibited from January through February each year although sea conditions preclude the likelihood such work would be possible.

Pile installation is assumed to occur for about 10 hours a day, with a total of approximately 15 piles installed per day. This production rate was assumed to give a conservative estimate regarding the duration of effects. It is more likely that up to 20 piles could be installed per day. Each offloading facility would have about ¼ of the total piles mentioned. For initial construction of all four offloading facilities combined, approximately up to 96 piles could be installed, and up to 373 sections of sheet pile to retain rock fill. They will be located within 200 feet of the jetty structure. This is a total of 469 initial installation and 469 removal events, over the span of about 67 days. In order to round the math, the Corps has assumed 68 days, so that each of the four offloading facilities takes about 17 days total for installation and removal. This is likely to maximum number of days for pile installation. The Corps is still determining whether or not to remove some or all of these offloading facilities, and some may not survive ocean conditions. Longer-term offloading facilities at South and North Jetties may need to be repaired if used more

than one season. The Corps will also be conducting post-construction pedestrian surveys along the jetties, and will have construction activities for about four seasons on the South Jetty.

In the NMFS BiOp, it was estimated that all the piles will all be driven and removed, and that 31 piles will be driven and removed twice for a total of 1,000 pile driving or removal events. Installation and removal of piles with a vibratory hammer will introduce sound waves into the MCR area intermittently for up to 7 years (depending on funding streams and construction sequences). However, it is likely that the bulk of the installation work will be completed during four main construction seasons (one for each facility), with an approximately 10-day period of pile installation or removal work each season. It is possible but unlikely that driving could occur at multiple facilities during the same season, which may change the number of seasons and days of exposure overall. Depending of the funding stream, more than one facility may be operational simultaneously. The total combined pile work is expected to take about 68 days.

Dredging duration was described in the pertinent sections of the Proposed Action (Section 1). Dredging for each offloading facility would occur early and once per construction season unless unforeseen infill problems arise (JASR = one event; NJSR = three events; SJIR = four events). With a range of 2.5 to 5 scows per day depending on the disposal site and equipment, a conservative estimate is 30 dredging days. Dredging and disposal would be sequenced to occur first in the season around spring to prepare for stone delivery. Depending of the funding stream, more than one facility may be operational simultaneously. The visual disturbance from dredging activities would only be expected at the South Jetty, and has been incorporated into the assumptions about seasonal duration for all construction work at South Jetty.

Monitoring and pedestrian surveys are also weather dependent and occur mostly in spring and summer and last 1 or 2 days per jetty. These will happen yearly or every 2 years. Only surveys at South Jetty would have any effects on pinnipeds. The Corps has assumed up to 3 surveys lasting 2 days each would occur prior to commencement of construction activities.

Road and access construction on top of each jetty and for the Jetty A causeway could happen year-round and could take up to 1 month, but is more likely early in the spring. Access construction may also occur throughout the season as access progresses with the armor repair template. Depending on the number of work seasons, additional repairs to access roads would be made early in each season. Due to its length, access at the South Jetty will be harder to maintain and may take additional repairs during each season. The Corps has assumed a construction season of April to October given the winter ocean conditions and exposed nature of the South Jetty.

As noted, placement of jetty stone would happen on a daily basis in the summer months generally from April or May through October.

3. Species and Numbers of Marine Mammals

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

Marine mammals known to occur in the Pacific Ocean offshore at the MCR include whales, orcas, dolphins, porpoises, sea lions, and harbor seals. Most cetacean species observed by Green and others (1992) occurred in Pacific slope or offshore waters (600 to 6,000 feet in depth). Harbor porpoises (*Phocoena phocoena*) and gray whales (*Eschrichtius robustus*) were prevalent in shelf waters less than 600 feet in depth. Orcas are known to feed on Chinook salmon at the mouth, and humpback whales (*Megaptera novaeangliae*) may transit through the area offshore of the jetties. The marine mammal species potentially present in the activity area are shown in Table 6.

Pinniped species that occur in the vicinity of the jetties include Pacific harbor seals (*Phoca vitulina richardsi*), California sea lions (*Zalophus californianus*), and Steller sea lions (*Eumetopias jubatus*). Their use is primarily confined to the South Jetty. According to the Washington Department of Fish and Wildlife (WDFW) aerial survey counts from 2000-2014, there are no records for harbor seals, Steller sea lions or California sea lions using the North Jetty or Jetty A (WDFW 2014).

As previously noted, jetty work including stone placement, pile installation, and dredging for offloading facilities is confined to areas on or directly adjacent to the jetty structures, with dredge disposal actions likely to occur in the flow-lanes or at the offshore EPA-designated ODMDS.

3.1. Cetaceans

Some species listed in Table 6 are federally endangered and occur as migrants off the Oregon Coast in waters typically much farther from shore than the nearshore MCR area. Federally listed ESA whales that could occur in the near or far proximity of the MCR jetties include blue, fin, sei, sperm, humpback, gray, and Southern resident and transient killer whales. Risso's dolphins, beaked whales, Pacific white-sided dolphins, and Dall's porpoises are also known to occur in the greater vicinity of the MCR along the Continental Shelf break. Whale species are mostly migratory in the vicinity of the MCR, generally are not found close to shore, and are highly mobile. Moreover, MCR is likely not the preferred habitat for several of these species; they are unlikely to feed in the immediate vicinity of the jetties, and jetty rehabilitation work would have inconsequential impacts on their prey base.

Table 6. Marine Mammal Species Potentially Present in the Project Area

Species	Stock(s) Abundance Estimate [1]	ESA Status	MMPA* Status	Frequency of Occurrence [3]
Killer Whale (*Orcinus orca*) *Eastern N. Pacific, Southern Resident Stock*	85	Endangered	Depleted and Strategic	Infrequent/ Rare
Killer Whale (*Orcinus orca*) *Eastern N. Pacific, West Coast Transient Stock*	243	--	Non-depleted	Rare
Humpback Whale (*Megaptera novaeangliae*) *California/Oregon/Washington Stock*	1918	Endangered	Depleted and Strategic	Rare
Gray Whale (*Eschrichtius robustus*) *Eastern North Pacific Stock, (Pacific Coast Feed Group)*	18,017 (173)	Delisted/ Recovered (1994)	Non-depleted	Rare
Harbor Porpoise (*Phocoena phocoena*) *Northern Oregon/Washington Coast Stock*	21,487	--	Non-depleted	Likely
Steller Sea Lion (*Eumetopias jubatus*) *Eastern U.S. Stock/DPS***	63,160 – 78,198	Delisted/ Recovered (2013)	Depleted and Strategic [2]	Likely
California Sea Lion (*Zalophus californianus*) *U.S. Stock*	296,750	--	Non-depleted	Likely
Harbor Seal (*Phoca vitulina richardii*) *Oregon and Washington Stock*	24,732	--	Non-depleted	Seasonal

[1] NOAA/NMFS 2014 marine mammal stock assessment reports at http://www.nmfs.noaa.gov/pr/sars/species.htm.

[2] May be updated based on the recent delisting status.

[3] Frequency defined here in the range of:

- Rare – Few confirmed sightings, or the distribution of the species is near enough to the area that the species could occur there.
- Infrequent – Confirmed, but irregular sightings.
- Likely – Confirmed and regular sightings of the species in the area year-round.
- Seasonal – Confirmed and regular sightings of the species in the area on a seasonal basis.

* MMPA = Marine Mammal Protection Act

** DPS = Distinct population segment.

Blue whales occur off the coast in May and June, as well as in August through October. Blue whales typically occur offshore as individuals or in small groups and winter well south of Oregon. Fin whales also winter far south of Oregon and range off the coast during summer. Sei whales winter south of Oregon and probably occur in southward migration off the Oregon Coast in late summer and early fall. Sperm whales occur as migrants and some may summer off the coast; they forage in waters much deeper than those in the nearshore area. North Pacific right whales may occur off the coast during winter and summer in cool waters north of 50 degrees north latitude. Risso's dolphins, beaked whales, Dall's porpoises, and Pacific white-sided dolphins also have been sighted along the Continental Shelf break (Griffith 2015). From the tip of the South Jetty, it is about 35 miles (U.S.) to the Continental Shelf break and the 600-foot isobath. It is about 18 miles (U.S.) to the beginning of the break at the Astoria Canyon. The 35-mile distance generally marks the differential between nearshore use and foraging and migration along the shelf break.

Anecdotal information suggested that there has been a rare spotting of a gray whale at Buoy 14 within the Columbia River. However, gray whales are more likely to be present in the nearshore areas rather than in the river (Griffith 2015). Killer whales have also been observed in the

nearshore areas as recently indicated in a newspaper article of the *Daily Astorian* (2015). Harbor porpoises (*Phocoena phocoena*) are known to be in the nearshore area and have been spotted near Jetty A (Griffith 2015).

During the EA and ESA consultation for the NMFS BiOp, the primary cetacean marine mammal species of concern were the Southern resident killer whale and the humpback whale, which are addressed in further detail below.

3.1.1. Killer Whale

During construction of the project, it is possible that two killer whale stocks could be in the vicinity of the MCR nearshore. However, based on the restrictions to the work window for pile installation, it is very unlikely that either West Coast transient or Southern resident killer whales will be present in the area during the period of possible acoustic effects.

3.1.1.1. Eastern North Pacific Southern Resident Killer Whale

According to the 2013 Pacific Marine Mammal Stock Assessments Report, the estimated population of the Eastern North Pacific Southern resident killer whale is about 85 animals (NOAA 2014a).

According to the NMFS (2008a), the Southern resident killer whale population consists of three pods, designated J, K, and L pods, that reside from late spring to fall in the inland waterways of Washington State and British Columbia. During winter, pods have moved into Pacific coastal waters and are known to travel as far south as central California. Winter and early spring movements and distribution are largely unknown for the population. Sightings of members of K and L pods in Oregon (L pod at Depoe Bay in April 1999 and Yaquina Bay in March 2000, unidentified Southern residents at Depoe Bay in April 2000, and members of K and L pods off of the Columbia River) and in California (17 members of L pod and four members of K pod at Monterey Bay in 2000; L pod members at Monterey Bay in March 2003; L pod members near the Farallon Islands in February 2005 and again off Pt. Reyes in January 2006) have considerably extended the southern limit of their known range (NMFS 2008a). Sightings of Southern resident killer whales off the coast of Washington, Oregon, and California indicate that they are utilizing resources in the California Current ecosystem in contrast to other North Pacific resident pods that exclusively use resources in the Alaskan Gyre system (NMFS 2008a).

During the 2011 BiOp consultation, NMFS indicated Southern resident killer whales are known to feed on migrating Chinook salmon in the Columbia River plume during the peak salmon runs in March through April. Anecdotal evidence indicates that orcas historically were somewhat frequent visitors in the vicinity of the estuary, but have been less common in current times (Wilson 2015). However, there is low likelihood of them being in close proximity to any of the pile installation locations, and there would be minimal overlap of their presence during the peak summer construction season. To further avoid any overlap with Southern resident killer whales use during pile installation, the Corps would limit the pile installation window to start on or after May 1 and end after September 30 of each year to avoid peak adult salmon runs.

3.1.1.1. Eastern North Pacific West Coast Transient Stock Killer Whale

The West Coast Transient stock is considered to include transient killer whales from California through southeastern Alaska. However, it should be noted that the Department of Fisheries and Oceans (DFO) Canada recently decided to exclude whales from California from their assessment of the West Coast Transient Population (DFO 2007 cited in NOAA 2013b). The West Coast Transient stock is a trans-boundary stock including killer whales from British Columbia.

Preliminary analysis of photographic data resulted in the following minimum counts for 'transient' killer whales belonging to the West Coast Transient Stock (NOAA 2013b). Over the time series from 1975 to 2012, 521 individual transient killer whales have been identified. Of these, 217 are considered part of the poorly known "outer coast" subpopulation and 304 belong to the well-known "inner coast" population. However, of the 304, the number of whales currently alive is not certain (see Ford et al. 2013 cited in NOAA 2013b). A recent mark-recapture estimate that does not include the "outer coast" subpopulation or whales from California for the west coast transient population resulted in an estimate of 243 (95% probability interval = 180-339) in 2006 (DFO 2009 cited in NOAA 2013b). This estimate applies to the population of West Coast transient whales that occur in the inside waters of southeastern Alaska, British Columbia, and northern Washington. Given that the California transient numbers have not been updated since the publication of the catalogue in 1997 (Black et al. 1997 cited in NOAA 2013b), the total number of transient killer whales reported above should be considered as a minimum count for the West Coast transient stock.

For this project, it is possible only the inner-coast species would be considered for potential exposure to acoustic effects. However, they are even less likely to be in the project area than Southern resident killer whales, especially outside of the peak salmon runs. The Corps is avoiding pile installation work during potential peak feeding timeframes in order to further reduce the potential for acoustic exposure. However, it is possible that West Coast transients come in to feed on the pinniped population hauled out on the South Jetty.

3.1.2. Humpback Whale

According to the 2013 Pacific Marine Mammal Stock Assessments Report (Appendix 3), the estimated population of the humpback whale California/Oregon/Washington stock is about 1,918 animals (NOAA 2014a). There are at least three separate populations of humpback whales in the North Pacific, of which one population migrates and feeds along the U.S. west coast. This population, previously called the California/Oregon/Washington stock, winters in coastal waters of Mexico and Central America and migrates to areas ranging from the coast of California to southern British Columbia in summer/fall (Carretta et al. 2010 cited in NMFS 2011a). Within this population, regional abundance estimates vary among the feeding areas. Average abundance estimates ranged from 200 to 400 individuals for southern British Columbia/northern Washington, and 1,400 to 1,700 individuals for California/Oregon (Calambokidis et al. 2008 cited in NMFS 2011a).

There is a high degree of site fidelity in these feeding ranges with almost no interchange between these two feeding regions. Humpback whales forage on a variety of crustaceans, other

invertebrates and forage fish (review in NMFS 1991). In their summer foraging areas, humpback whales tend to occupy shallow, coastal waters. In contrast, during their winter migrations humpback whales tend to occupy deeper waters further offshore, and are less likely to occupy shallow, coastal waters.

Humpback whales are sighted off the Washington and Oregon coasts close to shore (Carretta et al. 2010, Lagerquist and Mate 2002, Oleson et al. 2009 cited in NMFS 2011a). Humpback whales are known to predictably forage an average of 22 miles offshore of Grays Harbor, Washington during spring and summer months (Oleson et al. 2009). Grays Harbor is approximately 45 miles north of the project site. Oleson and others (2009) documented 147 individual humpback whales foraging off Grays Harbor from 2004 to 2008, and foraging whales (1-19 whales sighted per day) were sighted on 50% of the days surveyed (22 of 44 survey days). Anecdotally, humpback whales are regularly spotted in areas about 15 to 20 miles (U.S.) offshore of MCR (Griffith 2015).

The Corps has limited fine-scale information about humpback whale foraging habits and space use along the Washington coast, and does not have specific fine-scale information for the project area. Based on the available information, humpback whales may occur within 4.6 miles of the MCR jetties or 8.6 miles of shore (where in-water sound from pile driving activities may be audible) given both their general tendency to occupy shallow, coastal waters when foraging, and the available information on their fine-scale use of a proximate location. Based on this information, humpback whales are likely to pass through and may forage intermittently in the project vicinity.

3.1.3. Gray Whale

During summer and fall, most gray whales in the Eastern North Pacific stock feed in the Chukchi, Beaufort and northwestern Bering Seas (NOAA 2014c). An exception is the relatively small number of whales (approximately 200) that summer and feed along the Pacific coast between Kodiak Island, Alaska and northern California (Darling 1984, Gosho et al. 2011, Calambokidis et al. 2012 cited in NOAA 2014c), also known as the "Pacific Coast Feeding Group." The minimum population estimate for the Eastern North Pacific stock using the 2006/2007 abundance estimate of 19,126 and its associated coefficient of variation (CV) of 0.071 is 18,017 animals. The minimum population estimate for Pacific Coast Feeding Group gray whales is calculated as the lower 20th percentile of the log-normal distribution of the 2010 mark-recapture estimate, or 173 animals (NOAA 2014c). If gray whales were in the vicinity of MCR, the Pacific Coast Feeding Group would be the most likely visitor. Anecdotal evidence indicates they have been seen at MCR, but are not a common visitor, as they mostly remain in the vicinity of the offshore shelf-break (Griffith 2015).

3.1.4. Harbor Porpoise

For the Northern Oregon/Washington Coast stock of harbor porpoise (Lincoln City, OR, to Cape Flattery, WA), the corrected estimate of abundance in coastal waters (2010-2011) is 21,487 (CV = 0.44; Forney et al. 2013 cited in NOAA 2014b). Harbor porpoise are known to occur year-round in the inland transboundary waters of Washington and British Columbia, Canada (Osborne

et al. 1988 cited in NOAA 2014b) and along the Oregon/Washington coast (Barlow 1988, Barlow et al. 1988, Green et al. 1992 cited in NOAA 2014b). Aerial survey data from coastal Oregon and Washington, collected during all seasons, suggest that harbor porpoise distribution varies by depth (Green et al. 1992 cited in NOAA 2014b). Although distinct seasonal changes in abundance along the west coast have been noted and attributed to possible shifts in distribution to deeper offshore waters during late winter (Dohl et al. 1983, Barlow 1988 cited in NOAA 2014b), seasonal movement patterns are not fully understood. Harbor porpoises are sighted regularly at the MCR (Griffith 2015).

According to the online database, Ocean Biogeographic Information System, Spatial Ecological Analysis of Megavertebrate Populations (Halpin 2009 at OBIS-SEAMAP 2015), harbor porpoises are usually found in shallow water, most often nearshore, although they occasionally travel over deeper offshore waters. West Coast populations have more restricted movements and do not migrate as much as East Coast populations. Most harbor porpoise groups are small, generally consisting of less than five or six individuals, though for feeding or migration they may aggregate into large, loose groups of 50 to several hundred animals. Behavior tends to be inconspicuous, compared to most dolphins, and they feed by seizing prey which consists of wide variety of fish and cephalopods ranging from benthic or demersal.

3.2. Pinnipeds

Aerial survey counts by WDFW at the North Jetty and Jetty A from 2000-2014 showed no records for harbor seals, Steller sea lions or California sea lions using these jetties (WDFW 2014). As noted previously, pinniped use is confined mostly to the end of the South Jetty.

The Eastern DPS Steller sea lion, recently delisted from threatened status under the ESA, and the California sea lion regularly use the MCR South Jetty as a haulout, while the harbor seal is an infrequent visitor at the haul-out, but known to be in the area. Table 7, Table 8 and Table 9 reflect current and historical data from Oregon Department of Fish and Wildlife (ODFW) and WDFW for sea lion and harbor seal use at the South Jetty. The ODFW had two data sets from different periods, and WDFW was able to provide a single data set with more recent survey results. Depending on the year, a different number of surveys were conducted in any given month. Not all months were surveyed each year. In order to determine the monthly seasonality of use, the available information regarding the number of times surveyed per month is included for all of the years reflected in the data set. Not all species were counted during each survey or for each month. The WDFW data appears more complete, as more surveys were conducted in the same time frame. All three sets of data are provided to show the seasonality of use and the trends based on the different sample data sets.

Table 7. Average Number of Pinnipeds per Month on South Jetty, 1995-2004 (ODFW)

Month	# of Years Surveyed	Avg. Number of Steller Sea Lions	Avg. Number of California Sea Lions	Avg. Number of Harbor Seals
January	1	246	18	0
February	4	246	50	0
March	1	635	39	0
April	3	613	48	1
May	4	252	42	1
June	8	245	82	2
July	4	385	56	0
August	2	486	27	0
September	0	--	--	--
October	1	168	63	0
November	1	923	297	0
December	1	1,106	725	0
Totals	30	5,305	1,447	4

Source: Data from ODFW 2007.

Table 8. Average Number of Pinnipeds per Month on South Jetty, 2000-2014 (ODFW)

Month	# of Times Surveyed in Month	Avg. Number of Steller Sea Lions	# of Times Surveyed in Month	Avg. Number of California Sea Lions	# of Times Surveyed in Month	Avg. Number of Harbor Seals
January	1	0	1	0	1	15
February	1	209	1	146	0	--
March	0	--	0	--	0	--
April	1	606	1	61	0	--
May	2	503	2	74	3	0
June	4	457	1	45	5	6
July	6	483 (*)	1	0	2	10
August	1	350-400	1	30	0	--
September	1	68	1	68	0	--
October	0	--	0	--	0	--
November	0	--	0	--	0	--
December	0	--	0	--	0	--
Totals	17	~2,701	9	424	11	31

(*) Does not include pending 2014 counts. Source: Data from ODFW 2014.

Table 9. Average Number of Pinnipeds per Month on South Jetty, 2000-2014 (WDFW)

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

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

Most work on the South Jetty trunk will occur from April through October (pile installation will not start before May 1 and will not extend past September 30), away from the concrete monolith. During this timeframe, current average numbers have peaked to as many as 824 Steller sea lions, 508 California sea lions, and 57 harbor seals present in the action area during months of peak construction activity on the jetty (April-October; WDFW 2014).

3.2.1. Steller Sea Lion

The MCR South Jetty is used by Steller sea lions for hauling out and is not designated critical habitat. Use occurs chiefly at the concrete block structure at the terminus, or head of the jetty, and at the emergent rubble mound comprised of the eroding jetty trunk near the terminus. The Proposed Action will re-build the trunk of the South Jetty in its present configuration, and may establish a head stabilization feature at or near the current terminus of the jetty (which is shorter/nearer shore than the authorized length and concrete monolith). The current jetty endpoint is approximately 600 feet from the emergent rubble mound and 1,400 feet from the concrete block structure which comprise the authorized jetty length. Erosion has turned the block structure and the rubble mound into islands as portions of the jetty trunk have deteriorated.

California sea lions also use this area and can intermingle with Steller sea lions. Steller sea lions appear to out-compete California sea lions for the preferred haul out area on the concrete block structure. Both species use the rubble mound extensively during high tides, when the concrete block structure is underwater.

Previous monthly averages between 1995 and 2004 for Steller sea lions hauled-out at the South Jetty head ranged from about 168 to 1,106 animals. More recent data from ODFW from 2000-2014 reflects a lower frequency of surveys, and numbers ranged from zero animals to 606 Steller sea lions (ODFW 2014). More frequent surveys by WDFW for the same time frame (2000-2014) put the monthly range at 177 to 1,663 animals throughout the year. According to ODFW (2014), most counts of animals remain at or near the jetty tip.

Steller sea lions are present, in varying abundances, all year (Table 7, Table 8 and Table 9). Abundance is typically lower as the summer progresses when adults are at the breeding rookeries. Steller sea lions are most abundant in the vicinity during the winter months and tend to disperse elsewhere to rookeries during breeding season between May and July (Corps 2007). Abundance increases following the breeding season. However, this is not always true as evidenced by a flyover count of the South Jetty on May 23, 2007 where 1,146 Steller sea lions were observed on the concrete block structure and none on the rubble mound (ODFW 2007). Those counts represent a high-use day on the South Jetty. According to ODFW (2014), during the summer months it is not uncommon to have between 500-1,000 Steller sea lions present, the majority of which are immature males and females (no pups or pregnant females). All population age classes, and both males and females, use the South Jetty to haul out. Only non-breeding individuals are typically found on the jetty during May-July, and a greater percentage of juveniles are present. There is probably a lot of turnover in sea lion numbers using the jetty. That is, the 100 or so sea lions hauled out one week might not be the same individuals hauled out the following week. Recent ODFW and WDFW survey data continue to support these findings (Table 8 and Table 9).

3.2.2. California Sea Lion

The population size of the U.S. stock of California sea lions is estimated at 296,750 animals (NOAA 2014a). As with Steller sea lions, according to ODFW (2014) most counts of California sea lions are also concentrated near the tip of the jetty, although sometimes haul out about halfway down the jetty. Survey information (2007 and 2014) from ODFW indicates that California sea lions are relatively less prevalent in the Pacific Northwest during June and July, though in the months just before and after their absence there can be several hundred using the South Jetty. More frequent WDFW surveys (2014) indicate greater numbers in the summer, and use remains concentrated to fall and winter months. Nearly all California sea lions in the Pacific Northwest are sub-adult and adult males (females and young generally stay in California). Again, there is probably a lot of turnover in sea lion numbers using the jetty. That is, the 100 or so sea lions hauled out one week might not be the same individuals hauled out the following week (ODFW 2014).

3.2.3. Harbor Seal

According to NOAA (2014a), in 1999 the harbor seal population estimate for the Oregon/Washington Coast stock was about 24,732 animals. However, the data used was over 8 years old; there are no current abundance estimates (NOAA 2014a).

Harbor seals haul-out on the rubble near the tip of South Jetty but probably get outcompeted by sea lions, pushing them to more landward sections of the remaining jetty. Harbor seals have not been seen in the past 2 years by ODFW, and their numbers from earlier surveys were less than 2 dozen (in contrast, about 2,000 harbor seals haul-out in the estuary). Both male and female harbor seals may occur at the South Jetty but probably no pups (ODFW 2014).

4. Affected Species Status and Distribution

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

The duration and scope of the Proposed Action for the MCR jetties remain within the scope of effects previously evaluated in the 2011 NMFS BiOp (May 18, 2011, *Endangered Species Act Biological Opinion and Conference Report and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Major Rehabilitation of the Jetty System at the Mouth of the Columbia River* – NMFS No 2010/06104), as well as in the USFWS Concurrence Letter (2/23/2011, *Major Rehabilitation of the Jetty System at the Mouth of the Columbia River Navigation Channel, Clatsop County, Oregon and Pacific County*, WA USFWS # 13420-2011-I-0082). The Corps consulted with the NMFS regarding marine mammal species under ESA jurisdiction listed in Table 10.

In the 2011 NMFS BiOp, the Corps received a determination that the Proposed Action for the MCR jetties is not likely to jeopardize the continued existence of Stellar sea lions or humpback whales, and that the Proposed Action may affect but is not likely to adversely affect fin whale, Southern resident killer whale, sperm whale, sei whale, and blue whale. Harbor seals and California sea lions are also known to be in the vicinity of the jetties. The Corps stated in the BA that an IHA permit would be obtained from NMFS for incidental harassment of Steller sea lions, humpback whales, and non-federally listed California sea lions and harbor seals.

Table 10. Federal Register Notices for Final Rules Listing Threatened and Endangered Species, Designated Critical Habitats, or Protective Regulations for Marine Mammals

Species	Listing Status	Critical Habitat	Protective Regulations
Marine Mammals			
Steller sea lion (*Eumetopias jubatus*)			
Eastern	T 5/5/1997; 63 FR 24345 D 11/04/2013; 78 FR 66139	8/ 27/93; 58 FR 45269	11/26/90; 55 FR 49204 10/1/09; 50 CFR 223.202 MMPA
Blue whale (*Balaenoptera musculus*)			
	E 12/02/70; 35 FR 18319	Not applicable	ESA section 9 applies; MMPA
Fin whale (*Balaenoptera physalus*)			
	E 12/02/70; 35 FR 18319	Not applicable	ESA section 9 applies; MMPA
Humpback whale (*Megaptera novaeangliae*)			
	E 12/02/70; 35 FR 18319	Not applicable	ESA section 9 applies; MMPA
Killer whale (*Orcinus orca*)			
Southern Resident	E 11/18/05; 70 FR 69903	11/26/06; 71 FR 69054	ESA section 9 applies; MMPA
Transient	Not listed	Not applicable	MMPA
Sei whale (*Balaenoptera borealis*)			
	E 12/02/70; 35 FR 18319	Not applicable	ESA section 9 applies; MMPA
Sperm whale (*Physeter macrocephalus*)			
	E 12/02/70; 35 FR 18319	Not applicable	ESA section 9 applies; MMPA
Gray whale (*Eschrichtius robustus*)			
Eastern North Pacific Stock	D 06/16/1994; 59 FR 31094	Not applicable	MMPA

Listing status: 'T' means listed as threatened under the ESA; 'E' means listed as endangered; 'P' means proposed; "D" means delisted. FR = Federal Register; CFR = Code of Federal Regulations.

The NMFS (2011) concurred with the Corps' "may affect, not likely to adversely affect" determinations for the following marine mammal: blue whales, Sei whales, sperm whales, fin whales, Southern and Resident killer whales. NMFS agreed that these ESA-listed species do not occur in the Columbia River, they will not be exposed to any potential stressors from the proposed activities that occur in the estuary and river proper, and no effects from activities in these areas are therefore anticipated. The above ESA-listed marine mammal species may occur outside of the Columbia River in the marine portion of the action area. The proposed activity with a potential stressor in the marine portion of the action area that may affect these species is in-water noise from pile driving that extends out 6.2 miles (NMFS 2011a) into the ocean from the jetty locations where rock placement is proposed. Blue, fin, Sei and sperm whales and leatherback sea turtles are not generally distributed near shore. Their presence within range of in-water noise from pile driving is extremely unlikely and any effects from this activity are therefore discountable (NMFS 2011a).

Southern Resident killer whales have been repeatedly observed feeding off the Columbia River plume in the vicinity of the MCR jetties in March and April during peak spring Chinook salmon runs, for example in 2004 (Krahn et al. 2004), in 2005 (Zamon et al. 2007), in 2006 (Hanson et al. 2008a,b), and in 2009 (Hanson et al. 2010 cited in NMFS 2011a). The Corps restricted the

window in which piling installation will most likely be conducted (May through September) to avoid possible project effects that overlap with limited peak killer whale use in the project vicinity (March through April). Southern Resident killer whales can occur near shore, but their presence is likely to be infrequent and transitory, such that co-occurrence of these killer whales and proposed pile driving from May through the summer is extremely unlikely and any effects from this activity are therefore discountable.

Additionally, the Proposed Action is not likely to cause a measurable reduction in the quantity of salmon and other ESA-listed or proposed fish, as described above and therefore will not affect the quantity of prey available to marine mammals. The quality of prey available to marine mammals will not be adversely affected by the Proposed Action, because there is no causal mechanism for the proposed activities to increase the concentration of persistent organic pollutants in fish. In the 2011 BiOp, the NMFS concurred with the Corps' determinations that effects of the action are either insignificant or discountable and therefore are not likely to adversely affect blue whales, Sei whales, sperm whales, fin whales, and Southern Resident killer whales. Therefore, the Corps is not seeking incidental take for these species.

4.1. Killer Whale

4.1.1. Southern Resident Killer Whale

Southern resident killer whales were formally listed as "endangered" under the ESA in 2005 and consequently, the stock is automatically considered as a "strategic" stock under the MMPA. This stock was considered "depleted" prior to its 2005 listing under the ESA (NOAA 2014a).

The following information was taken directly from NOAA's recent stock assessment (2014a). Most sightings of the Eastern North Pacific Southern Resident stock of killer whales have occurred in the summer in inland waters of Washington and southern British Columbia. However, pods belonging to this stock have also been sighted in coastal waters off southern Vancouver Island and Washington (Bigg et al. 1990, Ford et al. 2000, Northwest Fisheries Science Center (NWFSC) unpublished data, cited in NOAA 2014). The complete winter range of this stock is uncertain. Of the three pods comprising this stock, one (J1) is commonly sighted in inshore waters in winter, while the other two (K1 and L1) apparently spend more time offshore (Ford et al. 2000, cited in NOAA 2014). These latter two pods have been sighted as far south as Monterey Bay and central California in recent years (N. Black, pers. comm., K. Balcomb, pers. comm., cited in NOAA 2014). They sometimes have also been seen entering the inland waters of Vancouver Island through Johnstone Strait in the spring (Ford et al. 2000, cited in NOAA 2014), suggesting that they may spend time along the outer coast of Vancouver Island during the winter. In June 2007, whales from L-pod were sighted off Chatham Strait, Alaska, the farthest north they have ever been documented (J. Ford, pers. comm., cited in NOAA 2014).

According to stock assessments (NOAA 2014a), the number of Southern resident killer whales has fluctuated annually since the first complete census in 1974, when 71 animals were identified. Between 1974 and 1993, the Southern resident stock increased approximately 35% from 71 to 96 individuals (Ford et al. 1994, cited in NOAA 2014), representing a net annual growth rate of 1.8% during those years. Following a peak census count of 99 animals in 1995, population size

has fluctuated and stands at 85 animals as of the 2012 census (Ford et al. 2000; Center for Whale Research, unpubl. data, cited in NOAA 2014).

Killer whales are significant predators of regional salmon stocks. Killer whales show a strong preference for Chinook salmon (78% of identified prey) during late spring to fall (Hanson et al. 2005; Ford and Ellis 2006 cited in NOAA 2014). Chum salmon are also taken in significant amounts (11%), especially in autumn. Chinook are preferred despite much lower abundance in comparison to other salmonids (such as sockeye) presumably because of the species' large size, high fat and energy content, and year-round occurrence in the area. Killer whales also captured older (i.e., larger) than average Chinook (Ford and Ellis 2006 cited in NOAA 2014). Throughout inland waters from May to September, the diet of Southern residents is approximately 88% Chinook (Hanson et al. 2008a cited in NOAA 2014), with a shift to chum salmon in fall. Little is known about the winter and early spring diet. Early results from genetic analysis of fecal and prey samples indicate that Southern residents consume Fraser River-origin Chinook, as well as salmon from Puget Sound, Washington and Oregon coasts, the Columbia River, and Central Valley of California (Hanson et al. 2008b cited in NOAA 2014).

As noted by NOAA (2014a), several of the potential risk factors identified for this population have habitat implications. The summer range of this population, the inland waters of Washington and British Columbia, is the home to a large commercial whale watch industry as well as high levels of recreational boating and commercial shipping. There continues to be concern about potential for masking effects by noise generated from these activities on the whales' communication and foraging. In addition, the high trophic level and longevity of the animals has predisposed them to accumulate levels of contaminants that are high enough to cause potential health impacts. In particular, there is recent evidence of extremely high levels of flame retardants in young animals (Krahn et al. 2007, 2009, cited in NOAA 2014).

4.1.2. West Coast Transient Killer Whale

The West Coast transient killer whale stock is not designated as "depleted" under the MMPA or listed as "threatened" or "endangered" under the ESA. In 2001, the Committee on the Status of Endangered Wildlife in Canada designated West Coast transient killer whales in British Columbia as "threatened" under the Species at Risk Act for Canada (NOAA 2013b).

For the purposes of the 2013 stock assessment report (NOAA 2013b), the West Coast Transient Stock includes animals that occur in California, Oregon, Washington, British Columbia and southeastern Alaska. A recent mark-recapture estimate that does not include the "outer coast" subpopulation or whales from California for the west coast transient population resulted in an estimate of 243 in 2006 (DFO 2009 cited in NOAA 2013b). This estimate applies to the population of west coast transient whales that occur in the inside waters of southeastern Alaska, British Columbia, and northern Washington. Given that the California transient numbers have not been updated since the publication of the catalogue in 1997 (Black et al. 1997 cited in NOAA 2013b), the total number of transient killer whales reported above should be considered as a minimum count for the west coast transient stock.

There was rapid growth of the West Coast transient population in the mid-1970s to mid-1990s coinciding with a dramatic increase in the abundance of harbor seals in nearshore waters, but population growth began slowing in the mid-1990s and has continued to slow in recent years (DFO 2009 cited in NOAA 2013b).

While shooting was a concern in the past, the current likelihood of shooting incidents involving 'transient' killer whales is thought to be minimal since commercial fishermen are most likely to observe 'transients' feeding on seals or sea lions instead of interacting with their fishing gear (G. Ellis, Pacific Biological Station, Canada, pers. comm. cited in NOAA 2013b). Collisions with boats may be another source of mortality, though none have been reported for this stock (NOAA 2013b).

4.2. Humpback Whale

As a result of commercial whaling, humpback whales were listed as "endangered" under the Endangered Species Conservation Act of 1969. This protection was transferred to the ESA in 1973. The species is currently listed as endangered and consequently, the California/ Oregon/Washington stock is automatically considered as a depleted and strategic stock under the MMPA (NOAA 2014a). The current estimate for the California/Oregon/Washington stock is at about 1,918 animals (NOAA 2014a).

Humpback whales occur in all major oceans of the world. The abundance and population trends of humpback whales are difficult to estimate, but based on the available data humpback whales appear to be increasing in abundance across much of their range (Carretta et al. 2010 cited in NOAA 2014a). Calambokidis and others (2008 cited in NOAA 2014) estimated that the current population of humpback whales in the North Pacific is approximately 18,000 to 20,000 whales, not counting calves. More recently, the abundance was estimated to be over 21,000 individuals (Barlow et al. 2011 cited in NOAA 2014a). The estimated growth rate for this stock is between 7% and 8%, annually (Carretta et al. 2010 cited in NOAA 2014a).

For MMPA stock assessment reports, the California/Oregon/Washington stock is defined to include humpback whales that feed off the west coast of the United States, including animals from both the California-Oregon and Washington-southern British Columbia feeding groups (Calambokidis et al. 1996, Calambokidis et al. 2008, Barlow et al. 2011 cited in NOAA 2014a). This includes animals that appear to be part of two separate feeding groups, a California and Oregon feeding group and a northern Washington and southern British Columbia feeding group (Calambokidis et al. 2008, Barlow et al. 2011 cited in NOAA 2014a). Very few photographic matches between these feeding groups have been documented (Calambokidis et al. 2008 cited in NOAA 2014a). Humpbacks from both groups have been photographically matched to breeding areas off Central America, mainland Mexico, and Baja California, but whales from the northern Washington and southern British Columbia feeding group also winter near the Hawaiian Islands and the Revillagigedo Islands off Mexico (Barlow et al. 2011 cited in NOAA 2014a).

Current threats to the humpback whales include mortality and serious injury from entanglement with fishing gear and collisions with ships, whale watch harassment, proposed harvest (i.e.,

Japan's proposal for scientific whaling), and anthropogenic sound in the ocean that is a habitat concern for low-frequency sound specialists, such as humpback whales (NMFS 1991).

4.3. Gray Whale

Once common throughout the Northern Hemisphere, the gray whale became extinct in the Atlantic by the early 1700s (Fraser 1970; Mead and Mitchell 1984 cited in NOAA 2014c) and are now only found in the North Pacific. Genetic comparisons indicate there are distinct Eastern North Pacific (ENP) and Western North Pacific (WNP) population stocks (LeDuc et al. 2002; Lang et al. 2011, Weller et al. 2013 cited in NOAA 2014a).

A relatively small number of whales that summer and feed along the Pacific coast between Kodiak Island, Alaska and northern California (Darling 1984, Gosho et al. 2011, Calambokidis et al. 2012 cited in NOAA 2014c), are known as the Pacific Coast Feeding Group (PCFG). If gray whales were in the vicinity of MCR, the PCFG would be the most likely visitor. Anecdotal evidence indicates they have been seen at MCR, but are not a common visitor, as they mostly remain in the vicinity of the offshore shelf-break (Griffith 2015).

The minimum ENP population estimate is 18,017 animals, and the minimum population estimate for the PCFG is 173 animals (NOAA 2014c). The population size of the ENP gray whale stock has increased over several decades despite an unusual mortality event (UME) in 1999 and 2000 (NOAA 2014c). The estimated annual rate of increase, based on the abundance time series from Laake et al. (2012 cited in NOAA 2014c) is 3.2%.

In 1994, the ENP stock of gray whales was removed from the List of Endangered and Threatened Wildlife, as it was no longer considered endangered or threatened under the ESA. Further, the ENP stock of gray whales is not classified as a strategic stock, and the PCFG gray whales do not currently have a formal status under the MMPA (NOAA 2014c).

According to Calambokidis and others (2012 cited in NOAA 2014c), gray whales using the Pacific Northwest during summer and autumn include two components: (1) whales that frequently return to the area, display a high degree of intra-seasonal "fidelity" and account for a majority of the sightings between 1 June and 30 November, and (2)"visitors" from the northbound migration that are sighted only in one year, tend to be seen for shorter time periods in that year, and are encountered in more limited areas.

Mortality risks to gray whales include human caused injuries and mortality from entanglement in fishing nets, subsistence hunting, and ship strikes (NOAA 2014c). Habitat concerns include Arctic climate change and resulting reductions in sea ice cover (Johannessen et al. 2004, Comiso et al. 2008 cited in NOAA 2014c), which is likely to affect gray whales as exemplified by the decade-long expansion in their summer range (Rugh et al. 2001 cited in NOAA 2014c). Bluhm and Gradinger (2008 cited in NOAA 2014c) concluded that in the Arctic, pelagic prey is likely to increase while benthic prey is likely to decrease in response to climate change. Therefore, they asserted that marine mammal species exhibiting trophic plasticity by feeding on both benthic and pelagic prey (such as gray whales) will adapt better than trophic specialists. Conversely, ocean acidification is predicted to reduce the abundance of shell-forming organisms (Fabry et al. 2008,

Hall-Spencer et al. 2008 cited in NOAA 2014c), many of which are important in the gray whales' diet (Nerini 1984 cited in NOAA 2014c). Increased anthropogenic activities due to increased Arctic access could also increase risks of acoustic disturbance and oil spill from increased oil drilling operations (NOAA 2104c).

4.4. Harbor Porpoise

Harbor porpoise are not listed as "depleted" under the MMPA or listed as "threatened" or "endangered" under the Endangered Species Act (NOAA 2014b). The corrected estimate of abundance (2010-2011) for harbor porpoise in the coastal waters of northern Oregon (north of Lincoln City) and Washington is 21,487 (CV = 0.44; Forney et al. 2013 cited in NOAA 2014b).

There are no reliable data on population trends of harbor porpoise for coastal Oregon, Washington, or British Columbia waters (NOAA 2014b). The 2010-2011 Northern Oregon/Washington Coast stock estimate is greater than the previous 2002 estimate of 15,674 (CV = 0.39), but the previous estimate is within the confidence limit of the current abundance estimate (Forney et al. 2013 cited in NOAA 2014b).

Mortality and injury risks for porpoises include commercial and tribal fisheries. In 2006, a significant increase in the number of harbor porpoise strandings reported throughout Oregon and Washington prompted the Working Group on Marine Mammal Unusual Mortality Events to declare an UME on 3 November 2006 (Huggins 2008 cited in NOAA 2014b). The cause of the UME has not been determined, and several factors, including contaminants, genetics, and environmental conditions, are still being investigated (NOAA 2014b).

The Strategic Environmental Research and Development Program (SERDP) is a consortium of modeling estimates, links, and depiction of various datasets developed by Duke University, NOAA, National Aeronautics and Space Administration, Department of Defense, EPA, and the Department of Energy (https://www.serdp-estcp.org; Barlow et. al. 2009). The OBIS-SEAMAP is a spatially referenced online database, aggregating marine mammal, seabird and sea turtle observation data from across the globe (Halpin et. al. 2009).

According to SERDP and OBIS, the NOAA Southwest Fisheries Center (SWFSC) stratum model under the Marine Animal Monitor Model indicates that the estimated density per square kilometer (km^2) of year-round porpoises for areas near northern CA (is much farther south of the MCR project location) is in the range of 3.642 animals/km^2 (Barlow et. al. 2009, Halpin et. al. 2009). This is a relatively high density compared to values moving south along the model boundaries. Given anecdotal evidence (Griffith 2015) and sightings recorded on the OBIS network from surveys done between 1989 and 2005, (Halpin et al. 2009, OBIS-SEAMAP 2015), this higher density may be appropriate for the MCR vicinity, or may be conservative.

4.5. Steller Sea Lion

The Steller sea lion was listed under the ESA as threatened throughout its range on December 4, 1990. This listing included animals from Alaska, California, Oregon and Washington in the U.S., as well as Canada, Japan, and Russia. On June 4, 1997, the population west of 144° W

longitude was listed as an endangered DPS (the Western DPS) under the ESA; the population east of 144° W remained listed as threatened as the Eastern DPS. In 2013 the Eastern DPS stock was delisted under ESA and considered recovered. Under the MMPA, all Steller sea lions were classified as "strategic stocks" and were considered "depleted". Subsequent to the delisting of the Eastern DPS, this may be updated. Currently, the 2013 stock report estimates between 63,160 and 78,198 animals (NOAA 2013a).

Steller sea lions breed along the West Coast from California's Channel Islands to the Kurile Islands and the Okhotsk Sea in the western North Pacific Ocean. They are year-long residents along the Oregon Coast. The eastern DPS Steller sea lions range from southeast Alaska to southern California with a minimum abundance of 45,000 animals (NMFS 2008b), and have increased at 3% per year for the past 30 years (NMFS 2008b). The greatest increases have occurred in southeast Alaska and British Columbia (together accounting for 82% of pup production), but performance has remained poor in California at the southern extent of their range. In Southeast Alaska, British Columbia and Oregon, the number of Steller sea lions has more than doubled since the 1970s. There are no substantial threats to the species, and the population continues to increase at approximately 3% per year. The final Steller sea lion recovery plan identified the need to initiate a status review for the eastern Steller sea lion and consider removing it from the Federal List of Endangered Wildlife and Plants (NMFS 2008b). The Eastern population was ultimately delisted in 2013.

The Eastern Steller sea lion breeds on rookeries in southeast Alaska, British Columbia, Oregon, and California; there are no rookeries in Washington. Haulouts are located throughout the eastern population's range (NMFS 2008b). Steller sea lions occur in Oregon waters throughout the year, and use breeding rookeries at Rogue Reef and Orford Reef and haulout locations along the Oregon coast. There are four haulout sites used by Steller sea lions in the lower Columbia River and these include the tip of the South Jetty, where greater than 500 Steller sea lions commonly occur, and three locations proximate to and at the Bonneville Dam tailrace area where Steller sea lions occasionally occur. Critical habitat of Steller sea lions is not affected by the Proposed Action and is not discussed.

The Steller sea lions that use the South Jetty as a haulout use rookeries in Southern Oregon and British Columbia. The breeding season occurs from late May to early July, thus corresponding to relatively lower numbers at the South Jetty. The Steller sea lion is not known to migrate, but they disperse widely outside this breeding season. Steller sea lions are present, in varying abundances, all year (see Tables 7, 8 and 9) but are more numerous in the winter. Abundance is typically lowest in the summer as many of the adults are at the breeding rookeries. Only non-breeding individuals are found on the jetty during this time, and a greater percentage of juveniles are present. Abundance increases following the breeding season. All population age classes, and both males and females use the jetty for haulout. Adult males tend to disperse from the MCR South Jetty in late summer and fall.

Killer whale predation, particularly on the western DPS under reduced population size, may cause significant reductions in the stock (NMFS 2008b). Steller sea lions have tested positive for several pathogens, but disease levels are unknown (DFO 2008). Similarly, parasites in this species are common, but mortality resulting from infestation is unknown. However, significant

negative effects of these factors may occur in combination with stress, which reduces immune capability to resist infections and infestations. If other factors, such as disturbance, injury, or difficulty feeding occur, it is more likely that disease and parasitism can play a greater role in population reduction.

Steller sea lions were historically and recently subjected to substantial mortality by humans, primarily due to commercial exploitation and both sanctioned and unsanctioned predator control, (Bonnot 1928, Rowley 1929, Scheffer 1946, Bonnot and Ripley 1948, Scheffer 1950, Pearson and Verts 1970, Bigg 1988, Atkinson et al. 2008, NMFS 2008b). Several dozen individuals may become entangled and drown in commercial fishing gear (Atkinson et al. 2008, NMFS 2008b). Several hundred individuals are removed by subsistence hunters annually in controlled and authorized takes. Marine debris is also concerning for the health of Steller sea lion populations. It is estimated that 0.2% of Steller sea lions have marine debris around their necks (0.07%), or are hooked by fishing gear (DFO 2008). Contaminants including Polycyclic aromatic hydrocarbons, heavy metals, and organochlorines including polychlorinated biphenyls and dichloro-diphenyl-trichloroethane (DDT) are also considerable issue for Steller sea lions.

4.6. California Sea Lion

California sea lions in the U.S. are not listed as endangered or threatened under the ESA or as depleted under the MMPA. The optimum sustainable population status of this population has not been formally determined. The current population estimate of the U.S. stock is 296,750 animals (NOAA 2014a). California sea lions are not considered strategic under the MMPA because total human-caused mortality is less than the potential biological risk (NOAA 2014a). The U.S. stock occurs from northern Washington and Canada to southern California and Mexico. Major rookeries are found in waters of southern California and Baja California. Only male California sea lions occur at the MCR South Jetty, as post-breeding dispersers from the south. They, like Steller sea lions, are present all year but also are more numerous in winter.

El Niño events are known to negatively influence pup production, but pup counts have generally increased since the mid-1970s (NOAA 2014a). Current causes of California sea lion mortality include gill netting and trawl fisheries and related entanglement. Other mortality threats include boat and car collisions, shootings, entanglement and ingestion of marine debris, toxic algal blooms, predation control, and entrainment in power plants (NOAA 2014a).

4.7. Harbor Seal

Harbor seals are not listed under the ESA. The Oregon/Washington Coast stock of harbor seals occurs from northern Washington to southern Oregon and is generally non-migratory. The most current population estimates are about 24,732 animals (NOAA 2014a). The Oregon/Washington coastal stock is *not* classified as depleted or strategic. The total population size of the Oregon/Washington coastal stock of harbor seals is estimated at about 25,000 individuals, but the data is over 8 years old (NOAA 2014a). The stock has increased since the 1970s and data from Oregon suggest that it may be nearing equilibrium.

Harbor seals breed and pup throughout their range, including the vicinity of the Columbia River. Based on data from the NMFS website indicating 2009 data from NMFS and WDFW, estimates from Washington indicate pups occur in the regional vicinity of the North Jetty and Jetty A from around mid-April through July (NMFS website accessed October 2014). They use the Columbia River extensively throughout the year and only rarely have been noted on the MCR South Jetty.

The stock was heavily hunted for bounty, even into the 1970s. Other causes of mortality or injury include entanglement in fisheries drift or gill nets, boat strikes, or shooting.

5. Type of Incidental Taking Authorization Requested

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

For the Proposed Action at the MCR jetties, the Corps is requesting incidental taking authorization for harassment by behavioral disruption – Level B. The term "take" as defined in Section 3 [16 U.S.C. § 1362 (13)] of the MMPA means, "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal." "Harassment" was further defined in the 1994 amendments to the MMPA, which provided two levels of harassment: Level A — potential injury, and Level B — potential behavioral disruption. The methods of incidental taking are described below in greater detail.

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

In the Corps 2010 BA, it was stated that prior to implementing the Proposed Action, an IHA permit would be requested from NMFS for incidental harassment of Steller sea lions, humpback whales, and California sea lions and harbor seals. According to the 2011 NMFS BiOp, the only proposed activities that NMFS anticipated may adversely affect humpback whales were pile driving activities.

Incidental take would result from airborne acoustic effects of heavy equipment operation, dredging and disposal actions, and pile installation at the MCR North Jetty, Jetty A, and South Jetty, as well as human presence in proximity to the haul-out at the MCR South Jetty. Trucks, cranes, and excavators will be used for construction of a haul road on top of the jetty and for placement of rock on the jetty and at the offloading sites. Aerial and pedestrian surveys occur on annual basis at all three jetties along the entire trunk including the terminus of the jetties. Because North Jetty and Jetty A are not used by pinnipeds, only airborne acoustics from

construction and surveys at South Jetty would have the potential to disturb pinnipeds. Pile installation for facilities at all three jetties could impact cetaceans and pinnipeds.

Noise would be generated above and below the water by operation of construction equipment and related activities. The trucks and cranes used to move the jetty rocks would generate a moderate degree of noise and visual activity above water. Noise would also be generated below water from the installation of piles related to the offloading facilities planned for all three jetties. Dredges and vibratory hammers would be used to create offloading facilities. Flushing or avoidance behaviors may occur as work proceeds towards the terminus of South Jetty, at the offloading facilities, and during annual inspections near the westernmost points on South Jetty.

Incidental take would be a temporary and localized disturbance of animals from elevated sound levels, construction and barge traffic, pile installation, and visual stimulus from construction activities on the jetty and in the water. The Corps does not anticipate Level A harassment for any of these species. There are several reasons for this. First, vibratory pile driving would be used for pile installation and it has a relatively low source level [less than 190 decibels (dB)]. Second, pile driving would be delayed until after May 1 and would cease after September 30 in order to avoid the presence of killer whales. Additionally, pinniped use is concentrated at the westernmost end of the South Jetty on the concrete monolith or the rock islands, which are removed from direct proximity to work at the terminus, and even further from work along the trunk. The area of concentrated pinniped use is well outside of the injury zone described later in this analysis. Actions at the North Jetty and Jetty A would cause nominal impact to the haul out, as there is no recorded use of pinniped these jetties. Further, installation of the offloading facility at Jetty A is much further inland than that on the South or North Jetties, and acoustical effects from installation at all jetties would be buffered by the jetties themselves.

6. Take Estimates for Marine Mammals

By age, sex, and reproductive condition (if possible), the number of marine mammals (by species) that may be taken by each type of taking identified in Section 5, and the number of times such takings by each type of taking are likely to occur.

6.1. General Acoustic Thresholds

Marine mammals are characterized in functional hearing groups depending on their dominant frequency range (NMFS 2012, see Table 11). Humpbacks are low-frequency cetaceans, and killer whales are in the mid-frequency range. Pinnipeds can be affected by both underwater and airborne acoustics. These functional hearing ranges are important in establishing harmful thresholds and determining the effects of the Proposed Action, including whether or not certain thresholds are expected to be exceeded.

Table 11. F-low and f-high Limits for Characterizing Underwater Background Sound Relevant to Marine Mammals (NMFS 2012)

Functional Hearing Group[1]	f-low[2] (Hz)	f-high (kHz)
Low-frequency cetaceans	7	20
Mid-frequency cetaceans	150	20
High-frequency cetaceans	200	20
Pinnipeds	75	20

[1] All genera represented in each functional hearing group are specified in Southall et al. 2007 (cited in NMFS 2012).
[2] F-low values of estimated auditory bandwidths in Southall et al. 2007 (cited in NMFS 2012).

In describing underwater sound pressure, the reference amplitude is usually 1 microPascal (µPa) or 10^{-6} Pascal (Pa), and is expressed as "dB re 1 µPa." For in-air sound pressure, the reference amplitude is usually 20 µPa and is expressed as "dB re 20 µPa." Table 12 summarizes commonly used acoustical terms (taken from Naval Base Kitsap, 2014). Two common descriptors are the instantaneous peak sound pressure level (SPL) and the root mean square (rms) SPL (dB rms). The peak pressure is the instantaneous maximum or minimum overpressure observed during each pulse or sound event and is presented in Pa or dB referenced to a pressure of 1 microPascal (dB re 1 µPa). The rms level is the square root of the energy divided by a defined time period. For all intents and purposes this is a time-averaged sound level (Naval Base Kitsap 2014). For the purposes of this evaluation, the Corps focused on the rms measure per NMFS guidance (2015).

Table 12. Definitions of Acoustical Terms

Term	Definition
Decibel (dB)	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for water is 1 microPascal (µPa) and for air is 20 µPa (approximate threshold of human audibility).
Sound Pressure Level (SPL)	Sound pressure is the force per unit area, usually expressed in microPascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure. Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	Frequency is expressed in terms of oscillations, or cycles, per second. Cycles per second are commonly referred to as hertz (Hz). Typical human hearing ranges from 20 Hz to 20,000 Hz.
Peak Sound Pressure (unweighted), dB re 1 µPa	Peak sound pressure level is based on the largest absolute value of the instantaneous sound pressure over the frequency range from 20 Hz to 20,000 Hz. This pressure is expressed in this application as dB re 1 µPa.
Root Mean Square (rms), dB re 1 µPa	The rms level is the square root of the energy divided by a defined time period. For pulses, the rms has been defined as the average of the squared pressures over the time that comprises that portion of waveform containing 90 percent of the sound energy for one impact pile driving impulse. For non-pulsed energy or continuous sound, rms energy represents the average of the squared pressures over the measurement period and is not limited by the 90 percent energy criterion.
Sound Exposure Level, dB re 1 µPa2 sec	Sound exposure level is a measure of energy. Specifically, it is the dB level of the time integral of the squared-instantaneous sound pressure, normalized to a 1-second period. It can be an extremely useful metric for assessing cumulative exposure because it enables sounds of differing duration to be compared in terms of total energy.
Waveforms, µPa over time	A graphical plot illustrating the time history of positive and negative sound pressure of individual pile strikes shown as a plot of µPa over time (i.e., seconds).
Frequency Spectra, dB over frequency range	A graphical plot illustrating the frequency content over a given frequency range. Bandwidth is generally defined as linear (narrowband) or logarithmic (broadband) and is stated in frequency (Hz).
A-Weighting Sound Level, dB(A)	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the low and high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective human reactions to noise.
Ambient Noise Level	The background sound level, which is a composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.

Taken from Naval Base Kitsap, 2014.

Since 1997, NMFS has used generic sound exposure thresholds to determine when an activity in the ocean that produces sound might result in impacts to a marine mammal such that a take by harassment might occur (NMFS 2005a). Current NMFS practice regarding exposure of marine mammals to high underwater level sounds is that cetaceans and pinnipeds exposed to non-pulsed (vibratory) or pulsed (impact) sounds $\geq$180 and 190 dB rms, respectively, are considered to have been taken by Level A (i.e., injurious) harassment. Behavioral harassment (Level B) is considered to have occurred when marine mammals are exposed to underwater sounds $\geq$160 dB

rms for impulse sounds (e.g., impact pile driving) and 120 dB rms for continuous noise (e.g., vibratory pile driving), but the sound levels are below injurious thresholds. Level A (injury) and Level B (disturbance) thresholds are provided in Table 13.

Table 13. Injury and Disturbance Thresholds for Underwater and Airborne Sounds

Marine Mammals[4]	Airborne Marine Construction Criteria (Impact and Vibratory Pile Driving) (dB re 20 µPa)[1] Disturbance Guideline Threshold (Haul-out)[2]	Underwater Vibratory Pile Driving Criteria (non-pulsed/continuous sounds) (dB re 1µPa)		Underwater Impact Pile Driving Criteria (pulsed sounds) (dB re 1µPa)	
		Level A[3] Injury Threshold	Level B Disturbance Threshold	Level A[3] Injury Threshold	Level B Disturbance Threshold
Cetaceans (whales, dolphins, porpoises)	Not applicable	180 dB rms	120 dB rms	180 dB rms	160 dB rms
Pinnipeds (seals, sea lions, walrus, except harbor seal)	100 dB rms (unweighted)	190 dB rms	120 dB rms	190 dB rms	160 dB rms
Harbor seal	90 dB rms (unweighted)	190 dB rms	120 dB rms	190 dB rms	160 dB rms

[1] Airborne disturbance thresholds do not specify pile driver type.
[2] Sound level at which pinniped haul-out disturbance has been documented.
[3] Level A Injury Threshold does not specify pile driver type; therefore, the Corps assumed the same threshold for both types.
[4] Data from http://www.westcoast.fisheries.noaa.gov/protected_species/marine_mammals/threshold_guidance.html (accessed 1/2/2015).

As described above for underwater sound injury and harassment thresholds, NMFS uses generic SPLs to determine when an activity that produces airborne sound might result in impacts to a marine mammal (NMFS 2005a). Construction-period airborne noise would have little impact to cetaceans because noise from airborne sources would not transmit well underwater (Richardson et al. 1995); thus, noise would primarily be a problem for hauled-out pinnipeds near the project locations. The NMFS has identified behavioral harassment threshold criteria for airborne noise generated by pile driving for pinnipeds regulated under the MMPA. The Level B behavioral harassment threshold for harbor seals is 90 dB rms (unweighted) and for all other pinnipeds is 100 dB rms (unweighted). See Table 13.

These injury thresholds were considered in comparison with the noise levels of various natural, ambient, and anthropogenic sources. Sound sources described in Table 14 are somewhat representative of the sound sources and levels that would occur as a result of the proposed jetty rehabilitation actions. However, pile sizes in Table 14 are much larger than what would likely be used at the jetties. Smaller, representative pile sizes and their respective sound levels are included in subsequent tables.

Table 14. Representative Noise Levels of Anthropogenic Sources

Noise Source	Frequency Range (Hz)	Underwater Noise Level (dB re 1 µPa)	Reference
Small vessels	250–1,000	151 dB rms at 1 m	Richardson et al. 1995 [1]
Tug docking gravel barge	200–1,000	149 dB rms at 100 m	Blackwell and Greene 2002 [1]
Vibratory driving of 72-inch steel pipe pile	10–1,500	180 dB rms at 10 m	Illingworth and Rodkin 2007 [1]
Impact driving of 36-inch steel pipe pile	10–1,500	195 dB rms at 10 m	WSDOT 2007 [1]
Impact driving of 66-inch cast-in-steel-shells piles	100–1,500	195 dB rms at 10 m	Reviewed in Hastings and Popper 2005 [1]
Wind and waves[2]	200–50 kHz	--	Mitson 1995 [2]
Surf noise at 8.5 km (5.3 mi) from shore[2]	100–700	--	NMFS 2011b
Precipitation[2]	100–500	--	NMFS 2011b
Biological[2]	12-100	--	NMFS 2011b
Shipping[2]	20-300	--	NMFS 2011b

[1] As cited in Naval Base Kitsap 2014.
[2] As cited in NMFS 2011b.

6.2. Underwater Acoustic Thresholds

The Portland District does not have information or modeling results related to pile installation activities. However, some features of the Proposed Action are similar to those recently proposed by the Navy, WSDOT, and other entities which were issued IHA/LOAs. For these reasons, the Corps considered some of the results from previous, representative monitoring efforts. Though the MCR navigation channel is a major commercial thoroughfare, there are no ports or piers in the immediate proximity of the jetties, as the seas are too dangerous. The location and setting of the MCR jetties is far more dynamic than a naval pier setting in the Puget Sound, the substrate is mostly sand, and the natural background noise is likely to be much higher with the large, breaking wave sets, dynamic currents, and high winds. The Corps project is also in the immediate proximity of the open ocean, with less opportunity for sound attenuation by land.

The Corps considered representative results from underwater monitoring for concrete, steel, and wood piles that were installed via both impact and vibratory hammers in water depths from 5 to 15 meters (Illingworth and Rodkin 2007, WSDOT 2011 cited in Naval Base Kitsap 2014, Navy 2014, and NMFS 2011b). Transmission loss and propagation estimates are affected by the size and depth of the piles, the type of hammer and installation method, frequency, temperature, sea conditions, currents, source and receiver depth, water depth, water chemistry, and bottom composition and topography. The Corps reviewed and summarized several documents that included relevant monitoring results for radial distances and proxy sound levels encompassed by underwater pile driving noise. These distances are summarized in Table 15.

Table 15. Representative Underwater Sound Pressure Levels from Pile Driving Studies Using Impact Hammers

Project	Location	Pile Type	Hammer Type	Water Depth	Distance	Measured Sound Levels
Berth 22, Port of Oakland [1]	CA	Concrete pile 24- inch	Impact	15 m (49 ft)	10 m/33 ft	176 dB re 1 µPa rms
Eagle Harbor Maintenance Facility [2]	WA	Steel pipe pile 30-in (0.8 m)	Impact	10 m (33 ft)	10 m/33 ft	192 dB re 1 µPa rms
Friday Harbor Ferry Terminal [2]	WA	Steel pipe pile 30-in (0.8 m)	Impact	10 m (33 ft)	10 m/33 ft	196 dB re 1 µPa rms
Navy Facilities Command Proxy Study[3]	2 (Bainbridge Is and Friday Harbor WA)	Steel 24-inch	Impact	varied	10 m/(33 ft)	193 dB re 1 µPa rms; Recommended proxy source SPL based on n-weighted pile average = (181-198 range of average rms)
Deep Water-Tongue Point Facility Pier Repairs[4]	Mouth of Columbia River; Astoria, OR	Steel 24-inch	Diesel	unknown	10 m/(33 ft)	182 dB re 1 µPa rms - Average; Average range 178-189

[1] Illingworth and Rodkin, Inc. 2007 (Naval Base Kitsap 2014).
[2] Cited in NMFS 2011b.
[3] Navy 2014.
[4] Caltrans 2012 cited in Navy 2014.

The tables presented here detail representative pile driving sound pressure levels (SPL) that have been recorded from similar construction activities in recent years. The Corps does not have site or project specific data, so proxy information was used to identify an appropriate range of sound levels in light of the absence of multiple samples from installation of 24-in steel piles. Due to the similarity of these actions and the Corps's Proposed Action, these values represent a conservative range of reasonable proxy SPLs which could be anticipated, and which were used in the acoustic modeling and analysis. Table 15 represents SPLs that may be expected during pile installation using an impact hammer. Table 16 represents SPLs that may be expected during pile installation using a vibratory hammer.

Currently, the Corps anticipates the use of a vibratory hammer for all installation and removal work. The maximum anticipated pile size is 24-inches in diameter. Information related to impact hammers and larger pile size is included here for comparison and to characterize the risk if unforeseen and unavoidable conditions or design standards require the Corps to employ limited use of an impulse hammer or larger piles. If larger piles are used, this typically results in fewer installation events or number of piles needed. However, the Corps' Proposed Action captures what is anticipated to be the worst-case scenario for size and number of piles installed at all facilities. As previously noted, the Corps originally proposed 16-in diameter piles, but may need to use up to 24-inch piles due to load sizes. For the purposes of this analysis, a 24-in pile diameter was used because data is available for this size, and it provides a more conservative

sound estimate. The Corps confirmed with NMFS this pile size would remain within the scope of effects determination in its current BiOp (NMFS 2015b).

Table 16. Representative Underwater Sound Pressure Levels from Pile Driving Studies Using Vibratory Hammers

Project	Location	Pile Type	Hammer Type	Water Depth	Distance	Measured Sound Levels
Mad River Slough Pipeline [1]	CA	Steel Pipe/ 13-inch	Vibratory	~5 m/ (15 ft)	10 m/ (33 ft)	155 dB re 1 µPa rms
Keystone Ferry Terminal [2]	WA	Steel pipe pile/30-in	Vibratory	~5 m	10 m/ (33 ft)	164 dB re 1 µPa rms
Keystone Ferry Terminal [2]	WA	Steel pipe pile/30-in	Vibratory	~8 m/ (28 ft)	10 m/ (33 ft)	165 dB re 1 µPa rms
Vashon Ferry Terminal [2]	WA	Steel pipe pile/30-in	Vibratory	~6 m/ (20 ft)	10 m/ (33 ft)	165 dB re 1 µPa rms
Port Townsend Ferry Terminal [3]	WA	Wood pile removal/12-in	Vibratory	-	16 m/ (52 ft)	150 dB re 1 µPa rms
Friday Harbor Ferry Terminal [4]	WA	Steel pipe pile/24-in	Vibratory	2.6	10 m/ (33 ft)	162 dB re 1 µPa rms
Port Townsend Ferry Terminal [5]	WA	Steel pipe pile/30-in	Vibratory	-	10 m/ (33 ft)	170 dB re 1 µPa rms (174 max)
Navy Facilities Command Proxy[6] Study	4 projects, WA & CA	Steel Pipe[7], 16 and 24-in	Vibratory	Varied	10 m/ (33 ft)	161 dB re 1 µPa rms; Recommended proxy source SPL based on n-weighted pile average = (159-162 range of average rms)
Navy Facilities Command Proxy[6] Study	3 projects, Oakland CA	AZ25 Steel Sheet – 24-in	Vibratory	Varied, 12-15	10 m/ (33 ft)	163 dB re 1 µPa rms; Recommended proxy source SPL based on n-weighted pile average = (160-163 range of average rms)

[1] Illingworth and Rodkin, Inc. 2007 (Naval Base Kitsap 2014).
[2] Laughlin 2010a, 2010b; Illingworth and Rodkin, Inc. 2007 (cited in NMFS 2011b).
[3] WSDOT 2011b (cited in Washington State Ferries 2013).
[4] Laughlin 2010a (cited in Washington State Ferries 2013).
[5] Laughlin 2010b (cited in Washington State Ferries 2013).
[6] Navy 2014 - Table 2-2.
[7] Due to the similarity in levels across multiple projects, 16-inch and 24-inch piles were considered together (Navy 2014).

Since no site-specific, in-water noise attenuation data is available, the practical spreading model described and used by NOAA was used to determine transmission loss and the distances at which impact and vibratory pile driving or removal source levels are expected to attenuate down to the pertinent acoustic thresholds. The underwater practical spreading model is provided below:

$$R_2 = R_1 * 10\text{^} ((dB_{at\ R1} - dB_{acoustic\ threshold})/15)$$

where:

R_1 = distance of a known or measured sound level.
R_2 = estimated distance required for sound to attenuate to a prescribed acoustic threshold.

The Corps used representative sound levels from different studies in Table 15 and Table 16 as inputs to determine appropriate proxy sound levels and to model estimated distances until pertinent thresholds (R_1 and dB at R_1). Studies which met the following parameters were considered: pile materials comprised of wood, concrete, and steel pipe piles; pile sizes 24- up to 30-inches diameter, and pile driver type of either vibratory and impact hammers. These types and sizes of piles were considered in order to evaluate a representative range of sound levels that may result from the Proposed Action. In some cases since there was little or no data specific to 24-inch piles, the Corps analyzed 30-in piles as the next larger pile size with available data. The Corps will include a maximum pile size of 24-inches as a constraint in its construction contracts, though it will consult with NMFS regarding the originally proposed size.

Results of the practical spreading model provided the distance of the radii that were used to establish a ZOI or area affected by the noise criteria. At the MCR, the channel is about 3 miles wide between the South and North Jetty. These jetties, as well as Jetty A, could attenuate noise, but the flanking sides on two of the jetties are open ocean, and Jetty A is slightly further interior in the estuary. Clatsop Spit, Cape Disappointment, Hammond Point, as well as the Sand Islands, are also land features that would attenuate noise. Therefore, as a conservative estimate, the Corps is using (and showing on ZOI maps) the maximum distance and area, but has indicated jetty attenuation in the ZOI area maps.

The Corps selected proxy values for impact installation methods and calculated distances to acoustic thresholds for comparison and contextual purposes. The Corps is not proposing impact installation. The following information is used to compare impact installation proxy values and threshold distances to the preferred vibratory method described next. Using samples from Table 15, which were derived from impact piles installation, different SPLs were evaluated for various pile sizes and locations. For one sample of representative values in Table 15, the SPL for the single 24-inch pile sample was higher than that of some of the 30-inch steel monitoring samples, and the pile itself was concrete, which is a material the Corps is relatively less likely to use. The Corps ultimately relied most heavily on the proxy values developed by the Navy (2014) as suggested by NMFS (2015).

For ***impact*** installation, the Corps used ***193 rms dB re 1 µPa rms*** at a distance of 10 meters, which is comprised of the range of average rms of n-weighted piles used to determine the recommended proxy source SPLs at 10m as determined by Navy (2014). It is notable that site-specific information from the Deep Water-Tongue Point Facility at the Mouth of the Columbia River near Astoria was excluded from the Navy's calculations of the proxy data. However, the Tongue Point data (182 db re 1 µPa rms at a distance of 10 meters for 24-in steel piles (Navy 2014) is likely more applicable to this MCR jetty project because: it is of similar sandy rather than gravely substrate; and it is within the same geographical and hydraulic context, though it is likely more sheltered than conditions at the jetties. Therefore, 193 rms dB re 1 µPa rms is an extremely conservative proxy estimate for impact installation, as sandy substrate and the hydraulic context would further reduce spreading distance.

For ***vibratory*** installation, the Corps proposes ***163 dB re 1 µPa rms***. The proxy value of 163 dB re 1 µPa rms is greater than the 24-inch pipe pile proxy and equal to the sheet pile values proposed by Navy (2014) at 161 dB re 1 µPa rms and 163 dB re 1 µPa rms, respectively, and is also higher than the Friday Harbor Ferry sample (162 dB re 1 µPa rms) (Navy 2014 and Laughlin 2010a cited in Washington State Ferries 2013, respectively). The Corps is proposing 163 dB re 1 µPa rms to reflect sheet pile installation, which registered higher than the pipe pile levels in the proxy study. Given the comparative differences between the substrate and context used in the Navy study relative to the MCR, 163 dB re 1 µPa rms is a very conservative evaluation level. Results are listed in Table 17 and Table 18.

Table 17. Calculated Distance(s) to an Area Encompassed by Underwater Marine Mammal Sound Thresholds During Pile Installation

Underwater Threshold[1]	Distance – m (ft)	Area - km^2 (mi^2) (Total Without Attenuation)
Impact driving, pinniped injury (190 dB)	16 (52.5)	0.0008 (0.0003)
Impact driving, cetacean injury (180 dB)	74 (242.8)	0.02 (0.006)
Impact driving, disturbance (160 dB)	1,585 (5,200.1, or ~1 mile)	7.9 (3.1)
Vibratory driving, pinniped injury (190 dB)	0	0
Vibratory driving, cetacean injury (180 dB)	1 (3.3)	0.000003 (0.000001)
Vibratory driving, disturbance (160 dB)	16 (52.5)	0.0008 (0.0003)
Vibratory driving, disturbance (120 dB)	7,356 (4.6 miles)	170 (65.6)

[1] SPLs used for calculations were 193 dB for impact and 163 dB re 1 µPa rms for vibratory driving.

Table 18. Calculated Area Encompassed within Zone of Influence at MCR Jetties for Underwater Marine Mammal Sound Thresholds

Jetty	Underwater Threshold[1]	Distance – m (ft)	Area Excluding Land & Jetty Masses - km^2 (mi^2)
Jetty A: ~ Station 78+50, River Side	Impact driving, pinniped injury (190 dB)	16 (52.5)	<0.001 (0.0003)
	Impact driving, cetacean injury (180 dB)	74 (242.8)	0.01 (0.004)
	Impact driving, disturbance (160 dB)	1,585 (5,200.1, or ~1 mile)	3.38 (1.31)
	Vibratory driving, pinniped injury (190 dB)	0	0
	Vibratory driving, cetacean injury (180 dB)	1 (3.3)	<0.000003 (0.000001)
	Vibratory driving, disturbance (120 dB)	7,356 (4.6 miles)	23.63 (9.12)

Table 18 (continued). Calculated Area Encompassed within Zone of Influence at MCR Jetties for Underwater Marine Mammal Sound Thresholds

Jetty	Underwater Threshold[1]	Distance – m (ft)	Area Excluding Land & Jetty Masses - km^2 (mi^2)
North Jetty: ~ Station 70+00, Channel Side	Impact driving, pinniped injury (190 dB)	16 (52.5)	<0.001 (0.0003)
	Impact driving, cetacean injury (180 dB)	74 (242.8)	0.01 (0.004)
	Impact driving, disturbance (160 dB)	1,585 (5,200.1, or ~1 mile)	4.02 (1.55)
	Vibratory driving, pinniped injury (190 dB)	0	0
	Vibratory driving, cetacean injury (180 dB)	1 (3.3)	<0.000003 (0.000001)
	Vibratory driving, disturbance (120 dB)	7,356 (4.6 miles)	49.18 (18.99)

Jetty	Underwater Threshold[1]	Distance – m (ft)	Area Excluding Land & Jetty Masses - km^2 (mi^2)
South Jetty: ~ Clatsop Spit Site	Impact driving, pinniped injury (190 dB)	16 (52.5)	<0.001 (0.0003)
	Impact driving, cetacean injury (180 dB)	74 (242.8)	0.01 (0.004)
	Impact driving, disturbance (160 dB)	1,585 (5,200.1, or ~1 mile)	4.55 (1.76)
	Vibratory driving, pinniped injury (190 dB)	0	0
	Vibratory driving, cetacean injury (180 dB)	1 (3.3)	<0.000003 (0.000001)
	Vibratory driving, disturbance (120 dB)	7,356 (4.6 miles)	51.96 (20.06)

Jetty	Underwater Threshold[1]	Distance – m (ft)	Area Excluding Land & Jetty Masses - km^2 (mi^2)
South Jetty: ~ Station 270+00 Channel Side	Impact driving, pinniped injury (190 dB)	16 (52.5)	<0.001 (0.0003)
	Impact driving, cetacean injury (180 dB)	74 (242.8)	0.01 (0.004)
	Impact driving, disturbance (160 dB)	1,585 (5,200.1, or ~1 mile)	3.88 (1.50)
	Vibratory driving, pinniped injury (190 dB)	0	0
	Vibratory driving, cetacean injury (180 dB)	1 (3.3)	<0.000003 (0.000001)
	Vibratory driving, disturbance (120 dB)	7,356 (4.6 miles)	52.89 (20.42)

6.3. Airborne Acoustic Thresholds

Airborne construction sound may also cause behavioral responses. Again, the Corps does not have specific, in-situ data and has used monitoring results from similar actions to obtain representative proxy SPLs. This also included the Navy (2014) proxy study for acoustic values from both vibratory and impact installation methods. Table 19 summarizes these findings.

Table 19. Representative Airborne Sound Pressure Levels from Similar In-situ Monitored Construction Activities

Project and Location	Pile Size and Type	Installation Method	Water Depth	Distance	Measured Sound Pressure Levels
Wahkiakum County Ferry Terminal, WA[1]	18-inch steel pile	Vibratory	--	15 m (50 ft)	87.5 dB re 20 µPa rms
Test Pile Program, NAVBASE Kitsap Bangor, WA[1]	24-inch steel pile	Impact	--	15 m (50 ft)	89 dB re 20 µPa rms
Navy Facilities Command Proxy Study[4]	24-inch steel pile	Impact	--	15 m (50 ft)	110 re 20 µPa rms (L_{max})
Navy Facilities Command Proxy Study[5]	24-inch steel pile	Vibratory	--	15 m (50 ft)	92 re 20 µPa rms (L_{eq})
2010 Keystone Ferry Terminal Wingwalls Replacement Project[3]	30-inch steel pile	Vibratory	9 m (30 ft)	15 m (50 ft)	95 - 97.8 dB re 20 µPa rms

[1]Illingworth and Rodkin, Inc., 2012; Laughlin 2010b (cited in Naval Base Kitsap 2014).
[2]Laughlin 2010b (cited in Washington State Ferries 2013).
[3]Laughlin 2010b (cited in NMFS 2011b).
[4]L_{max} is the instantaneous highest sound level measured during a specified period, or maximum noise level. Because impact pile driving is an impulsive sound with short durations, L_{max} is the most appropriate to characterize impulse sounds (Navy 2014).
[5]L_{eq} is the equivalent steady-state noise level in a stated period of time and is primarily used for a steadier, non-impulsive noise, which is a better descriptor for non-impulsive sound like vibratory pile driving (Navy 2014).

Construction noise behaves as point-source and is not directionally inhibited; therefore, it follows the spherical spreading law. This means that there is a 6 dB decrease in SPL over water ("hard-site" condition) per doubling of distance (WSDOT 2010 cited in Naval Base Kitsap 2014). Assuming spherical spreading, the transmission loss equation is:

TL = 20 log10 (R1/R2)

where:

TL = transmission loss in dB.
R1 = distance of the modeled SPL from the driven pile.
R2 = distance from the driven pile of the initial measurement.

This is slightly different than the cylindrical spreading law for underwater transmission, which is bounded by water surface and bottom conditions. As demonstrated for underwater transmission, this equation can be rearranged to solve for R2, or distance of transmission loss to threshold:

$$R_2 = R_1 * 10\text{^} ((dB_{at\ R1} - dB_{acoustic\ threshold})/20))$$

This model was used to estimate the distance to the 100 dB re 20 µPa and 90 dB re 20 µPa rms (unweighted) airborne thresholds. These thresholds correspond with pinniped and harbor seal behavioral harassment thresholds, respectively. Though the Corps anticipates a maximum of 24-inch diameter steel piles installed via vibratory hammer, the values of the 30-inch vibratory installation level and the 18- and 24-inch sound levels were also considered in determining the appropriate proxy value. This was done because there was only a single 24-inch sample available as a proxy.

During the Navy study (2014), a maximum level of 110 dB was measured for a single 24-inch pile installed via impact hammer, and was selected as the most representative value for modeling analysis under the Navy proxy study. The site was located in the Puget Sound. A single 30-second measurement was made for 24-inch piles during the Test Pile Program at NBK, Bangor via vibratory installation, and because these data fit the overall trend of smaller and larger pile sizes, the limited data set for 24-inch steel pipe supported the Navy (2014) representative proxy value of 92 dB (Navy 2014) for vibratory installation. The rms L_{eq} value for 24-inch steel pipe piles also was chosen as the best estimate for 24-inch sheet piles in the Navy study (Navy 2014). Therefore, very conservative levels of ***110 and 92 dB re 20 µPa rms*** were used for impact and vibratory installation, respectively, in order to model the distance of airborne transmission loss. The sandy substrate and hydraulic context at MCR are different than that at the proxy sites and likely would further reduce spreading distance relative to the proxy values. Table 20 includes modeling results for airborne transmission loss to thresholds.

Table 20. Calculated Distance(s) to an Area Encompassed by Airborne Marine Mammal Sound Thresholds During Pile Installation

Airborne Threshold[1]	Distance – m (ft)	Total Area - km^2 (mi^2)
Impact Driving - Pinniped Disturbance (100 dB)	47 (154.2)	0.007 (0.003)
Vibratory Driving - Pinniped Disturbance (100 dB)	6 (19.7)	0.0001 (0.00004)
Impact Driving - Harbor Seal Disturbance (90 dB)	150 (492.1)	0.07 (0.03)
Vibratory Driving - Harbor Seal Disturbance (90 dB)	19 (62.3)	0.001 (0.0004)

[1] SPL used for calculations was: 110 and 92 dB re 20 µPa rms impact and vibratory driving, respectively.

For the Proposed Action, ZOI maps were prepared for each MCR jetty and Clatsop Spit (Figures 18 to 21).

Figure 18. ZOI Map, Marine Mammal Sound Thresholds from Pile Driving, North Jetty

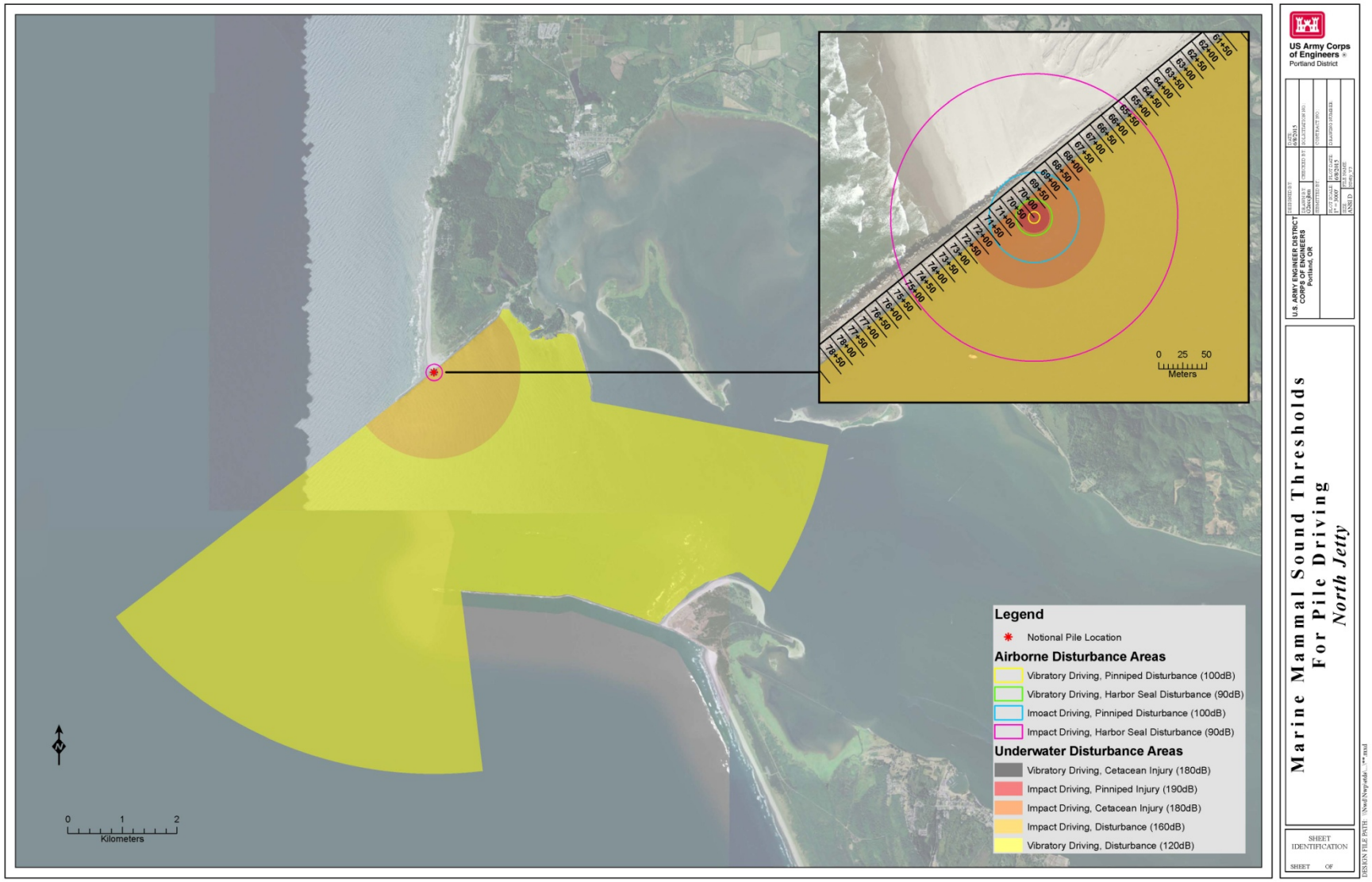


Figure 19. ZOI Map, Marine Mammal Sound Thresholds from Pile Driving, Jetty A

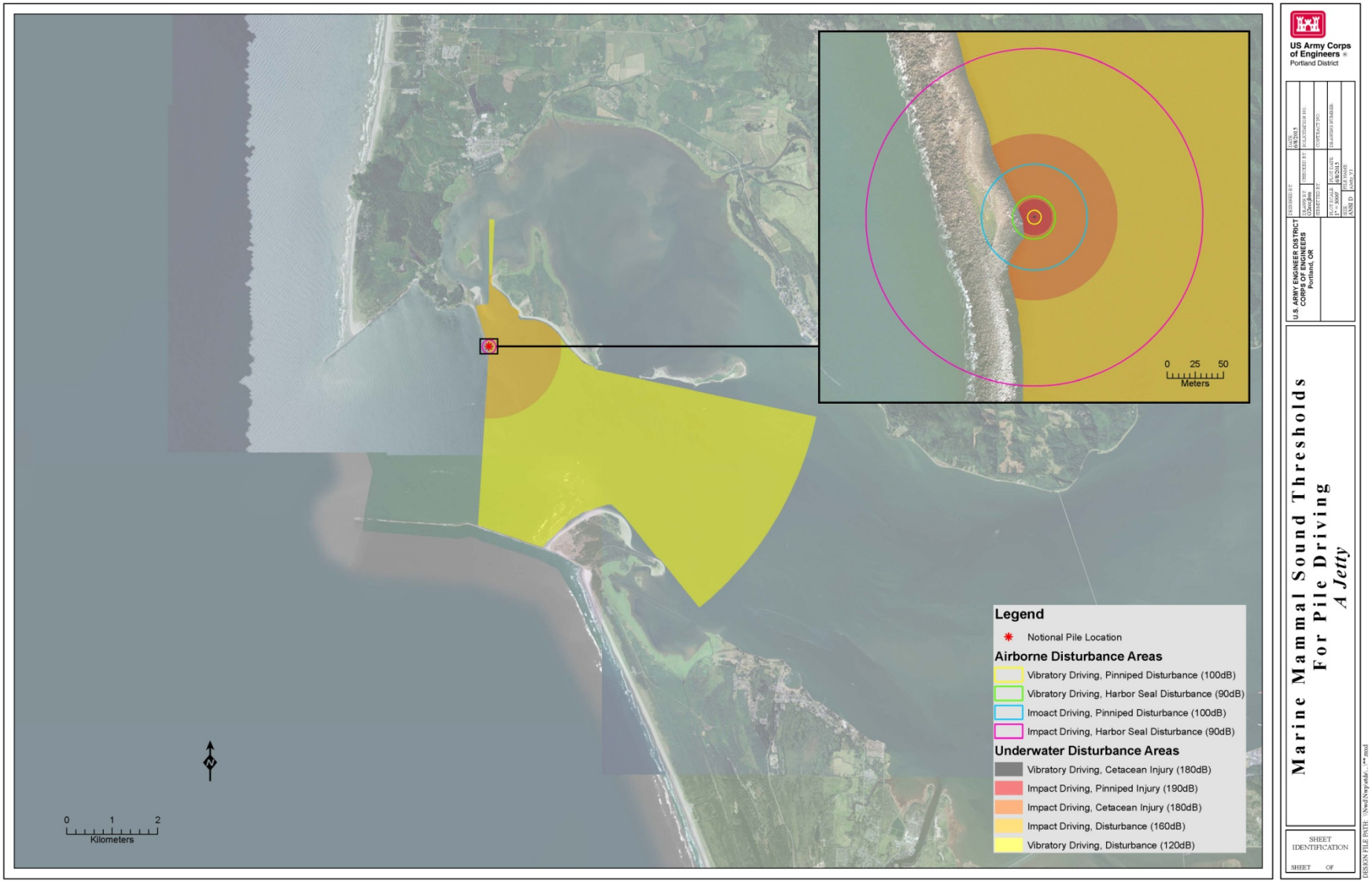


Figure 20. ZOI Map, Marine Mammal Sound Thresholds from Pile Driving, South Jetty

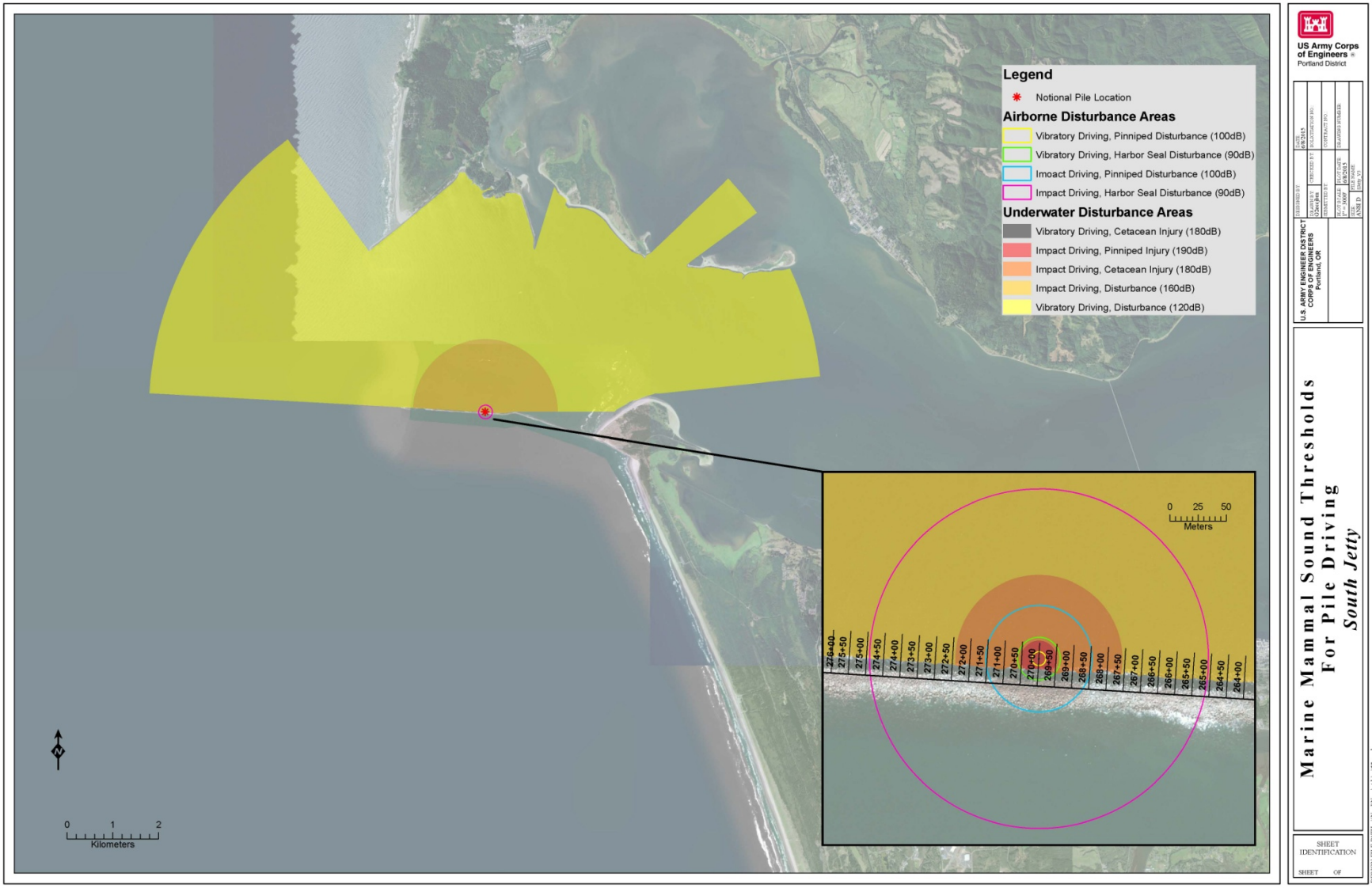
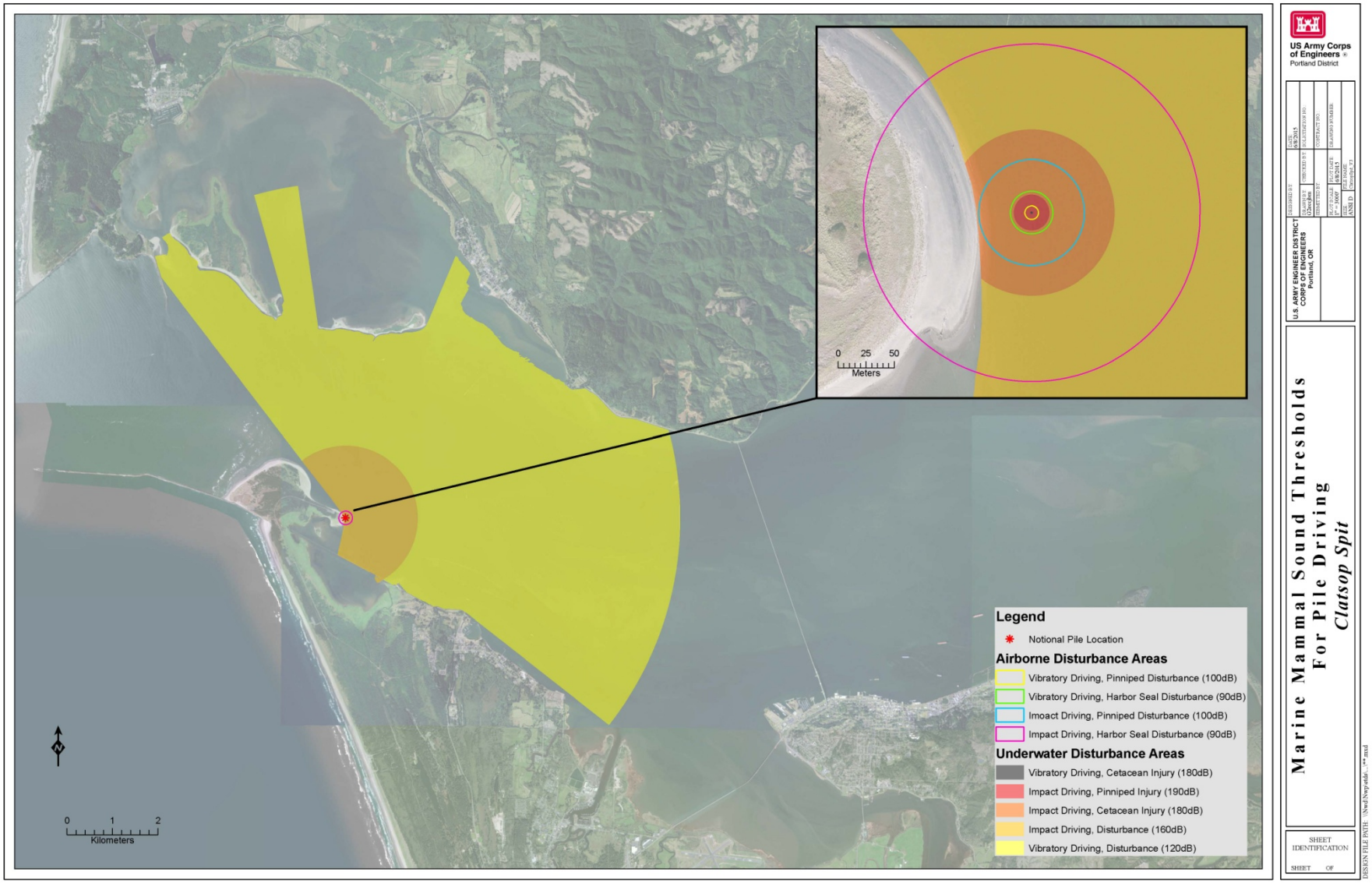


Figure 21. ZOI Map, Marine Mammal Sound Thresholds from Pile Driving, Clatsop Spit



6.4. Assumptions about Estimated Harassment Exposures

Pile installation is assumed to occur for about 10 hours a day with a maximum total of approximately 20 piles installed per day. In order to be conservative in its total project duration estimates, the Corps will assume about 15 piles are installed daily. The fewer piles installed each day, the longer the total project time is expected to be. Each facility would have about ¼ of the total piles mentioned. For initial construction of all four barge offloading facilities combined, up to 96 piles could be installed as tie-up pilings, and up to 373 Z- or H-pile sections of sheet pile to retain rock fill. They would be located within 200 feet of the jetty structure. This is a total of 469 initial installations and 469 removal events. In the 2011 BiOp, NMFS estimated in its analysis that all the piles would be driven and removed, and that 31 piles would be driven and removed twice for a total of 1,000 pile driving or removal events. If 15 piles were installed per day, this would encompass a duration of about 67 working days spread over about 8 event seasons (1 installation period, 1 removal period, four facilities) for underwater acoustic disturbance. In order to round-out the math, the Corps is assuming 68 days to account for about 17 days of installation and removal at each of the four offloading facilities. The Corps also conducts pedestrian surveys on each of the jetties during the summer about 1 time per year, lasting about 2 days each survey. During the life of this Proposed Action, about 6 days of surveys (3 seasons) would occur at the South Jetty, which is the only jetty survey with the potential to impact pinnipeds. During construction years, surveys are assumed to be part of normal construction actions and are not counted separately. This also applies to the dredging duration, which will occur as part of the regular construction activities during implementation of the barge offloading facility at South Jetty. The Corps is still determining whether or not to remove some or all of these offloading facilities, and some facilities may not survive ocean conditions. Longer-term offloading facilities at South and North Jetties may need to be repaired if used more than one season.

Installation and removal of piles with a vibratory hammer would introduce sound waves into the MCR area intermittently for up to 7 years (depending on funding streams and construction sequences). However, in terms of actual on-the-ground work it is possible, but unlikely, that driving could occur at multiple facilities on the same day, which may change the number of seasons and days of exposure overall.

The most likely funding scenario would have the Jetty A facility and scheduled repairs completed before the installation and work on the North Jetty Scheduled Repairs. North Jetty work would likely be completed before any work on the South Jetty, though it could overlap depending on funding streams and length of construction at North Jetty. However, the facility at North Jetty would likely be installed well before any facility or pile driving occurs on South Jetty. At the South Jetty, there are two offloading sites proposed. It is possible but unlikely that the contractor eventually selected would choose to implement two facilities. However, there is a small chance that two facilities could be deemed necessary; in which case there is potential they would be installed in the same season. Based on these assumptions and reasoning, the total combined pile work is 68 days, and pedestrian surveys on South Jetty outside of the 4 construction seasons is expected to take 6 days, for a total of 74 days.

The method used for calculating potential exposures to impact and vibratory pile driving noise for each threshold was estimated using local marine mammal data sets, the BiOp, best professional judgment from state and federal agencies, and data from IHA estimates on similar projects with similar actions. All estimates are conservative and include the following assumptions:

- During construction, each species could be present in the project area each day. The potential for a take is based on a 24-hour period. The model assumes that there can be one potential take (Level B harassment exposure) per individual per 24-hours.
- All pilings installed at each site would have an underwater noise disturbance equal to the piling that causes the greatest noise disturbance (i.e., the piling furthest from shore) installed with the method that has the largest ZOI. The largest underwater disturbance ZOI would be produced by vibratory driving steel piles. The ZOIs for each threshold are not spherical and are truncated by land masses which would dissipate sound pressure waves (WSDOT 2010 cited in Naval Base Kitsap 2014).
- All airborne noise generated by piling installations would be treated as being driven by a vibratory driver at a location furthest from shore. The result is that all noise generated from a particular pile drive is always modeled to have the greatest intensity and furthest reach of all the potential pile driving processes. This effectively expands the ZOIs. Exposures to airborne noise were only calculated for pinnipeds and harbor seals.
- Exposures were based on estimated work days. Numbers of days were based on an average production rate of 15 pilings per day for a total of 68 pile installation days. This means construction at each jetty offloading facility would occur over an approximate span of ~ 17 days.
- In absence of site specific underwater acoustic propagation modeling, the practical spreading loss model was used to determine the ZOI.

6.5. Killer Whale

6.5.1. Southern Resident Killer Whale

Southern resident killer whales have been observed within the study area and ZOI, but the Corps does not have fine-scale details on frequency of use. However, as noted in Section 3, members of K and L pods were sighted off the Oregon Coast in 1999 and 2000 and whales move as far north as Canada down to California, passing the MCR. Because Southern residents have been known to feed in the area, the Corps has limited its pile installation window in order to avoid peak salmon runs and any overlap with the presence of Southern residents. The Corps is not anticipating any acoustic exposure to Southern residents, and received a not likely to adversely affect determination from NMFS in its 2011 BiOp.

To ensure no Level B acoustical harassment occurs, the Corps will restrict pile installation from October 1 until on or after May 1 of each season. Therefore, the Corps is not requesting take for Southern resident killer whales.

6.5.2. Western Transient Killer Whale

It is difficult to reliably differentiate Western transient killer whales from Southern resident killer whales based on pod size, since resident pods can travel in relatively smaller groups (NOAA 2015). Transients may be traversing through the area over a greater duration of time than feeding residents, which means there is a somewhat greater potential of Western transients to be exposed to acoustic effects later in the summer construction season (NOAA 2015). If whales were traveling north-to-south (or vice versa) along the coast, the total distance to traverse through the oceanward, worst-case ZOI scenario of 120 dB rms disturbance extends longitudinally about 12 miles (if two jetties had barge offloading facility construction simultaneously, which is unlikely). Assuming a killer whale swims an average of 1.6 m/s, (or 3.58 miles per hour) (Williams and Noren 2009), transiting whales in the vicinity would be exposed to the 120 dB rms disturbance threshold for about 3.4 hours for 1 day, if they were still transiting directly through the area after May. Feeding whales that remain in the area after May would be exposed to the 120 dB rms disturbance thresholds for about 10 hours per day for about 10 to 20 days at each jetty, culminating in about a 2-month exposure span spread over up to 7 seasons (depending on funding streams and construction sequences). However, in order to reduce the likelihood of killer whales present in the vicinity during construction, the Corps has restricted the start of pile installation until on or after May of each season to reduce the likelihood feeding on peak salmon runs would overlap with pile installation. To minimize Level B acoustical harassment, the Corps will restrict pile installation from October 1 until on or after May 1 of each season.

Given the rare occurrence of transient killer whales in the ZOI, exposure of feeding or transient killer whales to Level B acoustical harassment from pile driving is unlikely to occur. However, the Corps is requesting take authorization on the small chance that transient orcas remain in the vicinity in order to feed on pinnipeds that are present at the South Jetty haul-out year-round.

The SWFSC stratum model under the Marine Animal Monitor Model provides an estimated density of 0.00070853 animals per km^2 for summer killer whales for areas near MCR, which may provide a surrogate proxy value for assuming possible densities near the jetties (Barlow et al. 2009 at SERDP, Halpin et al. 2009 at OBIS-SEAMAP). Given anecdotal evidence (Griffith 2015) and sightings recorded on the OBIS network from surveys done in 2005 (Halpin et al. 2009, OBIS-SEAMAP 2015), this density may be appropriate for the MCR vicinity.

Using the above information, the following formula was developed and applied:

$$\text{Exposure Estimate} = (N_{\text{DensityEstimate}} * \text{Area}_{\text{ZOI Jetty A}} * 17_{\text{days}}) + (N_{\text{DensityEstimate}} * \text{Area}_{\text{ZOI North Jetty}} * 17_{\text{days}}) + (N_{\text{DensityEstimate}} * \text{Area}_{\text{ZOI South Jetty Channel}} * 17_{\text{days}}) + (N_{\text{DensityEstimate}} * \text{Area}_{\text{ZOI South Jetty Clatsop}} * 17_{\text{days}})$$

where:

$\underline{N_{\text{DensityEstimate}}}$ = Represents estimated density of species within the 4.6-mile radius encompassing the ZOI at each jetty; using the density model suggested by NOAA (2015), this equates to 0.00070853 animals per km^2 (Barlow et al. 2009, SERDP 2015).

Days = Total days of pile installation or removal activity (1000 events, approximately 15 piles installed or removed per day ~ 68); divided by 4 to roughly estimate the number of days to install and remove at each jetty (68/4 ~ 17).

$Area_{ZOI}$ = The greatest underwater ZOI area over the underwater disturbance threshold for pile installation via vibratory methods at each jetty.

$$\text{Exposure Estimate} = (0.00070853_{\text{DensityEstimate}} * 23.63_{\text{ZOI Jetty A}} * 17_{\text{days}}) + (0.00070853_{\text{DensityEstimate}} * 49.18_{\text{ZOI North Jetty}} * 17_{\text{days}}) + (0.00070853_{\text{DensityEstimate}} * 51.96_{\text{ZOI South Jetty Clatsop}} * 17_{\text{days}}) + (0.00070853_{\text{DensityEstimate}} * 52.89_{\text{ZOI South Jetty Channel}} * 17_{\text{days}})$$

Based on the above formula, an estimate of two Western transient killer whale disturbance exposures was calculated over the duration of the entire project. However, the Corps is requesting Level B take of four animals under the 1-year work season covered by the IHA, and four animals for each season covered under the LOA (all four offloading facilities, as Jetty A will likely extend to 2-seasons). The Corp is requesting this number of takes because solitary killer whales are rarely observed, and typically transient whales travel in pods of 2-15 members. The Corps has assumed a pod size of four (Table 21). These are extremely conservative estimates, as each facility is estimated to expose less than one animal.

Table 21. Total Level B Take Request for Western Transient Killer Whales

Jetty Location	Number of Estimated Western Transient Killer Whale Exposures	Total Take Request for Western Transient Killer Whales
Jetty A	0.28	4 (IHA), 4 (LOA)
North Jetty	0.59	4
South Jetty – Clatsop	0.63	4
South Jetty – Channel	0.64	4
Total	**2.14**	**20**

6.6. Humpback Whale

As described in Section 3, the Corps does not have fine-scale information about humpback whale use within the project area. However, their occurrence within the oceanward perimeter of the project area is likely given both their general tendency to occupy shallow, coastal waters when foraging and given the available information on their fine-scale use of a proximate location (Grays Harbor) during spring and summer months. Based on this information, humpback whales are likely to pass through and may forage in the project vicinity within 4.6 miles of the jetties or within approximately 7 miles of shore. This distance represents the range of acoustic effects, as described in the BiOp and indicated in this analysis (the North and South Jetty are at or over about 2.4 miles in length from the shore). However, humpback whales are known to predictably forage an average of 22 miles offshore of Grays Harbor, Washington during spring and summer months (Oleson et al. 2009). This is 22-mile distance is well outside of the approximately 4.6-mile 120 dB acoustic threshold perimeter.

In the 2011 BiOp, the NMFS found it reasonable to assume that the number of humpback whales that may forage or pass through the project vicinity when pile driving would occur is best estimated by evaluating humpback whales use patterns at the most proximate location where data is available, in this case off of Grays Harbor. Given the time of year that most of the pile driving would occur (spring/summer), humpback whales may be in the project vicinity on about 50% of the days and the number of humpback whales affected could range between zero and 19 whales per day, based on surveys off of Grays Harbor (Oleson 2009 cited in NMFS 2011a). Therefore, it is possible that individuals could be exposed for about 10 hours per day, for about a 10- to 20-day time span early in the construction season during initial pile installation, and later at the end of construction, depending on the plans for removal. This could occur over seven construction seasons to accommodate work at the four offloading facilities for the three MCR jetties.

Based on conservative sound modeling, noise from vibratory installation and removal would attenuate to the 120 dB disturbance threshold within 4.6 miles (in the direction of the ocean, whereas land would be encountered on either shore of the river system or at the jetty itself prior to attenuating to the 120 dB rms threshold). In a worst case scenario (but very unlikely due to funding and schedules), if all installation occurred simultaneously so that migrating animals moving parallel along the coast had to transit through both the North and South Jetty disturbance zones within two, 4.6-mile radii of disturbance, the greatest possible linear distance through the 120 dB rms disturbance ZOI from the furthest point sources of sound is about 12 miles. A humpback whale swims an average of between 2.5 and 4 km/h, (1.6 - 2.5 mph) depending on whether or not it is singing (Noad and Cato 2007). Therefore, 19 transiting whales (they would not be expected to forage this close to the jetties) in the vicinity would be exposed to the 120 dB rms disturbance threshold for about 4.8 hours for 1 day each of the 7 seasons, if they were still transiting directly through the area after May. However, whales traveling within 4 to 6 miles from the jetties or shore would be at the far outer perimeter of the 120 dB rms threshold. Feeding whales that remained in the area after May would be exposed to the perimeter of the 120 dB rms disturbance thresholds for about 10 hours per day for about 10 to 20 days at each facility, culminating in about a 2-month span of exposure spread over up to seven seasons. This 4.6-mile radius or about 6 miles from shore comprises less than 1/3 of the distance out to the preferred general feeding zone located 22 miles offshore as observed at Grays Harbor.

Using the above information, the following formula was developed and applied:

$$\text{Exposure Estimate} = (N_{\text{DensityEstimate}} * \text{Area}_{\text{ZOI Jetty A}} * 17_{\text{days}}) + (N_{\text{DensityEstimate}} * \text{Area}_{\text{ZOI North Jetty}} * 17_{\text{days}}) + (N_{\text{DensityEstimate}} * \text{Area}_{\text{ZOI South Jetty Channel}} * 17_{\text{days}}) + (N_{\text{DensityEstimate}} * \text{Area}_{\text{ZOI South Jetty Clatsop}} * 17_{\text{days}})$$

where:

$\underline{N_{\text{DensityEstimate}}}$ = Represents estimated density of species within the 4.6-mile radius encompassing the ZOI at each jetty; using the density model suggested by NOAA (2015), this equates to 0.0039 animals per km^2 (Barlow et. all 2009, SERDP 2015).

Days = Total estimated days of pile installation or removal activity (1000 events, approximately 15 piles installed or removed per day ~ 68); divided by 4 to roughly estimate the number of days to install and remove at each jetty (68/4 ~ 17).

$Area_{ZOI}$ = The greatest underwater ZOI area over the underwater disturbance threshold for pile installation via vibratory methods at each jetty.

Exposure Estimate = $(0.0039_{DensityEstimate} * 23.63_{ZOI\ Jetty\ A} * 17_{days}) + (0.0039_{DensityEstimate} * 49.18_{ZOI\ North\ Jetty} * 17_{days}) + (0.0039_{DensityEstimate} * 51.96_{ZOI\ South\ Jetty\ Clatsop} * 17_{days}) + (0.0039_{DensityEstimate} * 52.89_{ZOI\ South\ Jetty\ Channel} * 17_{days})$

Based on the above formula, an estimate of 12 humpback whale disturbance exposures was calculated over the duration of the entire project. However, the Corps is requesting Level B take of 20 animals: four under the 1-year work season at Jetty A covered by the IHA, and four animals for each of the offloading facilities covered under the LOA (all four offloading facilities, as Jetty A will likely extend to 2-seasons). The Corps is requesting this higher number of takes due to the fact that solitary humpback whales are rarely observed, and typically migrating whales travel in smaller, 3-4 member pods. The Corps is assuming a pod size of four (Table 22).

Table 22. Total Level B Take Request for Humpback Whale

Jetty Location	Number of Estimated Humpback Whale Exposures	Total Level B Take Request for Humpback Whale
Jetty A	1.57	4 (IHA) 4 (LOA)
North Jetty	3.26	4
South Jetty – Clatsop	3.44	4
South Jetty – Channel	3.51	4
Total	**11.78**	**20**

6.7. Gray Whale

Based on anecdotal information and sightings between 2006 and 2011 (Halpin et al. 2009 at OBIS SEAMAP 2015), gray whales may be in the proximity of the Proposed Action and exposed to underwater acoustic disturbances. However, the Corps does not have any data specific to presence and numbers in the MCR vicinity, nor was it able to locate gray whale density estimates on the SERDP or OBIS-SEAMAP web model sites. A relatively small number of whales (approximately 200) summer and feed along the Pacific coast between Kodiak Island, Alaska and northern California (Darling 1984, Gosho et al. 2011, Calambokidis et al. 2012 cited in NOAA 2014c). Anecdotal evidence also indicates gray whales have been seen at MCR, but are not a common visitor, as they mostly remain in the vicinity of the further offshore shelf-break (Griffith 2015). According to NOAA's Cetacean Mapping classification of the MCR vicinity pertaining to gray whale use, its Biologically Important Area categorization is indicated as a migration corridor (http://cetsound.noaa.gov/biologically-important-area-map accessed 5/1/2015). As primarily bottom feeders, gray whales are the most coastal of all great whales; they primarily feed in shallow continental shelf waters and live much of their lives within a few tens of kilometers of shore (Barlow et. al. 2009 on OBIS-SEAMAP 2015).

If gray whales were in the vicinity of MCR, the Pacific Coast Feeding Group or northbound summer migrants would be the most likely visitors. Because the Corps has no specific information pertaining to gray whale densities, the Corps decided to apply proxy data for

estimating densities. As a proxy, data pertinent to humpback whales was selected because both are baleen species that would likely utilize the MCR vicinity for the same purposes (as a migration route or temporary feeding zone). However, the number of estimated exposures at each jetty was increased to account for the fact that gray whales are more likely to be in the nearshore environment than humpback whales. This increase was proposed strictly as a conservative assumption to acknowledge the distinct preference gray whales may have over humpbacks for nearshore feeding.

Therefore, the Corps is proposing a slight increase in numbers for gray whales and estimated 16 gray whale disturbance exposures over the duration of the entire project. However, the Corps is requesting Level B take for 25 animals. The Corp is requesting five takes under the 1-year work season covered by the IHA for work at Jetty A, and five animals for each of the offloading facilities covered under the LOA (all four offloading facilities, as Jetty A will likely extend to 2-seasons). This is due to the fact that solitary gray whales are rarely observed, and typically whales travel in small pods of 3-16 members. The Corps assumed a pod size of five. The higher number also is reflective of the slightly greater likelihood that gray whales would be present relative to humpback presence (Table 23).

Table 23. Total Level B Take Request for Gray Whale

Jetty Location	Number of Estimated Gray Whale Exposures [1]	Total Level B Take Request for Gray Whale
Jetty A	1.57 +1 = 2.57	5(IHA) 5 (LOA)
North Jetty	3.26 +1 = 4.26	5
South Jetty – Clatsop	3.44 +1 = 4.44	5
South Jetty – Channel	3.51+1 = 4.51	5
Total	**15.78**	**25**

[1] This data is strictly proxy values based on assumptions that densities would be slightly greater than those estimated for humpback whales.

6.8. Harbor Porpoise

As described in Section 3, the Corps does not have fine-scale information about harbor porpoise use within the project area, but anecdotally their presence is common (Griffith 2015). Their occurrence within the oceanward perimeter of the project area is likely given their general tendency to occupy shallow, coastal waters.

The SWFSC stratum model under the Marine Animal Monitor Model provides an estimated density per km^2 of year-round porpoises for areas near northern California, which may provide a surrogate proxy value for assuming possible densities near the jetties. Though not in the project vicinity, the range of 3.642 animals/km^2 (Barlow et al. 2009, Halpin et al. 2009) is a relatively high density compared to values moving even further south along the model boundaries, for which the northern-most extent ends in California. Given anecdotal evidence (Griffith 2015) and sightings recorded on the OBIS network from surveys done between 1989 and 2005, (Halpin et al. 2009, OBIS-SEAMAP 2015), this higher density may be appropriate for the MCR vicinity, or may be conservative.

Using the above information and the same approach recommended by NOAA (2015) and applied for humpback and killer whale exposure estimates, the following formula was initially developed and applied:

$$\text{Exposure Estimate} = (N_{\text{DensityEstimate}} * \text{Area}_{\text{ZOI Jetty A}} * 17_{\text{days}}) + (N_{\text{DensityEstimate}} * \text{Area}_{\text{ZOI North Jetty}} * 17_{\text{days}}) + (N_{\text{DensityEstimate}} * \text{Area}_{\text{ZOI South Jetty Channel}} * 17_{\text{days}}) + (N_{\text{DensityEstimate}} * \text{Area}_{\text{ZOI South Jetty Clatsop}} * 17_{\text{days}})$$

where:

$N_{DensityEstimate}$ = Represents estimated density of species within the 4.6-mile radius encompassing the ZOI at each jetty; using the density model suggested by NOAA (2015), this equates to 3.642 animals per km^2 (Barlow et. all 2009, SERDP 2015).

Days = estimated total days of pile installation or removal activity (1000 events, approximately 15 piles installed or removed per day ~ 68); divided by 4 to roughly estimate the number of days to install and remove at each jetty (68/4 ~ 17); and

$Area_{ZOI}$ = The greatest underwater ZOI area over the underwater disturbance threshold for pile installation via vibratory methods.

$$\text{Exposure Estimate} = (3.642_{\text{DensityEstimate}} * 23.63_{\text{ZOI Jetty A}} * 17_{\text{days}}) + (3.642_{\text{DensityEstimate}} * 49.18_{\text{ZOI North Jetty}} * 17_{\text{days}}) + (3.642_{\text{DensityEstimate}} * 51.96_{\text{ZOI South Jetty Clatsop}} * 17_{\text{days}}) + (3.642_{\text{DensityEstimate}} * 52.89_{\text{ZOI South Jetty Channel}} * 17_{\text{days}})$$

Based on the density model suggested by NOAA (2015), the Corps has provided a very conservative maximum estimate of 11,000 harbor porpoise disturbance exposures over the duration of 68 days in the span of up to seven seasons. However, this extreme number of potential exposures does not accurately reflect the actual number of animals that would potentially be taken for the MCR jetty project. Rather, it is more likely that the same pod may be exposed more than once during the 17-day window in which each of the 4 offloading facilities is installed or removed. It is unrealistic to assume that the Proposed Action would result in take of almost half of the entire Northern Oregon/Washington Coast stock of harbor porpoises, which is estimated to be 21,487 animals, as based on 2010-2011 numbers (Forney et al. 2013 cited in NOAA 2014b).

The highest estimated number of animals exposed on any single day based on the modeled proxy density (Barlow et al. 2009 at SERDP) and the jetty with the greatest ZOI is 193 animals (from South Jetty Channel). While the number of pods in the vicinity of the MCR is unknown, the size of the pods is usually assumed to be significantly smaller than 193 animals. According to OBIS-SEAMAP (2015 and Halpin et al. 2009), the normal range of group size generally consists of less than five or six individuals, though aggregations into large, loose groups of 50 to several hundred animals could occur for feeding or migration. Because the ZOI only extends for a maximum of 4.6 miles, it may also be assumed that due to competition and territorial circumstances only a limited number of pods would be feeding in the ZOI at any particular time. If the modeled density calculations are assumed, then this means anywhere from 32 small pods to 2 large, 100-animal pods might be feeding during every day of pile installation. Given these values seem an unrealistic representation of use and pod densities within any one of the ZOIs, the Corps is proposing an alternative calculation.

The Corps conservatively assumed that a single, large feeding pod of 50 animals forms within the ZOI for each jetty on each day of pile installation. Though this is likely much higher than actual use by multiple pods in the vicinity, it more realistically represents a worst-case scenario for the number of animals that could potentially be affected by the proposed work. This calculation also assumes that it is a new pod of individuals would be affected on each installation day, which is also unlikely given pod residency. However, the Corps is proposing this higher number in acknowledgement of the SERDP density estimates originally proposed by NOAA (2015). Therefore, Corps has provided an extreme estimate of disturbance exposures over the duration of the entire project, and is requesting Level B take for 3,400 animals (Table 24).

Table 24. Total Level B Take Request for Harbor Porpoise

Jetty Location	Number of Estimated Potential Harbor Porpoise Disturbance Exposures Using SERDP Densities [2]	Total Level B Take Request for Harbor Porpoise [1]
Jetty A	1,463	425 (IHA) + 425 (LOA)
North Jetty	3,045	850
South Jetty – Clatsop	3,217	850
South Jetty – Channel	3,275	850
Total	**11,000**	**3,400**

[1] Based on the assumption that a different 50-animal feeding pod forms every day of pile installation within the ZOI at each jetty. This was considered a more realistic estimate of take than the 190 to 448-animals present in the ZOI estimated by the SERDP density model.
[2] Assumes density of 3.642 animals per km^2 (Barlow et al. 2009).

6.9. Pinnipeds - Stellar Sea Lion, California Sea Lion and Harbor Seal

Steller sea lions using haulout sites (rubble mound or terminal concrete block structure) on the South Jetty are reasonably likely to be disturbed by the proposed rock placement and offloading construction activities during the repair of the jetty trunk and stabilization of the South Jetty terminus. Pinnipeds have been observed hauling out primarily seaward of around STA 250+00 on the South Jetty. Pinnipeds underwater in the area of all three jetties would be exposed to the 120 dB acoustic threshold for 68 days of pile installation. Work on the jetty trunk and on the terminus of the jetty around or between STA 311+00 and 313+00 also will occur in the vicinity of the haul out zone. Steller sea lions would likely be hauling out in proximity this area for the duration of the proposed project, which would span up to 4 seasons at the South Jetty. The remaining majority of construction work would occur a significant distance from the nearest location where Steller sea lions have been observed hauling out. However, California sea lions and harbor seals are more likely to be affected by work on more landward portions of the jetty, though the area is of low use for seals.

It is likely that all individuals that use the haul-out may be exposed to jetty construction activities, specifically the underwater thresholds during pile installation. The number of pinnipeds exposed daily would vary based on weather conditions, season, and daily fluctuations of abundance at the South Jetty. Given the time of year that most of the placement will occur

(spring/summer), the number of Steller sea lions affected daily could range from between about 200 to 800 animals (see WDFW data in Section 3). The number of Steller sea lions affected daily is likely to increase over the years of project activities, because the population is currently increasing at 3% per year. Geographically, work on the South Jetty also will be farther oceanward where sea lions are known to be more common. The number of California sea lions during the same time frame has ranged from about 1 to 500 animals, and the number of harbor seals has been between 1 and 57 during any given month. It is likely that individuals would be repeatedly exposed to both pile installation and rock placement activities over the construction period.

Based on previous jetty work, the Corps has some monitoring information that reflects actual pinniped responses during comparable repair actions. During construction in 2006 and 2007, sea lions were often seen in the water close to the jetty and to a lesser extent on the jetty but appeared to be unaffected by construction activities related to similar repair work and placement of large amour stone on the jetty proper. They often swam close to construction activities and at times appeared to feed in close proximity to construction activities. Nevertheless, some Steller sea lions were flushed into the water during the repairs that were performed on the South Jetty in 2006 and 2007 (refer to NMFS 2005b), and the effects of the Proposed Action are expected to be similar.

When construction activities occur within about 300 feet or less of an observed haulout area, incidental harassment may cause animals to flush from the jetty. From past experience, about 50 Steller sea lions were observed to flush from the jetty on June 20, 2006 from a distance of about 300 feet upon approach of a boat. Other groups of Steller sea lions, however, did not flush at this approach distance. A group of five California sea lions were approached on the same day and did not flush at a distance of about 100 feet.

In 2006, work on the MCR South Jetty finished on October 6 around STA 245+00. One California sea lion was noted on September 5 and 6 at approximately STA 240+00. This was a branded individual and thought to be in transit from the Puget Sound Region to the north, and was flushed from the jetty on both days. During the week of October 1, approximately 10 sea lions flushed into the ocean near STA 258+00. This group flushed when they saw a worker walking on the jetty, at a distance of 50 to 100 feet from the worker (flushing may have occurred at a greater distance had the worker been visible to sea lions earlier). Therefore, a total of 12 incidental takings occurred involving 11 animals over 3 days during 2006 construction.

From May 1 to October 13, 2007, the Corps conducted construction work and marine mammal monitoring at the South Jetty. In total, only five harassment events occurred during the construction and post construction inspections (one Steller sea lion on jetty moved into water; one harbor seal in water close to jetty became skittish and dove under water and away from jetty; and three sea lions (unknown species) on jetty (beyond terminus of work) moved from jetty into water. This was in association with a jetty inspection project. Pre-, during-, and post-construction monitoring was all conducted in accordance with the terms and conditions of the Corps' IHA.

The piles for the facility nearest the haul out at the South Jetty are likely to be installed west of STA 270+00, and could be as close as 600 feet from the rubble mound and 1,400 feet from the concrete block structure or as far as 5,000 feet from the primary concrete block structure used by Steller sea lions. Based on conservative sound modeling by NMFS, noise from vibratory installation and removal would attenuate to the 120 dB underwater disturbance threshold within 6.2 miles (in the direction of the ocean, whereas land would be encountered on either shore of the river system or at the jetty itself prior to attenuating to the 120 dB rms threshold) (NMFS 2011a). All individual pinnipeds that use the South Jetty are likely to be exposed to pile driving sound above the underwater 120 dB rms disturbance thresholds repeatedly early in each construction season over the 6- to 7-year period when pile driving would intermittently occur at all four offloading facilities for a total of ~68 days of installation. A much smaller percentage of seals and sea lions would be exposed to the airborne acoustic threshold of 90 and 100 dB re 20 µPa rms. Pinnipeds would have to be within 20 feet of the installed pile (a little over the length of a long-bed pick-up), and harbor seals within 60 feet (or the distance from the pitcher's mound to home plate) would be exposed to their respective disturbance thresholds.

Given the time of year that most of the pile driving would occur (spring/summer), the number of Steller sea lions at the haul out representing those affected by underwater disturbance daily could range from between around 200 to 850 animals and could increase over time because the population is growing at a rate of 3% annually. The numbers of California sea lions present at the haul out ranges from around 1 to 500 animals and the number of seals around 1 to 57 animals. Exposure and take estimates below are based on past pinniped data from WDFW (2000-2014 data), which had a more robust monthly sampling frequency relative to ODFW counts. The exception to this was for harbor seal counts, for which ODFW (also 2000-2014 data) had more sampling data in certain months. Therefore, ODFW harbor seal data was used for the months of May and July. Exposure estimates are much higher than take estimates. This is because unlike the exposure estimate which assumes all new individuals, the take estimate request assumes that some of the same individuals will remain in the area and be exposed multiple times during the short 17-day installation period to complete and remove each offloading facility (for a total of about 68 days). These take estimates also should be considered in light of the previous low number of incidental harassment events recorded by the Corps in the two years of monitoring during work seasons on the South Jetty in 2006 and 2007.

The Corps also has made the assumption that only about 5% of all Steller sea lions would occur within the immediate range of airborne disturbance during any particular month throughout the entirety of all four construction seasons. This is because all of the work is removed from the actual, most densely used haul-out area. Further, the acoustic radii for the airborne thresholds are a maximum of 19 meters (62 feet) from installation via vibratory methods (at 90 dB for harbor seals), which is the Corps' proposed installation method. The radii for airborne threshold distances are so short that visual disturbance alone would likely preclude animals from being in proximity to the airborne sound thresholds. The majority of Steller sea lions are more likely to be hauled out more than several hundred feet from the farthest oceanward point of work. California sea lions and seals are known to use areas of the jetty more shoreward than Steller sea lions. Therefore, using the same logic but acknowledging a slightly closer potential proximity to construction work, the Corps conservatively assumed that 7% of California sea lions and harbor seals present on the MCR South Jetty could be subject to airborne disturbance through the

duration of all four construction seasons. Work at the other jetties would not have airborne disturbance effects.

Exposure to underwater disturbance thresholds would only occur for a total of about 68 days during installation and removal actions at all three MCR jetties (four offloading facilities, ~ 17 days each). In this case, all pinnipeds and seals in the water would be disturbed. The Corps assumed that 50% of the three species may be in the water at any given time during pile installation. This is based on the best professional judgment of the ODFW biologist, who stated: "Assuming another 50% in the water above what is hauled out is probably on the high end, but it's probably best to be conservative (i.e., have more takes authorized than actually incurred). It's probably more like 10-20% but it's highly variable and dependent on a lot of unpredictable factors like weather conditions, recent disturbance events, etc." (ODFW 2015).

In order to estimate exposure from pedestrian surveys, there is no ZOI or threshold. Therefore, the Corps used best professional judgment and conservatively assumed that over the span of three survey seasons (6 days), there was a chance of disturbing 0.1% of pinnipeds that may be hauled out on the jetty during any single day. Because survey days are weather dependent and occur in the summer time, the Corps conservatively selected from the highest monthly average species number during the summer months between May to August.

Further, for pile installation days the Corps has assumed the underwater disturbance threshold encompasses the airborne disturbance ZOI and thus, did not double-count exposure estimates in the computation (i.e., May and June species numbers are used exclusively for underwater exposure, the numbers in the remaining months are used for airborne). Also, and most importantly, the numbers of sea lions and seals exposures are not necessarily total numbers of individuals, but are most likely the same individuals harassed on multiple days. For these reasons, as with harbor porpoise calculations using densities, the Corps is illustrating potential exposure events, but is proposing an alternate method for calculating actual take numbers that more realistically reflects take from the Proposed Action. Currently, the 2013 stock report estimates between 63,160 and 78,198 animals (NOAA 2013a). If the Corps used the number of exposure events to directly estimate take, this would unrealistically indicate that the Proposed Action was taking almost 1/3 of the population of Steller sea lions.

The level of take for the Proposed Action is expected to be greater than the take that occurred during 2006 and 2007 construction because work will occur through four seasons at the South Jetty and up to seven seasons at all three jetties with pile installation for their offloading facilities. The underwater disturbance threshold expands much further than the airborne threshold. Estimates for potential sound exposures were made conservatively and are reflected in Table 25, using this information, assumptions and the following formulas:

$$\text{Exposure Estimate}_{\text{Stellar/CA/Harbor}} = (N_{est} * \text{Density}_{\text{underwater/piles/all jetties}} * \text{Duration}_{\text{underwater/piles/all jetties}}) + (N_{est} * \text{Density}_{\text{airborne/South Jetty seasons}} * \text{Duration}_{\text{airborne/South Jetty seasons}}) + (N_{est} * \text{Density}_{\text{Surveys/South Jetty}} * \text{Duration}_{\text{Surveys/South Jetty}})$$

where:

$\underline{\mathbf{N_{est}}}$ = Estimated monthly average number of species hauled out at South Jetty based on WDFW data.

Duration = total days of pile installation or removal activity for underwater thresholds (68); or, South Jetty construction seasons for airborne thresholds (4 seasons); or, number of pedestrian survey days (3 seasons, 6 days total).

Density = the estimated percentage of individuals in the respective ZOI: underwater assumed to be 50% of WDFW haul-out average during 2 most likely months of pile installation (May or June); airborne assumed to be 5% and 7% of monthly WDFW average for hauled-out Steller sea lions, and harbor seals and California sea lions, respectively; and survey disturbance (no ZOI) estimated to disturb 0.1% of highest summer monthly average (summer = May - August).

To reiterate, these exposure estimates assume a new individual is exposed every day throughout each acoustic disturbance, for the entire duration of the project.

$$\text{Exposure Estimate}_{\text{Stellar}} = (N_{\text{est(May+June)}} * 50\% * 68_{\text{underwater/piles days}}) + (N_{\text{est(Full season, NOT May or June)}} * 5\% * 4_{\text{airborne seasons}}) + (N_{\text{est(highest May-Aug)}} * 0.1\% * 6_{\text{survey days}})$$

$$\text{Exposure Estimate}_{\text{California}} = (N_{\text{est(May+June)}} * 50\% * 68_{\text{underwater/piles days}}) + (N_{\text{est(Full season, NOT May or June)}} * 7\% * 4_{\text{airborne seasons}}) + (N_{\text{est(highest May-Aug)}} * 0.1\% * 6_{\text{survey days}})$$

$$\text{Exposure Estimate}_{\text{Harbor}} = (N_{\text{est(May+June)}} * 50\% * 68_{\text{underwater/piles days}}) + (N_{\text{est(Full season, NOT May or June)}} * 7\% * 4_{\text{airborne seasons}}) + (N_{\text{est(highest May-Aug)}} * 0.1\% * 6_{\text{survey days}})$$

Table 25. Estimated Sound Exposures Events Experienced by Pinnipeds During Pile Installation at All MCR Jetties and Construction/Survey Seasons at the South Jetty

Month	Steller Sea Lion			California Sea Lion			Harbor Seal		
	Avg[1] #	Airborne (# at 5% Density)	Underwater (# at 50% Density)	Avg[1] #	Airborne (# at 7% Density)	Underwater (# at 50% Density)	Avg[1,2] #	Airborne (# at 7% Density)	Underwater (# at 50% Density)
April	587	29	-	99	7	-	-	0	-
May	824	-	412	125	-	63	0	-	0
June	676	-	338	202	-	101	57	-	29
July	358	18	-	1	0	-	10	1	-
August	324	16	-	115	8	-	1	0	-
September	209	10	-	249	17	-	-	0	-
October	384	19	-	508	36	-	-	0	-
Preliminary Number of Individuals[4]	--	92	750	--	68	164	--	1	29
Exposure Duration[5]: 4 (air-SJ only); 68 (underwater-all)		368	51,000		272	11,152	--	4	1,972
SJ Surveys[3] Highest Avg Month (May-Aug) at 0.1% Density	824	0.824	--	202	0.202	--	57	0.057	--
Exposure Duration = 6 days at SJ	--	5	--	--	1	--	--	<1	--
Total Event Exposure Estimate	51,373			11,425			1,976		

[1] WDFW monthly averages from 2000-2014.
[2] ODFW monthly averages for May and July 2000-2014 data) due to additional available sampling data.
[3] There is no acoustic threshold for visual disturbance. Based on prior monitoring data and pinniped responses, assumed 0.1% of animals could be disturbed during each day of survey.
[4] Conservatively assumes each exposure is to new individual, all individuals are new arrivals each month, and no individual is exposed more than one time.
[5] Assumed 68 pile installation/removal days, (1000 events, approximately 15 piles installed/removed per day), or ~17 total days at each facility.

Requesting take based on exposure calculations using the above density/duration would inaccurately suggest that the Proposed Action would take almost the entire population of pinnipeds on the West Coast. It also assumes that each exposure is affecting a new animal, when the reality is a single animal is likely to be exposed to underwater disturbance more than one time. It also is possible for the animal to be exposed to both airborne and underwater thresholds on the same day and throughout multiple days. However, the likelihood of airborne exposure is very low based on the ZOIs. Therefore, the Corps is proposing the following take estimate and assumptions.

Based on WDFW data and assumptions above, the Corps will retain calculations using the airborne disturbance exposure assumptions to estimate take for all construction and survey work. These estimates are extremely conservative, particularly given past monitoring results. However, for pile installation, the Corps will assume pile installation occurs only in *either* May *or* June, which is the most likely construction scenario since each facility is expected to be

installed and removed within 17 days early in the construction season. Further, it is assumed that the number of animals taken by underwater acoustic disturbance is represented by the highest average number of animals present during the installation month (May or June), and that all animals are exposed to the underwater disturbance. Therefore, for Steller sea lions 824 animals will represent the seasonal take; for California sea lions, seasonal take will be 202 animals; and for harbor seals seasonal take will be 57 animals. Instead of 68 days of duration, the Corps will assume eight general installation and removal periods (two for each of the four offloading facilities). This is reasonable because each facility will take less than a month to install and remove (~17 days), and the number of animals used for exposure estimates represents the entire month. Any single installation or removal period would be assumed to take every animal present during that month. Using these assumptions, the take calculations are estimated in Table 26.

Steller sea lions to be disturbed could include non-breeding males, females, and juveniles from June through August (work in April will involve road construction on the jetty landward of haulout areas). Primarily females and juveniles would be subject to disturbance during September and October as males tend to leave the MCR South Jetty in late summer and fall and utilize other haul out sites in Oregon, Washington, and British Columbia. It is expected that the large majority of Steller sea lions would occur on the jetty seaward of STA 290+00 and would not be disturbed by a majority of the construction except for head stabilization.

California sea lions are comparatively more resilient to disturbance events. California sea lions to be disturbed during June through October would include only sub-adult and adult males that have dispersed from breeding grounds.

Table 26. Estimate of Seasonal Take by Pinnipeds During Pile Installation at All MCR Jetties and Construction/Survey Seasons at the South Jetty

Month	Steller Sea Lion			California Sea Lion			Harbor Seal		
	Avg[1] #	Airborne (# at 5% Density)	Underwater	Avg[1] #	Airborne (# at 7% Density)	Underwater	Avg[1,2] #	Airborne (# at 7% Density)	Underwater
April	587	29	-	99	7	-	-	0	-
May	824	-	824	125	-	125	0	-	0
June	676	-	676	202	-	202	57	-	57
July	358	18	-	1	0	-	10	1	-
August	324	16	-	115	8	-	1	0	-
September	209	10	-	249	17	-	-	0	-
October	384	19	-	508	36	-	-	0	-
Preliminary Total[4]	--	92	824	--	68	202		1	57
Duration: 4 (air-SJ only); 8 (underwater-all)	--	368	6,592		272	1,616	--	4	456
Survey-Highest Average Month (May-Aug) at 0.1% Density[3]	824	0.824	--	202	0.202	--	57	0.057	--
Survey 6 days at SJ	--	5	--	--	1	--	--	<1	--
Total Takes Requested	**6,965 (IHA = 1,648; LOA = 5,317)**			**1,889 (IHA = 404; LOA = 1,485)**			**460 (IHA = 114; LOA = 346)**		

[1] WDFW Monthly Averages from 2000-2014.
[2] ODFW Monthly Averages for May and July 2000-2014 data) due to additional available sampling data.
[3] There is no acoustic threshold for visual disturbance. Based on prior monitoring data and responses, assumed 0.1% of animals could be disturbed during each day of survey (3 surveys at SJ, 2 days each).
[4] Conservatively selected highest WDFW monthly average during most likely 2-month window of pile installation (May or June).

For harbor seals, males, females, and juveniles could be disturbed and are expected to occur at more landward points than sea lions. Thus, they could be disturbed even during the first month of road construction on the jetty.

Abundance of sea lions and seals subject to harassment may decline over the work period, since animals may not forage or haulout in the location of the work area once they have been subjected to a few disturbance events. However, as pinniped numbers trend upward, the numbers of interactions may increase throughout the seven seasons of work at the South Jetty.

6.10. Summary of Exposure and Level B Take Request Estimates

The summary presented in Table 27 indicates the total number of calculated exposure events that may result from the Proposed Action at the MCR jetties. Level B take request estimates for marine mammals were based on the estimated number of exposures and adjusted to reflect multiple exposures experienced by single individuals. To the extent possible, reporting will provide details of how many animals of each species are actually exposed within the ZOIs to underwater and airborne noise levels considered potential behavioral harassment at each location.

Table 27. Total Level B Exposure Estimates and Take Estimates Requested by Species at the MCR Jetties

Species	Total Exposure Event Estimates	Take Estimate Requested for IHA	Take Estimate Requested for LOA	Total Take Estimate Requested
Southern Resident Killer Whale	0	0	0	0
Western Transient Killer Whale	2.14	4	16	20
Humpback Whale	11.78	4	16	20
Gray Whale	15.78	5	20	25
Harbor Porpoise	11,000	425	2,975	3,400
Steller Sea Lion	51,373	1,648	5,317	6,965
California Sea Lion	11,425	404	1,485	1,889
Harbor Seal	1,976	114	346	460

7. Anticipated Impact of the Activity

The anticipated impact of the activity to the species or stock of marine mammal.

7.1. Cetaceans

The following auditory masking information was included in the Navy IHA application (Naval Base Kitsap 2014) and is pertinent to the work proposed by the Corps. Natural and artificial sounds can disrupt behavior by auditory masking. This masking interferes with a marine mammal's ability to hear other relevant sounds, such as communication and echolocation signals (Wartzok et al. 2003 cited in Naval Base Kitsap 2014). Masking occurs when both the signal and masking sound have similar frequencies and either overlap or occur very close to each other in time.

Noise can only mask a signal if it is within a certain "critical bandwidth" around the signal's frequency and its energy level is similar or higher than the signal (Wartzok et al. 2003, Holt 2008, cited in Naval Base Kitsap 2014). What is meant by an energy level that is "similar" is a strong function of the frequency of the signal/noise (Wartzok et al. 2003, cited in Naval Base Kitsap 2014). For example, in delphinid subjects, relevant 1 kilohertz (kHz) signals needed to be 17 to 20 dB louder than masking noise in order to be detected; 100 kHz signals need to be 40 dB greater (Richardson et al. 1995, cited in Naval Base Kitsap 2014).

If a masking sound is manmade, it can be potentially harassing (as defined by the MMPA) if it disrupts hearing-dependent behavior such as communications or echolocation. The most intense underwater sounds in the Proposed Action are those produced by vibratory pile driving (impact is not proposed, but provided for comparison and context). Given that the energy distribution of pile driving covers a broad frequency spectrum, with greatest amplitude typically from 50 to 1,000 Hz (WSDOT 2011a, b, cited in Naval Base Kitsap 2014); pile driving sound would be primarily within the lower audible range of the pinniped and cetacean species that may occur in the project area. Some overlap of frequencies used for social signals by the marine mammal species with pile driving frequencies may occur, especially affecting pinnipeds that use and are more sensitive to lower frequencies than the cetaceans that may occur in the project area. Any masking event that could possibly rise to Level B harassment under the MMPA would occur concurrently within the zones of behavioral harassment estimated for vibratory pile driving, which are taken into account in the exposure analysis (see Section 6). Therefore, masking effects are not considered as separately contributing to exposure estimates in this application.

Due to the proposed pile installation window, the Corps determined, and NMFS concurred in its 2011 BiOp, that the Proposed Action is not likely to adversely affect Southern resident killer whales. The Corps will avoid pile installation during the March and April peak feeding season when whales are foraging on returning adult salmon.

The Corps is requesting take for the Western transient stock of killer whales because there is a small chance they may be feeding on pinnipeds in the area or transiting through the ZOIs during pile installation. If whales were exposed to Level B underwater acoustic disturbance, it could result in some acoustic masking that may interfere with foraging and communication in the ZOI. If they are migrating through the area, they may exhibit a slight course deviation around the ZOI, or they would be exposed to disturbance for a duration of about 3.4 hours for 1 day (if *both* ZOIs at North and South Jetty were affected, which is highly unlikely). However, the additional distance traveled is unlikely to cause a significant increase in an individual's energy budget, and effects would therefore be non-lasting. In either case, the likely behavioral responses, even considering potential for repeat exposures of individual whales, are not anticipated to reduce the reproductive success or increase the risk of injury or mortality for any individual killer whale.

The NMFS (2011) further concluded that the Proposed Action is not likely to cause a measurable reduction in the quantity of salmon and other ESA-listed or proposed fish, and therefore will not affect the quantity of prey available to marine mammals. The quality of prey available to marine mammals will not be adversely affected by the Proposed Action, because there is no causal mechanism for the proposed activities to increase the concentration of persistent organic pollutants in fish. NMFS concurs with the Corps' determinations that effects of the action are either insignificant or discountable and therefore are not likely to adversely affect Southern Resident killer whales.

Humpback whales are considered low-frequency cetaceans affected by background acoustics with frequencies in the range of 7 Hz to 20 kHz (NMFS 2012). Exposure of humpback whales to sound at or above 120 dB rms threshold is likely to elicit behavioral responses within the range of previously documented responses by low- frequency hearing specialists to non-pulse sound. Southall and others (2007, cited in NMFS 2011a) conducted a comprehensive literature review of the effects of sound on marine mammals. Based on previous studies of low-frequency hearing specialists and their responses to non-pulse sound, they conclude that there is an increasing probability of avoidance and other behavioral effects in the 120 dB rms to 160 dB rms range (summarized in Table 14 from Southall et al. 2007, cited in NMFS 2011a). However, they caution that there is considerable variability in received levels associated with behavioral responses, and that context (i.e., novelty of the sound and what the animals are doing in the area) is likely as important if not more important than exposure level in predicting behavioral response.

According to NMFS (2011), there are no studies that document the response of low-frequency sound specialists to vibratory pile driving. Humpback whales exposed to sound from the proposed vibratory pile driving are unlikely to detect the physical presence of pile driving machinery (i.e., they are more likely to occur closer to the ocean-ward edge of the 4.6-mile radius area). For this reason, NMFS (2011) found it reasonable to assume that of the non-pulse sound sources that have been studied, studies that have documented response to playback sound, as opposed to studies that documented response to both sound and physical presence of machinery, are most applicable to the likely response under evaluation [i.e., gray whales migrating (Malme et al. 1983, 1984) and gray whales feeding (Malme et al. 1986)].

These studies documented responses that range from slight deviation in course and deflection around the sound (migrating whales) to avoidance of the area (feeding whales). Therefore, NMFS anticipated that humpback whales exposed to sound from the proposed pile driving in the project vicinity would respond by either a deviation in their course to deflect around the sound (in the case of whales otherwise passing through the area) or by avoiding the area (in the case of whales otherwise feeding in the area). Exposed humpback whales are likely to be temporarily displaced and precluded from foraging in the project vicinity. However, there are alternate foraging areas available (i.e., areas offshore and closer to the shelf break and Grays Harbor to the north, as discussed above). Exposed humpback whales are also likely to deflect around the sound instead of passing through the area. However, the additional distance traveled is unlikely to cause a significant increase in an individual's energy budget, and effects would therefore be non-lasting. In either case, the likely behavioral responses, even considering potential for repeat exposures of individual whales, are not anticipated to reduce the reproductive success or increase the risk of injury or mortality for any individual humpback whale. In addition, current threats to the species that may occur as part of the environmental baseline or cumulative effects in this area include vessel sound that is a habitat concern for low-frequency sound specialists, such as humpback whales. NMFS (2011) concluded that the effects of the action, in addition to threats that are part of the environmental baseline or cumulative effects, are not anticipated to appreciably reduce the species' ability to survive and recover.

The NMFS (2011) used studies of gray whales (Malme et al. 1983, 1984 cited in NMFS 2011a) as a proxy to determining effects to humpbacks, which are also low-frequency sound specialists. Therefore, it is reasonable to assume that gray whales will also exhibit the same sort of responses to the Proposed Action ranging from slight deviation in course and deflection around the sound (migrating whales) to avoidance of the area (feeding whales). As determined for humpbacks, for gray whales the additional distance traveled is unlikely to cause a significant increase in an individual's energy budget, and effects would therefore be non-lasting. The likely behavioral responses, even considering potential for repeat exposures of individual whales, are not anticipated to reduce the reproductive success or increase the risk of injury or mortality for any individual gray whale.

Harbor porpoises are high-frequency sounds specialists and will be exposed to the underwater acoustic disturbance thresholds. As with the other cetaceans, they may avoid foraging in the vicinity, or may make a course deviation if moving through the area. As noted for killer whales, NMFS did not anticipate any reduction in food sources as a result of the Proposed Action. Pods may relocate and feed further away from the ZOI, and the seasonal duration of installation or removal will be limited to 17 days total for any particular facility. This disturbance will be intermittent over the course of these days, and potentially spread of the duration of 7 seasons. The likely behavioral responses, even considering potential for repeat exposures of individual porpoises, are not anticipated to reduce the reproductive success or increase the risk of injury or mortality for any individual porpoise.

7.2. Pinnipeds

The Eastern DPS of Steller sea lions is a large population, which over the past 30 years has increased approximately 3% per year. Steller sea lions are generalist predators, and able to

respond to changes in prey abundance. There are no substantial threats to the species, and the population was recently removed from the Federal List of Endangered Wildlife and Plants.

The South Jetty is used as a haulout year-round by Steller sea lions, California sea lions, and harbor seals. According to NMFS (2011), rock placement on the South Jetty and pile driving at all jetties are the only proposed activities that will affect Steller sea lions. This also applies to California sea lions and harbor seals. Given the time of year when most of the rock placement and pile driving activities will occur (spring/summer over seven seasons), the number of Steller sea lions affected daily could range from at least 200 to 850 animals. The response of Steller sea lions to these activities are expected to be similar to repairs performed on the South Jetty in 2006 and 2007 (refer to NMFS 2005b), which include alert behavior, approaches to the water, and flushes into the water.

In the 2011 BiOp, the NMFS used conservative underwater exposure thresholds of SPLs from broadband sounds that cause behavioral disturbance (160 dB re 1µPa rms for impulse sound and 120 dB re 1µPa rms for continuous sound) and injury (190 dB re 1µPa rms for pinnipeds) (NMFS 2005a in NMFS 2011a). In the air, SPLs greater than 100 dB re 20µPa rms have been shown to affect behavior and seals have a threshold at 90 dB re 20µPa rms.

The average underwater SEL recorded during a recent test pile program in Newport, Oregon in 2010 (NMFS 2010 cited in NMFS 2011a), using vibratory hammers was 146 dB average sound exposure level (SEL-average), well below the potential onset of injury threshold of SPLs. Based on these conservative thresholds, the Corps anticipates that the proposed pile driving and removal would produce SPLs that are likely to disturb pinnipeds. Underwater sound produced by the proposed vibratory pile driving and removal is anticipated to be below the injury threshold at the source.

The response of pinnipeds to the proposed rock placement may include alert behavior, approaches to the water, and flushes into the water. These potential disturbances could be caused by the movement of construction machinery and/or the noise produced by the machinery. Behaviorally, pinnipeds may respond to rock placement by vacating the area. Some may redistribute themselves along portions of the jetty away from construction activities and to other haul out sites in the lower river and along the coast to the south and north.

Based on past responses to similar activities, it likely that pinniped exposure to rock placement activities would nominally change their use of the South Jetty area and the amount of time they would otherwise spend foraging in the immediate vicinity. However, there are alternative foraging areas available to the affected individuals. Repetitive, short-term displacement is likely to cause repetitive, short-term disruptions in their normal behavioral patterns at the South Jetty. Disruption from airborne or visual disturbance would be limited to working hours during the predicted construction seasons. The in-water acoustic threshold may be exceeded for up to seven seasons of pile installation as a result of the construction of the offloading facilities. However as previously noted, the background acoustic levels at the mouth are likely to be very high given the strong tides, high winds, and breaking surf conditions.

The anticipated impact upon the sea lions and harbor seals includes temporary disturbance (flushing) and temporary displacement of animals to other parts of the jetty or other nearby haulouts until work is discontinued. Other haulouts are available for harbor seals throughout the Columbia River estuary, and for sea lions on other parts of the South Jetty, the North Jetty, or rocky headlands in northern Oregon, northern California, or southern Washington. Observations in the past have shown that animals that are flushed from the jetty do not leave the vicinity. Animals that flush from the jetty would be expected to move to other parts of the jetty, likely seaward of the point of disturbance. There is also not expected to be a reduction in prey resources as a result of the Proposed Action.

The Proposed Action may also include measures to intentionally deter the pinnipeds from using the portion of the jetty where work will occur. Such activities will be authorized under MMPA Section 109 (h)(1)(a), and the Steller sea lion regulations at 50 CFR 223.202(b)(2) should deterrence become necessary to protect the animals from injury during construction.

The NMFS (2011) found it likely that Steller sea lions would be exposed to and disturbed by sound generated by pile driving activities. The same would apply for California sea lions and harbor seals. Pinnipeds would likely spend less time at the South Jetty haulout or foraging in the immediate vicinity. However, there are alternative foraging and haul out areas available to the affected individuals. Repetitive, short-term displacement would likely cause repetitive, short-term disruptions in their normal behavioral patterns at the South Jetty. There are no current threats to the species that are either part of the environmental baseline or cumulative effects in the action area that are anticipated to affect pinnipeds in addition to the activities of the Proposed Action described above. Effects of the action are not anticipated to appreciably reduce the species' ability to survive and recover.

8. Anticipated Impacts on Subsistence Uses

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

Not applicable (this issue is only applicable in Alaska).

9. Anticipated Impacts on Habitat

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

Impacts to habitat from the Proposed Action are expected to be temporary and include increased human activity and noise levels, minimal impacts to water quality, and negligible changes in prey availability near the individual project sites.

The Corps does not anticipate any measureable long-term impact to the marine mammal habitat. Repairing the South Jetty by adding more rock would not reduce the availability, quality, or accessibility of habitat for Steller and California sea lions and harbor seals. Seals and sea lions use the existing tip of the jetty that is built of concrete blocks, and are easily able to climb up several vertical feet from one block to the next. They also use sections of the jetty composed of angular jetty stone in areas of differing slope and commonly use side slopes and the top of the jetty. On the angular jetty stone, they tend to occur at the top of the jetty during the winter when larger swells are present. They have excellent climbing abilities on concrete blocks and jetty stone and therefore are expected to easily make use of the repaired jetty.

Barge offloading would nominally increase vessel traffic along major navigation routes in existing harbors and navigation channels during daylight hours in the summer months, but impacts are not likely to be permanent. The number of additional barge trips per year attributable to the Proposed Action is expected to be somewhere between 8 and 22 ships. This is small (< 1%) annual percentage increase relative to the current number of other commercial and recreational vessels already using any of these potential routes. Additional noise could be generated by barge-mounted equipment, such as cranes and generators, but this noise would typically not exceed existing background underwater noise levels. Impacts to marine mammals from these noise sources are expected to be negligible.

Some degree of localized reduction in water quality would occur as a result of in-water construction activities. Most of this effect would occur during the installation and removal of piles from the substrate when bottom sediments are disturbed. Any effects to turbidity are expected to be short-term and minimal. Turbidity would return to normal levels within a short time after completion of the Proposed Action. No direct effects to marine mammals are expected from turbidity impacts.

Habitat-associated effects with pile installation and removal are in and of themselves insignificant. For example, the average SPL recorded during a recent test pile program in Newport, Oregon in 2010 (NMFS 2010 cited in NMFS 2011a), using vibratory hammers was 146 dB SEL-average, well below the potential onset of injury threshold of SPLs of 206 dB rms, and accumulated SELs of 183 dB rms (for fish that weigh 2 grams or less) and 187 dB rms (for fish that weigh greater than 2 grams). The relevant issue is the SEL, psi or dB, produced, expressed, and transmitted through the water and the potential effects, e.g., barotrauma, the transient energy field poses to fishes. Effects to habitat, such as suspended sediment, are likely to be so minor and transient that they could not be measured against background levels. Therefore, NMFS (2011) concluded effects associated with pile installation and removal on estuarine and marine habitats will be insignificant.

The Corps' 2010 BA and the NMFS 2011 BiOp indicated that no adverse effects were anticipated for critical habitat of prey species for marine mammals. Prey resources in the vicinity are not expected to be reduced.

All impacts to marine mammal habitat are expected to be limited to the duration of construction and pile extraction and installation each construction season. In-water activities associated with

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

10. Anticipated Effects of Habitat Impacts on Marine Mammals

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

The Corps does not anticipate that repairs to the MCR jetties or construction of the offloading facilities would result in any measurable loss or habitat modification affecting marine mammal populations. The Corps does not expect loss of prey or foraging resources. Minimal, temporary, seasonal disturbance at the South Jetty haulout during construction of the barge offloading facilities and repair of the jetty prism and terminus is not expected to reduce post-construction use of the area by the pinnipeds species. The MCR jetties were not designated critical habitat under the ESA for the Steller sea lion, nor for any other listed marine mammal. There are alternative forage areas for whales within 45 miles north at Gray's Harbor, and any avoidance of or diversion around the acoustic disturbance ZOI during migration would not meaningfully increase migration distances or detract from energy supplies.

11. Mitigation Measures

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

Rookeries, mating grounds, availability for subsistence uses and long term adverse impacts on habitat are not anticipated. Provided below is a summary of the impact minimization measures and best management practices (BMPs) that will be implemented.

- All rock placement will be done via crane and excavator from the top of the jetty or via a barge-mounted crane.
- Offloading facilities will be installed via vibratory hammer and will use steel or untreated wood piles.
- A Water Quality Protection and Monitoring Plan will be implemented on the Washington side, and turbidity monitoring will be implemented per CWA conditions at all three MCR jetties.
- The Corps will use environmentally acceptable lubricants for equipment on the jetties, and will employ a Wiggins Fast Fuel system or equivalent when it is required to refuel stationary equipment on the jetties.

- A spill prevention and response plan will also be developed and kept onsite with appropriate supplies.
- An Environmental Protection Plan will be developed and implemented prior to the commencement of any construction activities. The plan identifies construction elements and recognizes spill sources at the site. The plan outlines BMPs, response actions in the event of a spill or release, and notification and reporting procedures. The plan also outlines contractor management elements such as personnel responsibilities, project site security, site inspections, and training.
- No petroleum products, fresh cement, lime, fresh concrete, chemicals, or other toxic or harmful materials will be allowed to enter surface waters.
- Wash water resulting from wash-down of equipment or work areas will be contained for proper disposal and will not be discharged unless authorized.
- Equipment that enters surface waters will be maintained to prevent any visible sheen from petroleum products.
- No oil, fuels, or chemicals will be discharged to surface waters, or onto land where there is a potential for re-entry into surface waters to occur. Fuel hoses, oil drums, oil or fuel transfer valves, fittings, etc. will be checked regularly for leaks and will be maintained and stored properly to prevent spills.
- No cleaning solvents or chemicals used for tools or equipment cleaning will be discharged to ground or surface waters.
- Construction materials will not be stored where high tides, wave action, or upland runoff could cause materials to enter surface waters.
- The Corps will 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.
- The Corps will implement a soft-start procedure for pile installation. The objective of a soft-start is to provide a warning and/or give animals in close proximity to pile driving a chance to leave the area prior to a vibratory driver operating at full capacity thereby, exposing fewer animals to loud underwater and airborne sounds. A soft start procedure will be used at the beginning of each day when in-water pile driving or any time pile driving has ceased for more than 30 minutes. For vibratory pile driving, the contractor will initiate noise from vibratory hammers for 15 seconds at reduced energy followed by a 30-second waiting period. The procedure shall be repeated two additional times.
- For all vibratory pile driving, a shutdown and disturbance zone will be monitored.
    - Monitoring will take place from ~~15~~ 30 minutes (changed from original based on IHA conditions and request by NMFS) prior to initiation through 30 minutes post-completion of pile driving.
    - The shutdown zone will include all areas where the underwater SPLs are anticipated to equal or exceed the Level A (injury) criteria for marine mammals (180 dB isopleth for cetaceans; 190 dB isopleth for pinnipeds). The shutdown zone will always be a minimum of ~~10~~ 20 meters (~~33~~ 66 feet) to prevent injury from physical interaction of

marine mammals with construction equipment (the Corps is proposing a more restrictive radius to avoid confusion; 20 m is airborne acoustic *disturbance* threshold for harbor seals).

- A monitoring plan will be implemented as described in Section 13. This plan includes shut-down zones and specific procedures in the event a mammal is encountered.
- If the shutdown zone is obscured by fog or poor lighting conditions, pile driving will not be initiated until the entire shutdown zone is visible.
- Prior to the start of pile driving, the shutdown zone will be monitored for ~~15~~ 30 minutes (changed from original based on IHA conditions and/or by NMFS' request) to ensure that the shutdown zone is clear of marine mammals. Pile driving will only commence once observers have declared the shutdown zone clear of marine mammals.
- If a marine mammal approaches or enters the injury zone during pile driving, work will be halted and delayed until either the animal has voluntarily left and visually confirmed beyond the disturbance zone, or 15 minutes for pinnipeds or 30 minutes for cetaceans have passed without re-detection of the animal (changed from original based on IHA conditions and/or by NMFS' request).
- If a marine mammal is observed in the acoustic disturbance zone, but not approaching or entering the shutdown zone, a "take" will be recorded and the work will be allowed to proceed without cessation. Marine mammal behavior will be monitored and documented.
- If a marine mammal approaches or enters a shutdown zone during vibratory pile driving, work will be halted and delayed until either the animal has voluntarily left and been visually confirmed beyond the shutdown zone or 15 minutes for pinnipeds or 30 minutes for cetaceans have passed without re-detection of the animal (changed from original based on IHA conditions and/or by NMFS' request).
- Scan the waters for ~~15~~30 minutes before and during all pile driving. If any species for which take is not authorized are observed within the area of potential sound effects during or ~~15~~30 minutes before pile driving, the observer(s) will immediately notify the on-site supervisor or inspector, and require that pile driving either not initiate or temporarily cease until the animals have moved outside of the area of potential sound effects (changed from original based on IHA conditions and/or by NMFS' request).

12. Arctic Plan of Cooperation

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

Not applicable (this requirement is applicable only for activities that occur in Alaskan waters north of 60° North latitude).

13. Monitoring and Reporting

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

After multiple conversations with NMFS Seattle and Headquarters staff, the Corps submitted its original IHA/LOA request in June 2015, which included a monitoring and reporting plan. The Corps then received its IHA for work at Jetty A on August 31, 2015. Subsequent to the issuance of the IHA, NMFS indicated that there were concerns with possible SRKW presence in the ZOI for a longer and later duration than previously observed. In its ESA BiOp, the Corps received a *not likely to adversely affect* (NLAA) determination and did not request take for SRKW in its IHA/ LOA request under MMPA. Part of the ESA NLAA determination for SRKW was based on the Corps' agreement to limit its pile work window each year to May1 through September 30.

After several conversations with multiple divisions at NMFS, the Corps was subsequently requested to revise its originally proposed marine mammal monitoring plan encompassed in the IHA/LOA request (Mongillo, Laws, Pauline, 2015). The Corps also was given the following options related to its ESA consultation and MMPA LOA request:

1) Keep the existing BiOp issued to the Corps, retain the informal ESA concurrence for no SRKW take, and avoid take of all orcas through July1 of each year. Take could be avoided in 2 ways:
    a. Change the pile installation window to begin July 1 and end September 30. After July 1, any killer whales are assumed to be transient killer whales, for which the Corps requested MMPA take in the LOA request. A revised monitoring plan would still be required, but shut-down would not be required after July 1 if killer whales are present during this later time period;
    b. Modify the monitoring plan to include a shut-down if any killer whales enter the area encompassed by the ~ 4-mile Zone of Influence radius during the May 1 through July 1 window. The shut-down would remain in effect until the whales had left the ZOI. This shut-down trigger for all killer whales would remain in effect until July 1. This required change to monitoring also entailed providing additional monitors and boat surveys at the mouth, which is challenging due to sea conditions, the extent of the open ocean area, and the harassment caused by the monitoring itself. Therefore, the Corps had originally questioned the feasibility of the boat survey option.

2) The Corps could reinitiate formal ESA consultation for SRKW only and make a formal take request. The result would be that the Corps would receive a new Biological Opinion on SRKW, an Incidental Take Statement for both humpback and SRKW, and these would be issued concurrent with the MMPA Letter of Authorization covering take for the full suite of marine mammals.

Per the agencies' conversation on December 4, 2015 (Mongillo, Pauline, and Laws), the Corps was informed that, regardless of its decision regarding re-initiation and ESA take, its monitoring plan for the LOA request would require revision to include additional monitors and boat surveys. Based on the summary of the above options, the Corps is proposing to revise its monitoring plan to include additional monitors and vessel surveys and to implement a shut-down procedure if killer whales occur in the zone of influence during pile installation/removal/repair activities from May 1 to July 1. The Corps is not requesting to reinitiate ESA consultation for SRKW. The remainder of the Corps' proposed monitoring plan will stand as originally proposed with the exception of updates related to the IHA conditions and NMFS requests, which have been incorporated and indicated in this revision and addendum. An addendum that further details the proposed survey and monitoring protocols has been developed.

The following black text remains original to the Corps' initial official submittal and new or edited text has been red-lined with changes pertinent to the addendum and revisions described.

The Corps will conduct one pinniped monitoring count and report of the number of sea lions and seals (by species if possible) present on the South Jetty within 1 week before starting work each season at the South Jetty. The Corps is not proposing pre-or post-construction monitoring prior to or after any of the work at North Jetty or Jetty A. During construction at South Jetty, weekly reports will be provided to NMFS that include a summary of the previous week's numbers of sea lions and seals and cetaceans that may have been disturbed as a result of the construction activities. These reports and observations during activities other than pile installation will be conducted from the South Jetty and are not expected to detect or estimate all animals affected by underwater disturbance. Observations and reports made during pile installation/removal/maintenance activities will be conducted from the jetty, the Cape Disappointment Visitors Center, and a vessel or vessels. These reports will include take reporting for animals within the underwater and airborne disturbance Zones of Influence (ZOIs). ~~Any attempt to make such counts by boat would create additional disturbance due to the proximity and approach required to detect animals in the water.~~

These reports will provide dates, time, tidal height, maximum number of sea lions and seals on the jetty and any observed disturbances. The Corps also will provide a description of construction activities at the time of observation, any mitigation actions that were implemented, and an assessment of the implementation and effectiveness of the mitigation measures. Post-construction monitoring will occur with one count every 4 weeks for 8 weeks, to determine recolonization of the South Jetty. A report will be submitted to the NMFS and the AMT within 90 days of completion of each construction season at the South Jetty. The Corps will designate a biologically trained on-site marine mammal observer(s) to carry out the monitoring and reporting. The ODFW and WDFW, who also monitor seal and pinniped use of the South Jetty, will be apprised of the Corps work and results of the monitoring efforts.

The Corps is not proposing pre- or post-project pinniped monitoring or counts at Jetty A or North Jetty except for monitoring indicated specifically during pile activities because sea lions and seals have not been observed using either of these structures. However, at all MCR jetties the Corps will implement the relevant BMPs provided in Section 11 and the monitoring and shut-down protocols for pile installation. In addition, all marine mammal observations at all jetties will be recorded and reported on a daily basis, and will be provided to NMFS on a monthly basis, or upon request.

~~The Corps is not proposing boat monitoring for several reasons. First, the boat itself is likely to disturb foraging mammals in order to gain close enough proximity to obtain a solid confirmation of species type. Second, the ocean and river conditions at the MCR Bar are known to be very dynamic and dangerous and would require an adequately-sized ocean-going vessel that would likely cause more disturbance to any mammals present during its approach. Finally, it is unreasonable to patrol the entire open-ocean area encompassed by the underwater acoustic disturbance threshold.~~

Based on conversations with NMFS, the Corps is revising its monitoring proposal to include vessel monitoring only during pile installation/removal/maintenance activities, and will initiate a shut-down procedure if SRKW are present in the ZOI occurring in the May 1 to July 1 time frame. For work at the North and South Jetty, the Corps anticipates using up to two monitoring vessels stationed on the ocean sides of the North and South Jetties, and surveying through the plume, as feasible. The Corps will station a land-based monitor at each jetty at the location of the pile installation, removal, and maintenance activities. Additionally, for construction at the North and South Jetties, the Corps will station a monitor at the Cape Disappointment Visitors Center only for the duration of pile installation, removal, and maintenance activities. For work on Jetty A, the Corps will station a second land-based monitor on Clatsop Spit only for the duration of pile installation, removal, and maintenance activities.

For work at all the MCR jetties, the Corps is proposing the following monitoring protocols.

- For all vibratory pile driving, a shutdown and disturbance zone will be monitored.
  - Monitoring will take place from ~~15~~ 30 minutes (changed from original based on IHA conditions and/or by NMFS' request) prior to initiation through 30 minutes post-completion of pile driving.
  - The shutdown zone will include all areas where the underwater SPLs are anticipated to equal or exceed the Level A (injury) criteria for marine mammals (180 dB isopleth for cetaceans; 190 dB isopleth for pinnipeds). The shutdown zone will always be a minimum of ~~10~~ 20 meters (66~~33~~ feet) to prevent injury from physical interaction of marine mammals with construction equipment (20 m is airborne acoustic *disturbance* threshold for harbor seals; in order to avoid confusion the Corps is proposing a single more restrictive shutdown zone for both in or above-water work).
- Visual monitoring will be conducted by qualified, trained marine mammal observers (hereafter "observer"). Visual monitoring will be implemented during all pile installation activities at all jetties. Additional monitoring during other construction activities will

only be conducted on the South Jetty. An observer has prior training and experience conducting marine mammal monitoring or surveys, and who has the ability to identify marine mammal species and describe relevant behaviors that may occur in proximity to in-water construction activities.

- Trained observers will be placed at the best vantage points practicable (from the construction barges, on shore, or jetty-side,~~)~~ from the Cape Disappointment Visitors Center, at Clatsop Spit, and from survey vessels at the mouth, as applicable). Vessel monitoring will only occur when pile work is occurring. ~~to~~ Observers will monitor for marine mammals and implement shutdown/delay procedures when applicable by calling for the shutdown to the hammer operator.
- If the shutdown zone is obscured by fog or poor lighting conditions, pile driving will not be initiated until the entire shutdown zone is visible.
- Prior to the start of pile driving, the shutdown zone will be monitored for ~~15~~ 30 minutes (changed from original based on IHA conditions and/or NMFS' request) to ensure that the shutdown zone is clear of marine mammals. Pile driving will only commence once observers have declared the shutdown zone clear of marine mammals.
- If a marine mammal approaches or enters the injury zone (the Corps is proposing a more conservative 20 m shutdown zone) during pile driving, work will be halted and delayed until either the animal has voluntarily left and visually confirmed beyond the disturbance zone, or 15 minutes for pinnipeds or 30 minutes for cetaceans have passed without re-detection of the animal (changed from original based on IHA conditions and/or NMFS' request).
- If a marine mammal is observed in the acoustic disturbance zone, but not approaching or entering the shutdown zone, a "take" will be recorded and the work will be allowed to proceed without cessation. Marine mammal behavior will be monitored and documented.
- If a marine mammal approaches or enters a shutdown zone (the Corps is proposing a more conservative 20 m shutdown zone) during vibratory pile driving, work will be halted and delayed until either the animal has voluntarily left and been visually confirmed beyond the shutdown zone or 15 minutes for pinnipeds or 30 minutes for cetaceans have passed without re-detection of the animal (changed from original based on IHA conditions and/or NMFS' request).
- Marine mammal observer(s) will be on site at all times during pile driving. Each observer must meet a list of qualifications for marine mammal observers (see below) to be considered qualified, or undergo training to meet the qualifications before the start of pile driving.
- Monitor the area of potential sound effects for injury to marine mammals during pile driving. The observer position(s) will either be from the top of jetty or adjacent barge at the location of the pile activities, from Cape Disappointment Visitors Center during work at North and South Jetty, or Clatsop Spit for work at Jetty A, and from one or two vessels during pile actions at North and South Jetty.
- Use a hand-held or boat-mounted GPS device or rangefinder to verify the required monitoring distance from the project site.

- Scan the waters within the area of potential sound effects using binoculars (10x42 or similar) or spotting scopes (20-60 zoom or equivalent), and by making visual observations.
- MMOs will be equipped with camera and video capable of recording any necessary take information, including data required in the event of an unauthorized Level A take.
- If weather or sea conditions restrict the observer's ability to observe, or become unsafe for the monitoring vessel(s) to operate, cease pile installation until conditions allow for monitoring to resume.
- Scan the waters for ~~15~~ 30 minutes before and during all pile driving (changed from original based on IHA conditions and/or NMFS' request). If any species for which take is not authorized are observed within the area of potential sound effects during or ~~15~~ 30 minutes before pile driving, the observer(s) will immediately notify the on-site supervisor or inspector, and require that pile driving either not initiate or temporarily cease until the animals have moved outside of the area of potential sound effects.
- Conduct pile driving only during daylight hours from sunrise to sunset when it is possible to visually monitor marine mammals.
- Use a marine mammal observation sheet to record the species, date, and time of any marine mammal sightings. Record marine mammal behavior and any communication between the observer and the contractor during pile driving.
- If the Corps observes any dead or dying marine mammal species in the action area, regardless of known cause:
  - Record the species type (if known), date, time, and location of the observation
  - Take a photograph of the specimen
  - Immediately notify NOAA Fisheries.

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

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

The Corps will note in behavioral observations, to the extent practicable, if an animal has remained in the area during construction activities. Therefore, it may be possible to identify if the same animal or a different individuals are being taken. Collected data will be compiled following the end of each construction season at all jetties and submitted to NMFS.

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

- Visual acuity in both eyes (correction is permissible) sufficient to discern moving targets at the water's surface with ability to estimate target size and distance. Use of binoculars or spotting scope may be necessary to correctly identify the target.
- Advanced education in biological science, wildlife management, mammalogy or related fields (Bachelor's degree or higher is preferred).
- Experience and ability to conduct field observations and collect data according to assigned protocols (this may include academic experience).
- Experience or training in the field identification of marine mammals (cetaceans and pinnipeds).
- Sufficient training, orientation or experience with vessel operation and pile driving operations to provide for personal safety during observations.
- Writing skills sufficient to prepare a report of observations. Reports should include such information as number, type, and location of marine mammals observed; their behavior in the area of potential sound effects during construction; dates and times when observations and in-water construction activities were conducted; dates and times when in-water construction activities were suspended because of marine mammals, etc.
- Ability to communicate orally, by radio, or in-person with project personnel to provide real time information on marine mammals observed in the area, as needed.

14. Suggested Means of Coordination

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

Besides NMFS, the ODFW and WDFW, who also monitor seal and pinniped use of the South Jetty, will be apprised of the Corps work and results of the monitoring efforts.

15. Literature Cited

Atkinson, S., DeMaster, D.P., and Calkins, D.G. 2008. Anthropogenic causes of the western Steller sea lion population decline and their threat to recovery. *Mammal Review* 38:1-18.

Barlow, J. 1988. Harbor porpoise, Phocoena phocoena, abundance estimation for California, Oregon, and Washington: I. Ship surveys. *Fish. Bull*. 86:417-432.

Barlow, J., C.W. Oliver, T.D. Jackson, and B.L. Taylor. 1988. Harbor porpoise, *Phocoena phocoena*, abundance estimation for California, Oregon, and Washington: II. Aerial surveys. *Fish. Bull*. 86:433-444.

Barlow, J., M.C. Ferguson, E.A. Becker, J.V. Redfern, K.A. Forney, I.L. Vilchis, P.C. Fiedler, T. Gerrodette, L.T. Ballance. 2009. Predictive Modeling of Marine Mammal Density from existing survey data and model validation using upcoming surveys. NOAA Technical Memorandum. NOAA-TMNMFS-SWFSC-XXX. 196pp. Strategic Environmental Research and Development Program (SERDP) Density Model Accessed 3-26-2015 at: http://seamap.env.duke.edu/serdp/serdp_map.php

Barlow, J., J. Calambokidis, E.A. Falcone, C.S. Baker, A.M. Burdin, P.J. Clapham, J.K.B. Ford, C.M. Gabriele, R. LeDuc, D.K. Mattila, T.J. Quinn II, L. Rojas-Bracho, J.M. Straley, B.L. Taylor, J. Urbán, R.P. Wade, D. Weller, B.H. Witteveen, and M. Yamaguchi. 2011. Humpback whale abundance in the North Pacific estimated by photographic capture-recapture with bias correction from simulation studies. *Marine Mammal Science* 27(4):793-818.

Bigg, M.A. 1988. Status of the Steller sea lion, Eumetopias jubatus, in Canada. Can. *Field-Nature*. 102:315-336.

Bigg, M.A., P.F. Olesiuk, G.M. Ellis, J.K.B. Ford, K.C. Balcomb III. 1990. Social organization and genealogy of resident killer whales (Orcinus orca) in the coastal waters of British Columbia and Washington State. Pp. 386-406, In: Hammond, P.S., S.A. Mizroch, and G.P. Donovan (eds.), Individual Recognition of Cetaceans: Use of Photo-identification and Other Techniques to Estimate Population Parameters. *Rep. Int. Whal. Commn*. Special Issue 12.

Blackwell, S.B. and C.R. Greene. 2002. Acoustic measurements in Cook Inlet, Alaska, during August 2001. Greeneridge Report 271-1, Prepared by Greeneridge Sciences, Inc. for National Marine Fisheries Service.

Black, N. A., A. Schulman-Janiger, R. L. Ternullo, and M. Guerrero-Ruiz. 1997. Killer whales of California and western Mexico: a catalog of photo-identified individuals. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-SWFSC-247, 174 pp.

Bluhm, B. and Gradinger, R. 2008. Regional variability in food availability for Arctic marine mammals. Ecol. Appl. 18: S77-96.

Bonnot, P. 1928. Report on the seals and sea lions of California. Fish Bulletin Number 14. California Division of Fish and Game.

Bonnot, P. and W.E. Ripley. 1948. The California sea lion census for 1947. California *Fish and Game* 34:89-92.

Calambokidis, J., G.H. Steiger, J.R. Evenson, K.R. Flynn, K.C. Balcomb, D.E. Claridge, P. Bloedel, J.M. Straley, C.S. Baker, O. von Ziegesar, M.E. Dahlheim, J.M. Waite, J.D. Darling, G. Ellis, and G.A. Green. 1996. Interchange and isolation of humpback whales in California and other North Pacific feeding grounds. *Mar. Mamm. Sci*. 12(2):215-226.

Calambokidis, J. E.A. Falcone, T.J. Quinn, A.M. Burdin, P.J. Clapham, J.K.B. Ford, C.M. Gabriele, R. LeDuc, D. Mattila, L. Rojas-Bracho, J.M. Straley, B.L. Taylor, J. Urbán R., D. Weller, B.H. Witteveen, M. Yamaguchi, A. Bendlin, D. Camacho, K. Flynn, A. Havron, J. Huggins, and N. Maloney. 2008. SPLASH: Structure of Populations, Levels of Abundance and Status of Humpback Whales in the North Pacific. Final report for U.S. Dept of Commerce Western Administrative Center, Seattle, WA.

Calambokidis, J., J.L. Laake and A. Klimek. 2012. Updated analysis of abundance and population structure of seasonal gray whales in the Pacific Northwest, 1998-2010. Paper SC/M12/AWMP2-Rev submitted to the IWC Scientific Committee.

CalTrans. 2012. Compendium of Pile Driving Sound Data. Sacramento, California. Updated October 2012, posted March 20, 2013. Available at http://www.dot.ca.gov/hq/env/bio/fisheries_bioacoustics.htm.

Carretta, J.V., K.A. Forney, E. Oleson, K. Martien, M.M. Muto, M.S. Lowry, J. Barlow, J. Baker, B. Hanson, D. Lynch, L. Carswell, R.L. Brownell Jr., J.Robbins, D.K. Mattila, K. Ralls, and M.C. Hill. 2010. Draft U.S. Pacific Marine Mammal Stock Assessments: 2010. NOAA-TM-NMFS-SWFSC-XXX. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center.

Corps. See U.S. Army Corps of Engineers.

Comiso, J.C., C.L. Parkinson, R. Gersten, and L. Stock. 2008. Accelerated decline in the Arctic sea ice cover. Geophysical Research Letters, Vol. 35, L01703, doi:10.1029/2007GL031972.

Daily Astorian. 2015. Orca pod off Cape Disappointment Monday. Published March 30, 2015.

Darling, J.D. 1984. Gray whales off Vancouver Island, British Columbia. Pp. 267-287 In M.L. Jones, S.L. Swartz, and S. Leatherwood (eds.), The Gray Whale, *Eschrichtius robustus*. Academic Press, Inc., Orlando, FL.

Department of Fisheries and Oceans (DFO) Canada. 2007. Recovery Strategy for the Transient Killer Whale (*Orcinus orca*) in Canada. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada, Vancouver, B.C.

DFO Canada. 2008. Draft management plan for the Steller sea lion (*Eumetopias jubatus*) in Canada. Species at Risk Act Management Plan series. Ottawa, Canada.

DFO Canada. 2009. Recovery Potential Assessment for West Coast Transient Killer Whales. *DFO Can. Sci. Advis. Sec. Sci. Advis. Rep*. 2009/039.

Dohl, T.P., R. C. Guess, M. L. Duman, and R. C. Helm. 1983. Cetaceans of central and northern California, 1980-1983: status, abundance, and distribution. OCS Study MMS 84-0045. Pacific OCS Region Minerals Management Service, Los Angeles, CA.

Fabry, V.J., B.A. Seibel, R.A. Feely, and J.C. Orr. 2008. Impacts of ocean acidification on marine fauna and ecosystem processes. *ICES Journal of Marine Science* 65(3): 414–432.

Forney, K.A., J.V. Carretta, and S.R. Benson. 2013. Preliminary estimates of harbor porpoise abundance in Pacific Coast waters of California, Oregon and Washington, 2007-2012. Draft Document PSRG-2013-10 submitted to the Pacific Scientific Review Group, 2-4 April 2013, San Diego, CA.

Ford, J.K.B., G. M. Ellis, and K. C. Balcomb. 1994. Killer Whales: The Natural History and Genealogy of Orcinus orca in British Columbia and Washington State. University of British Columbia Press, Vancouver, BC, and University of Washington Press, Seattle.

Ford, J.K.B., G.M. Ellis and K.C. Balcomb. 2000. Killer whales: the natural history and genealogy of Orcinus orca in British Columbia and Washington State. 2nd ed. University of British Columbia Press, Vancouver, B.C.

Ford, J.K.B., and G.M. Ellis. 2006. Selective foraging by fish-eating killer whales Orcinus orca in British Columbia. *Marine Ecology Progress Series* 316:185–199.

Ford, J.K.B, E.H. Stredulinsky, J.R. Towers and G.M. Ellis. 2013. Information in support of the identification of critical habitat for transient killer whales (*Orcinus orca*) off the west coast of Canada. *DFO Can. Sci. Advis. Sec. Res. Doc*. 2013/025.

Forney, K.A., J.V. Carretta, and S.R. Benson. 2013. Preliminary estimates of harbor porpoise abundance in Pacific Coast waters of California, Oregon and Washington, 2007-2012. Draft Document PSRG-2013-10 submitted to the Pacific Scientific Review Group, 2-4 April 2013, San Diego, CA.

Fraser, F.C. 1970. An early 17th century record of the California gray whale in Icelandic waters. *Investigations on Cetacea* 2:13-20.

Gosho, M., P. Gearin, R. Jenkinson, J. Laake, L. Mazzuca, D. Kubiak, J. Calambokidis, W. Megill, B. Gisborne, D. Goley, C. Tombach, J. Darling, and V. Deecke. 2011. Movements and diet of gray whales (*Eschrichtius robustus*) off Kodiak Island, Alaska, 2002-2005. Paper SC/M11/AWMP2 presented to the International Whaling Commission AWMP workshop 28 March - 1 April 2011.

Green, G.A., J.J. Brueggeman, R.A. Grotefendt, C.E. Bowlby, M.L. Bonnel, and K.C. Balcomb III. 1992. Cetacean distribution and abundance off Oregon and Washington, 1989-1990. Pp. 1-100 in Oregon and Washington Marine Mammal and Seabird Surveys. Brueggeman, J.J. (ed). Final report prepared by Ebasco Environmental, Bellevue WA; Ecological Consulting, Inc., Portland OR; and Center for Whale Research, Friday Harbor WA for Minerals Management Service, Pacific OCS Region.

Griffith, David. 2015. Fish Biologist, U.S. Army Corps of Engineers, Portland District. Personal Communication. March 24, 2015.

Hall-Spencer, J. M., R. Rodolfo-Metalpa, S. Martin, E. Ransome, M. Fine, S. M. Turner, S. J. Rowley, D. Tedesco, and M. C. Buia. 2008. Volcanic carbon dioxide vents show ecosystem effects of ocean acidification. *Nature* 454: 96-99.

Halpin, P.N., A.J. Read, E. Fujioka, B.D. Best, B. Donnelly, L.J. Hazen, C. Kot, K. Urian, E. LaBrecque, A. Dimatteo, J. Cleary, C. Good, L.B. Crowder, and K.D. Hyrenbach. 2009. OBIS-SEAMAP: The world data center for marine mammal, sea bird, and sea turtle distributions. *Oceanography* 22(2):104-115).

Hanson, M.B., R.W. Baird, and G.S. Schorr. 2005. Focal behavioral observations and fish-eating killer whales: improving our understanding of foraging behavior and prey selection. 16th Biennial Conference on the Biology of Marine Mammals.

Hanson, M.B., D. P. Noren, T.F. Norris, C.A. Emmons, M. M. Holt, T. Guy, and J. Zamon. 2008a. Pacific Ocean killer whale and other cetaceans distribution survey, May 2007 (PODs 2007) conducted aboard the NOAA ship McArthur II. Unpubl. Rept, Northwest Fisheries Science Center, Seattle, WA.

Hanson, M.B., D.P. Noren, T.F. Norris, C.A. Emmons, T. Guy and J. Zamon. 2008b. Pacific Ocean killer whale and other marine mammals distribution survey, March 2006 (PODs 2006) conducted aboard the NOAA ship McArthur II. Unpubl. Rpt, Northwest Fisheries Science Center, Seattle, WA.

Hanson, M.B., D.P. Noren, T.F. Norris, C.A. Emmons, M.M. Holt, E. Phillips, J. Zamon, and J. Menkel. 2010. Pacific Orca Distribution Survey (PODS) conducted aboard the NOAA ship McArthur II in March-April 2009. (STATE DEPT. CRUISE NO: 2009-002). Unpubl. Rept, NWFSC, Seattle, WA.

Hastings, M.C. and A.N. Popper. 2005. Effects of sound on fish. Prepared by Jones & Stokes for the California Department of Transportation.

Holt, M. 2008. Sound exposure and southern resident killer whales (Orcinus orca): A review of current knowledge and data gaps. NOAA Technical Memorandum NMFS-NWFSC-89.

Huggins, J. 2008. Request for event closure: 2006-2007 Northwest harbor porpoise unusual mortality event. Unpublished Report by Cascadia Research Collective to NMFS, Northwest Regional Office. Available at NMFS, Northwest Regional Office, Seattle, WA.

Illingworth and Rodkin, Inc. 2007. Compendium of Pile Driving Data report to the California Department of Transportation. Available at http://www.dot.ca.gov/hq/env/bio/files/pile_driving_snd_comp9_27_07.pdf

Illingworth and Rodkin. 2012. Naval Base Kitsap at Bangor Test Pile Program: Acoustic monitoring report. Prepared by Illingworth and Rodkin, Inc. for Department of the Navy.

Johannessen, O.M., L. Bengtsson, M.W. Miles, S.I. Kuzmina, V.A. Semenov, G.V. Alexseev, A.P. Nagurnyi, V.F. Zakharov, L.P. Bobylev, L.H. Pettersson, K. Hasselmann, and H.P. Cattle. 2004. Arctic climate change: observed and modeled temperature and sea-ice variability. *Tellus* 56A:328-341.

Krahn, M.M., M.J. Ford, W.F. Perrin, P.R. Wade, R.P. Angliss, M.B. Hanson, B.L. Taylor, G.M. Ylitalo, M.E. Dahlheim, J.E. Stein, and R.S. Waples. 2004. 2004 status review of southern resident killer whales (*Orcinus orca*) under the Endangered Species Act. NOAA Technical Memorandum NMFS-NWFSC-62, U.S. Department of Commerce, Seattle, WA.

Krahn,, M.M., M.B. Hanson, R.W. Baird, R.H. Boyer, D.G. Burrows, C.K. Emmons, J.K.B. Ford, L.L. Jones, D.P. Noren, P.S. Ross, G.S. Schorr, and T.K. Collier. 2007. Persistent organic pollutants and stable isotopes in biopsy samples (2004/2006) from Southern Resident killer whales. *Marine Pollution Bulletin* 54:1903-1911.

Krahn, M.M, M.B. Hanson, G.S. Schorr, C.K. Emmons, D.G. Burrows, J.L. Bolton, R.W. Baird, and G.M. Ylitalo. 2009. Effects of age, sex and reproductive status on persistent organic pollutant concentrations in "Southern Resident" killer whales. *Marine Pollution Bulletin* 58:1522-1529.

Lagerquist, B.A. and B.R. Mate. 2002. Humpback whale sightings off the Oregon and northern California coast, during summer 2002. Presented at the U.S. GLOBEC NEP-CCS SI meeting, Corvallis, Oregon, November 19-21. Poster presentation.

Laake, J.L., Punt, A.E., Hobbs, R., Ferguson, M., Rugh, D. and Breiwick, J. 2012. Gray whale southbound migration surveys 1967-2006: An integrated re-analysis. *Journal of Cetacean Research and Management* 12(3):287-306.

Lang, A.R., Weller, D.W., LeDuc, R., Burdin, A.M., Pease, V.L., Litovka, D., Burkanov, V. and Brownell, R.L., Jr. 2011.Genetic analysis of stock structure and movements of gray whales in the eastern and western North Pacific. Paper SC/63/BRG10 presented to the IWC Scientific Committee.

Laughlin, J. 2010a. REVISED Friday Harbor Vibratory Pile Monitoring Technical Memorandum. Washington State Department of Transportation, Seattle, WA.

Laughlin, J. 2010b. Airborne Noise Measurements (A-weighted and un-weighted) during Vibratory Pile Installation - Technical Memorandum. Prepared by the Washington State Department of Transportation.

LeDuc, R.G., Weller, D.W., Hyde, J., Burdin, A.M., Rosel, P.E., Brownell, R.L., Würsig, B. and Dizon, A.E. 2002. Genetic differences between western and eastern gray whales (*Eschrichtius robustus*). *Journal of Cetacean Research and Management* 4:1-5.

Malme, C.I., P.R. Miles, C.W. Clark, P. Tyack, and J.E. Bird 1983. Investigations of the potential effects of underwater noise from petroleum industry activities on migrating gray whale behavior. Report No. 5366 prepared by Bolt Beranek and Newman Inc., Cambridge, MA, for the Minerals Management Service, Anchorage, AK.

Malme, C.I., P.R. Miles, C.W. Clark, P. Tyack, and J.E. Bird 1984. Investigations of the potential effects of underwater noise from petroleum industry activities on migrating gray whale behavior - Phase 2: January 1984 migration. Report No. 5586 prepared by Bolt Beranek and Newman Inc., Cambridge, MA, for the Minerals Management Service, Anchorage, AK.

Malme, C.I., P.W. Smith, Jr., and P.R. Miles 1986. Study of offshore geophysical acoustic survey operations on important commercial fisheries in California. Tech. Report No. 1 prepared by BBN Laboratories Inc., Cambridge, MA, for Battelle, Santa Barbara office.

Mead, J.G., and E.D. Mitchell. 1984. Atlantic gray whales. Pp. 33-53 In M. L. Jones, S. L. Swartz, and S. Leatherwood (eds.), The Gray Whale, Eschrichtius robustus.Academic Press, Inc., Orlando, FL.

Mitson, R.B. (ed.). 1995. Underwater Noise of Research Vessels: Review and Recommendations. *ICES Coop. Res. Rep*. No. 209, 61.

National Marine Fisheries Service (NMFS). 1991. Recovery Plan for the Humpback Whale (*Megaptera novaeangliae*). Prepared by the Humpback Whale Recovery Team for the National Marine Fisheries Service, Silver Spring, MD.

NMFS. 2005a. Department of Commerce, National Oceanic and Atmospheric Administration. Endangered Fish and Wildlife; Notice of Intent to Prepare an Environmental Impact Statement. *Federal Register*, Vol. 70, No. 7, Tuesday, January 11, 2005.

NMFS. 2005b. Reinitiation of Endangered Species Act Section 7 Formal Consultation for the Rehabilitation of the South Jetty at the Mouth of the Columbia River, Clatsop County, Oregon. NMFS Tracking number 2005/06359.

NMFS. 2008a. Recovery Plan for Southern Resident Killer Whales (Orcinus orca). National Marine Fisheries Service Northwest Regional Office. January 17, 2008.

NMFS. 2008b. Recovery Plan for the Steller Sea Lion (*Eumetopias jubatus*). Revision. National Marine Fisheries Service, Silver Spring, MD.

NMFS. 2010. Endangered Species Act Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Conservation Recommendations for the NOAA Marine Operations Center-Pacific, Yaquina Bay (6th field HUC 171002040303), Lincoln County, OR.

NMFS. 2011a. Endangered Species Act Biological Opinion and Conference Report and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Major Rehabilitation of the Jetty System at the Mouth of the Columbia River. NMFS No 2010/06104. Northwest Region, Seattle, WA.

NMFS. 2011b. Department of Commerce, National Oceanic and Atmospheric Administration. Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to a Wharf Construction Project. *Federal Register*, Vol. 76, No. 245, Wednesday, December 21, 2011 (79410).

NMFS. 2012. Guidance Document: Data Collection Methods to Characterize Impact and Vibratory Pile Driving Source Levels Relevant to Marine Mammals. Memorandum from NMFS Northwest Region and Northwest Fisheries Science Center. January 31, 2012. Accessed on 12/23/2014 at http://www.westcoast.fisheries.noaa.gov/publications/protected_species/marine_mammals/killer_whales/esa_status/characterize_pile_driving_source_levels_guidance_memo.pdf.

NMFS. 2015. Jeff Fisher. Branch Chief. personal communication via email and phone. Area Office Division. West Coast Regional Office. U.S. Department of Commerce. May 8, 2015.

NMFS/NOAA. 2015. Mongillo, Teresa, (Protected Resources Division); Laws, Ben (Office of Protected Resources), and Pauline, Robert (NOAA Affiliate). personal communications via conference calls and follow-up emails. Protected Resources Division, Seattle; and Permits and Conservation Division, Office of Protected Resources, Headquarters. U.S. Department of Commerce. 11/5/15, 11/6/2015, and 12/4/2015.

National Oceanic and Atmospheric Administration (NOAA). 2013a. Alaska Marine Mammal Stock Assessments, Steller Sea Lion (*Eumetopias jubatus*): Eastern U. S. Stock. NOAA-TM-AFSC-277. Allen, B.M., and R.P. Angliss. Revised 6/10/2013.

NOAA. 2013b. Alaska Marine Mammal Stock Assessments, Killer Whale (*Orcinus orca*): West Coast Transient Stock Assessment. NOAA-TM-AFSC-277 Allen, B. M., and R. P. Angliss. Revised 6/10/2013.

NOAA. 2014a. NOAA Technical Memorandum NMFS. U.S. Pacific Marine Mammal Stock Assessments, 2013. J.V. Carretta, and others. NOAA-TM-NMFS-SWFSC-532. Southwest Fisheries Science Center.

NOAA. 2014b. NOAA Technical Memorandum NMFS. U.S. Pacific Marine Mammal Stock Assessments, Harbor Porpoise (*Phocoena phocoena*): Northern Oregon/Washington Coast Stock. Revised 6/4/2014.

NOAA. 2014c. NOAA Technical Memorandum NMFS. U.S. Pacific Marine Mammal Stock Assessments, Gray Whale (*Eschrichtius robustus*): Eastern North Pacific Stock. Revised 7/15/2014

NOAA. 2015. Ben Laws, personal communication via email and phone. Office of Protected Resources NOAA Fisheries. U.S. Department of Commerce. March 31, 2015 and April 17, 2015.

Naval Base Kitsap. 2014. Request for an Incidental Harassment Authorization Under The Marine Mammal Protection Act for Pile Removal and Replacement Naval Base Kitsap Bremerton, Construction Year 2, October 1, 2014 through March 1, 2015. Submitted to National Marine Fisheries Service, National Oceanographic and Atmospheric Administration.

Navy (Facilities Engineering Command Northwest). 2014. Proxy Source Sound Levels and Potential Bubble Curtain Attenuation for Acoustic Modeling of Nearshore Marine Pile Driving at Navy Installations in Puget Sound. Silverdale, WA.

Nerini, M. 1984. A review of gray whale feeding ecology. Pp. 423-450 In M.L. Jones, S.L. Swartz, and S.Leatherwood (eds.), The Gray Whale, *Eschrichtius robustus*. Academic Press, Inc., Orlando, FL.

Noad, M.J. and D.H. Cato. 2007. Swimming speeds of singing and non-singing humpback whales during migration. *Marine Mammal Science* 23(3):481–495.

OBIS-SEAMAP (Ocean Biogeographic Information System, Spatial Ecological Analysis of Megavertebrate Populations). 2015. Located at http://seamap.env.duke.edu/species/180473, accessed 4/13/2015.

Oleson, E.M., J. Calambokidis, E. Falcone, G. Schorr, and J. A. Hildebrand. 2009. Acoustic and visual monitoring for cetaceans along the outer Washington coast. Technical Report NPS-OC-09-001. Naval Postgraduate School, Monterey, CA.

Oregon Department of Fish and Wildlife (ODFW). 2007. Information provided for Corps Biological Assessment, specific source not cited.

ODFW. 2014. Bryan Wright, Biometrician. Marine Mammal Research Program. Corvallis, OR. Excel data and narrative via email dated 9/26/2014.

ODFW. 2015. Bryan Wright, Biometrician. Marine Mammal Research Program. Corvallis, OR. Email dated 4/27/2015.

Osborne, R., J. Calambokidis, and E. M. Dorsey. 1988. A Guide to Marine Mammals of Greater Puget Sound. Island Publishers, Anacortes, WA.

Pearson, J.P., and J.P. Verts. 1970. Abundance and distribution of harbor seals and northern sea lions in Oregon. *Murrelet* 51:1-5.

Richardson, W.J., C.R. Greene, C.I. Malme, and D.H. Thomson. 1995. Marine Mammals and Noise. Academic Press, Inc., San Diego, CA.

Rowley, J. 1929. Life history of the sea-lions on the California coast. Journal of *Mammalogy* 10:1-39.

Rugh, D. J., K. E. W. Shelden, and A. Schulman-Janiger. 2001. Timing of the southbound migration of gray whales. J. Cetacean Res. Manage. 3(1):31-39.

Scheffer, V.B. 1946. Growth and behavior of young sea lions. *Journal of Mammalogy* 26:390-392.

Scheffer, V.B. 1950. Mammals of the Olympic National Park and vicinity. *Northwest Fauna* 2:192-225.

Southall, B.L., Bowles, A.E., Ellison, W.T., Finneran, J.J., Gentry, R.L., Greene, C.R. Jr., Kastak, D., Ketten, D.K., Miller, J.H., Nachtigall, P.E., Richardson, W.J., Thomas, J.A. and Tyack, P.L. 2007. Marine mammal noise exposure criteria: initial scientific recommendations. *Special Issue of Aquatic Mammals* 33(4):412-522.

U.S. Army Corps of Engineers. 2007. MCR South Jetty Rehabilitation: Final Report Summary of Monitoring. Provided to NMFS Office of Protected Resources, Washington, D.C. and Oregon State Habitat Office, Portland, OR. Portland District, Portland, OR.

U.S. Army Corps of Engineers. December 2010. Endangered Species Act Biological Assessment For Anadromous Salmonids, Green Sturgeon, Pacific Eulachon, Marine Mammals, & Marine Turtles and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Assessment for the Major Rehabilitation of the Jetty System at the Mouth of the Columbia River in Pacific County, Washington and Clatsop County, Oregon. Portland District, Portland, OR.

U.S. Army Corps of Engineers. June 2012. Revised Final Environmental Assessment, Rehabilitation of the Jetty System at the Mouth of the Columbia River. Portland District, Portland OR.

U.S. Fish and Wildlife Service. February 23, 2011. Letter of Concurrence. Major Rehabilitation of the Jetty System at the Mouth of the Columbia River Navigation Channel, Clatsop County, Oregon and Pacific County, WA. USFWS #13420-2011-I-0082. Portland, OR.

Wartzok, D., A.N. Popper, J. Gordon and J. Merrill. 2003. Factors affecting the responses of marine mammals to acoustic disturbance. *Marine Technology Society Journal* 37(4):6-15.

Washington Department of Fish and Wildlife (WDFW). 2014. Steven Jeffries. Marine Mammal Investigations. Lakewood, WA (Excel data and narrative via email 10/6/2014).

Washington State Department of Transportation (WSDOT). 2007. Underwater sound levels associated with driving steel and concrete piles near Mukilteo Ferry Terminal. Olympia, WA.

WSDOT. 2010. Biological assessment preparation for transportation projects advanced training manual, version 02-2010. Olympia, WA.

WSDOT. 2011a. Application for incidental harassment authorization, Port Townsend Ferry Terminal transfer span replacement. Submitted to NMFS. August 2011. Available at http://www.nmfs.noaa.gov/pr/permits/incidental.htm.

WSDOT. 2011b. Port Townsend Dolphin Timber Pile Removal - Vibratory Pile Monitoring Technical Memorandum. January 3, 2011. Available at http://www.wsdot.wa.gov/Environment/Air/PileDrivingReports.htm.

Washington State Ferries. 2013. Request for an Incidental Harassment Authorization Under the Marine Mammal Protection Act: Bremerton Ferry Terminal Wingwalls Replacement Project. Submitted To: National Marine Fisheries Service, Office of Protected Resources, Silver Spring, MD.

Weller, D.W., S. Bettridge, R.L. Brownell Jr., J.L. Laake, J.E. Moore, P.E. Rosel, B.L. Taylor, and P.R. Wade. 2013. Report of the National Marine Fisheries Service Gray Whale Stock Identification Workshop. U.S. Dep. Commer., NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-507.

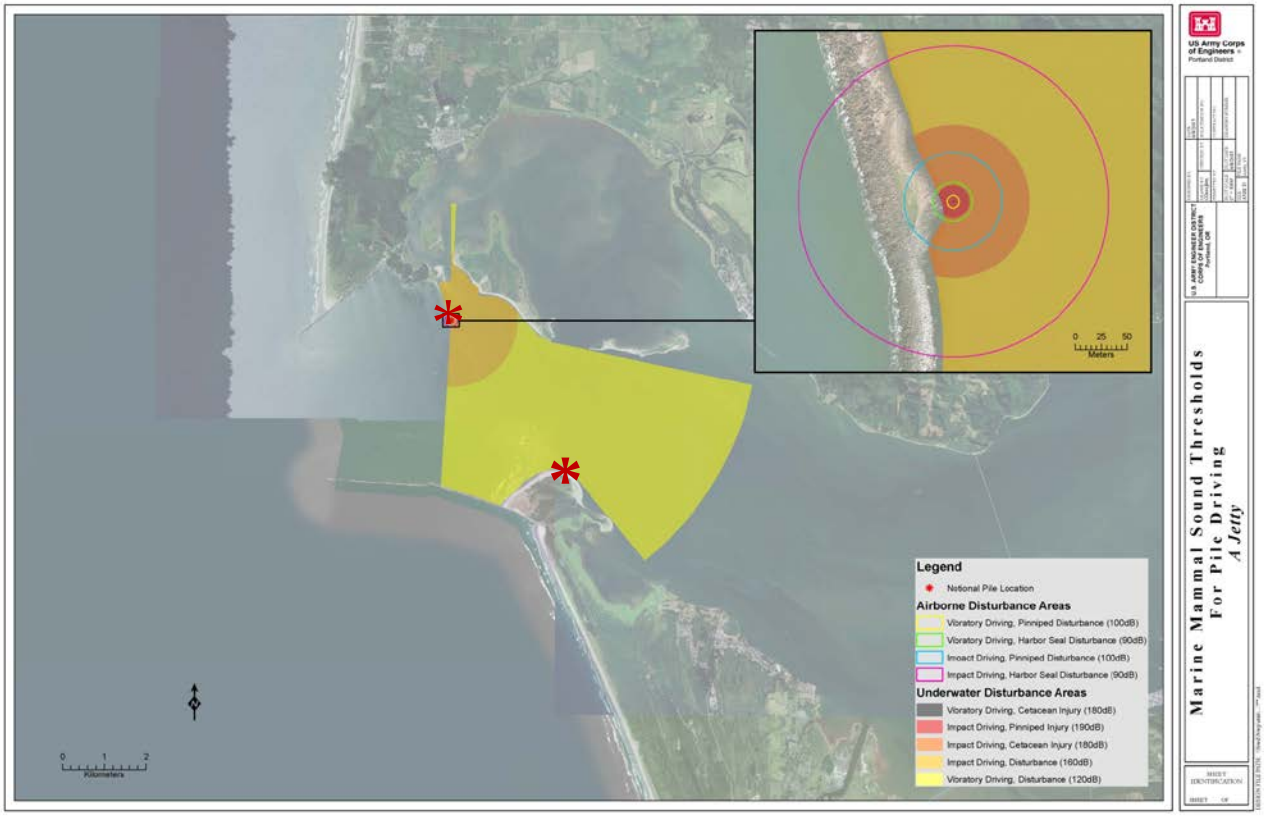
Williams, R. and D.P. Noren. 2009. Swimming speed, respiration rate, and estimated cost of transport in adult killer whales. *Marine Mammal Science* 25(2):327-350.

Wilson, K. 2015. Orca pod struggles to thrive: Whales spend part of the year on outer coast. *The Daily Astorian*. EO Media Group. Published March 23, 2015.

Zamon J.E., Guy T.J., Balcomb K., and Ellifrit D. 2007. Winter observations of southern resident killer whales (*Orcinus orca*) near the Columbia River plume during the 2005 spring Chinook salmon (*Oncorhynchus Tshawytscha*) spawning migration. *Northwestern Naturalist* 88: 193-198.

16. ADDENDUM TO ORIGINALLY PROPOSED MONITORING PLAN

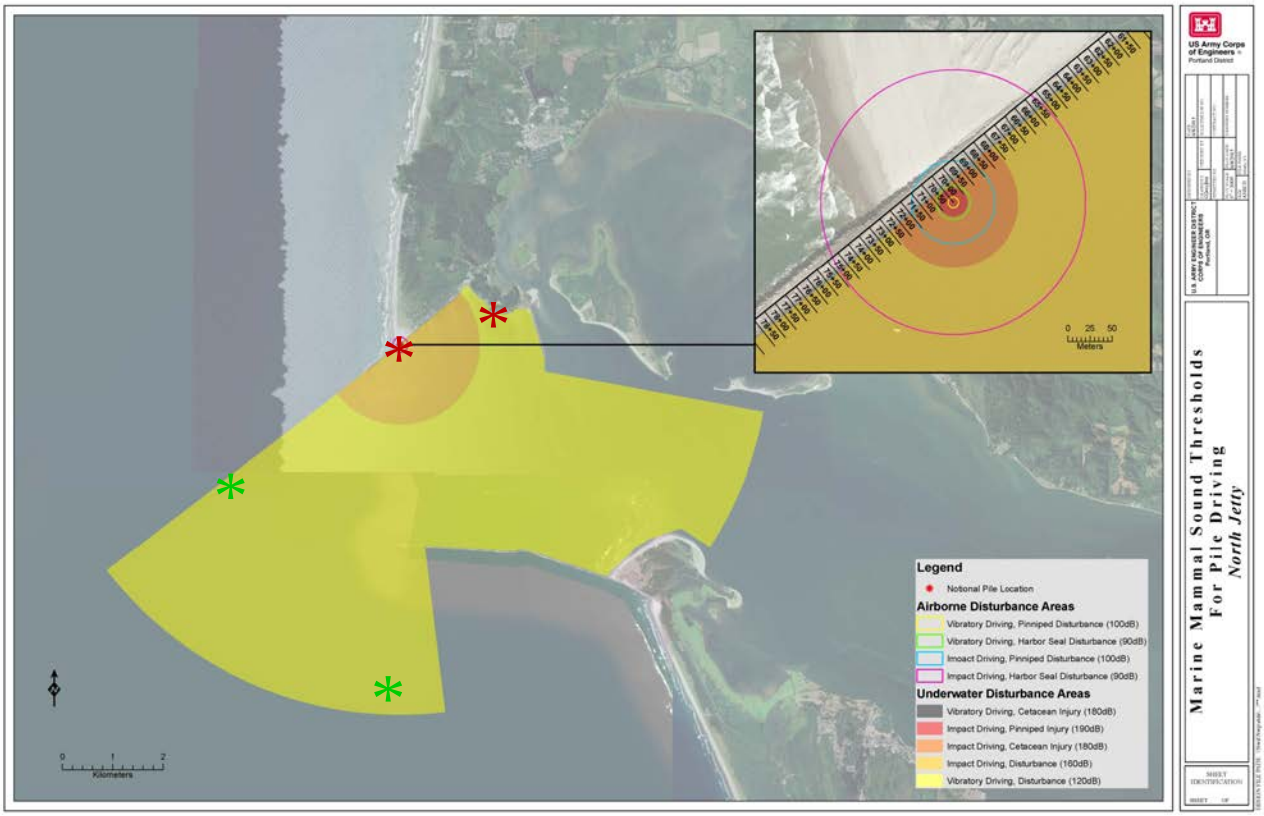
16.1. Jetty A Monitoring Locations



***Indicates Approximate Location of Land-based Marine Mammal Observers Only During <u>ALL Pile Installation/Removal/Maintenance Activities</u> at Jetty A. (Note that there is no proposed vessel monitoring, and Cape Disappointment Visitors Center does not provide an optimal vantage point.)**

Jetty	Underwater Threshold[1]	Distance – m (ft)	Area Excluding Land & Jetty Masses - km^2 (mi^2)
Jetty A: ~ Station 78+50, River Side	Vibratory driving, pinniped injury (190 dB)	0	0
	Vibratory driving, cetacean injury (180 dB)	1 (3.3)	<0.000003 (0.000001)
	Vibratory driving, disturbance (120 dB)	7,356 (4.6 miles)	23.63 (9.12)
Airborne Threshold[1]		**Distance – m (ft)**	**Total Area - km^2 (mi^2)**
Vibratory Driving - Pinniped Disturbance (100 dB)		6 (19.7)	0.0001 (0.00004)
Vibratory Driving - Harbor Seal Disturbance (90 dB)		19 (62.3)	0.001 (0.0004)

16.2. North Jetty Monitoring Locations

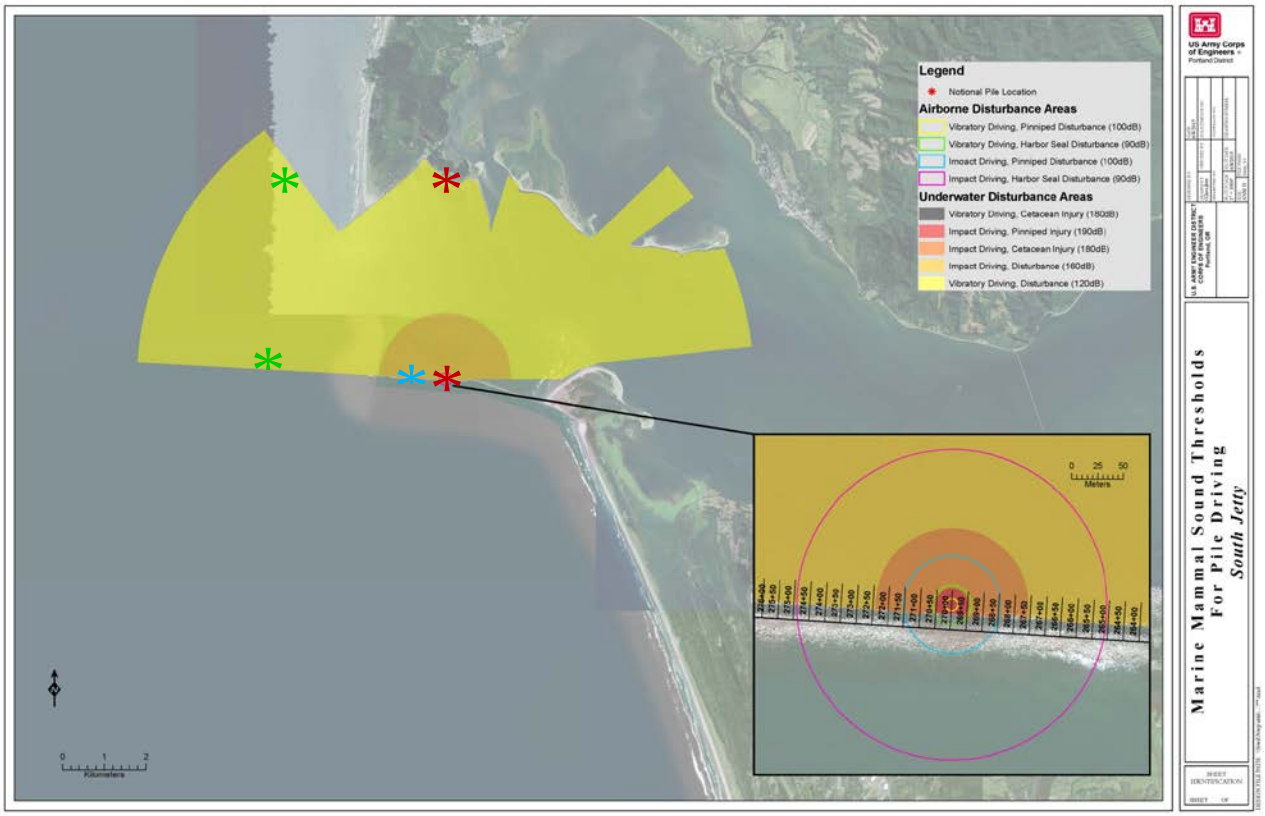


***Red Indicates Approximate LAND-based Location of Marine Mammal Observers Only During ALL Pile Installation/Removal/Maintenance Activities at North Jetty. Note that Cape Disappointment Visitors Center provides a higher, more expansive vantage point than Clatsop Spit on the Oregon shore.**

***Green Is Proposed Vessel Monitoring ONLY During Pile Activities, and Vessel Might Traverse Plume, As Feasible. (Up to two vessels may be deployed, as needed).**

Jetty	Underwater Threshold[1]	Distance – m (ft)	Area Excluding Land & Jetty Masses - km^2 (mi^2)
North Jetty: ~ Station 70+00, Channel Side	Vibratory driving, pinniped injury (190 dB)	0	0
	Vibratory driving, cetacean injury (180 dB)	1 (3.3)	<0.000003 (0.000001)
	Vibratory driving, disturbance (120 dB)	7,356 (4.6 miles)	49.18 (18.99)
Airborne Threshold[1]		**Distance – m (ft)**	**Total Area - km^2 (mi^2)**
Vibratory Driving - Pinniped Disturbance (100 dB)		6 (19.7)	0.0001 (0.00004)
Vibratory Driving - Harbor Seal Disturbance (90 dB)		19 (62.3)	0.001 (0.0004)

16.3. South Jetty Monitoring Locations



***Red Indicates Approximate LAND-based Location of Marine Mammal Observers Only During ALL Pile Driving Activities at South Jetty.**

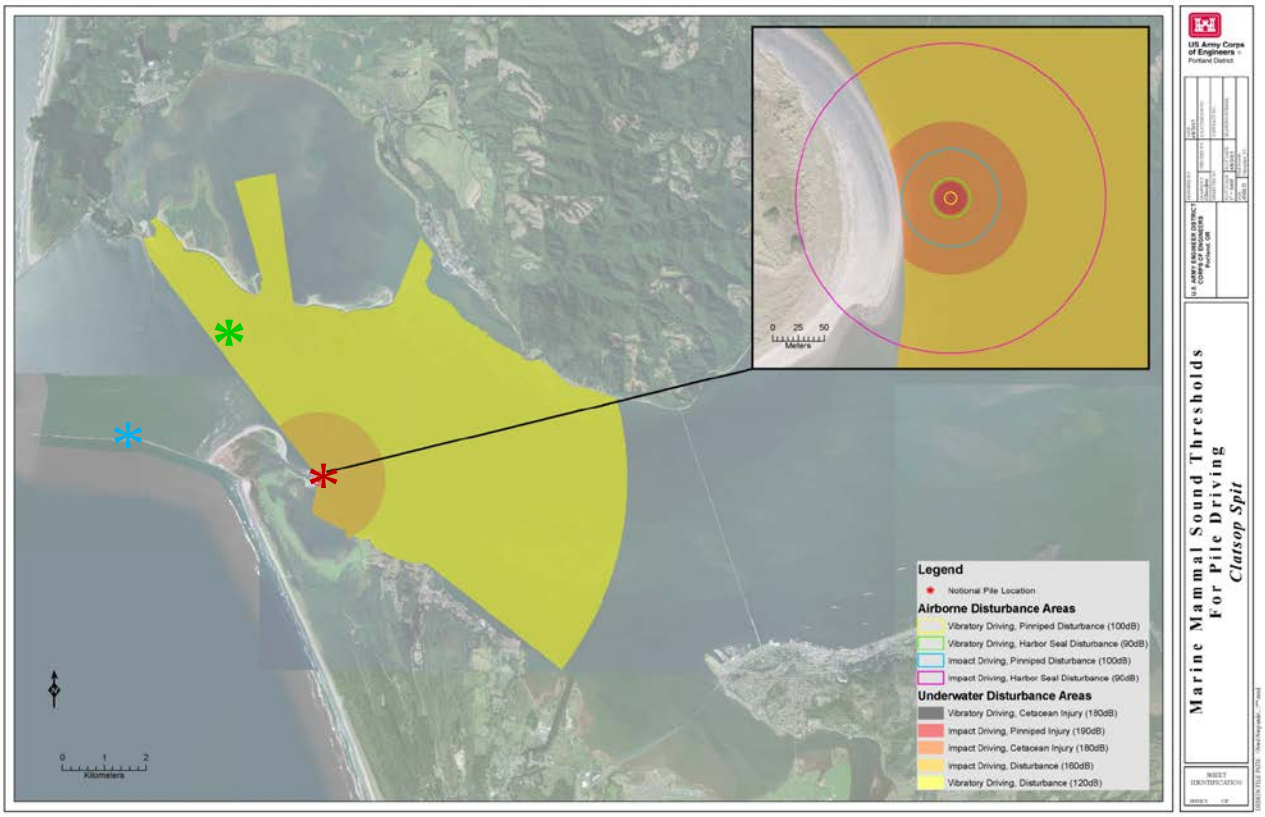
***Green Is Proposed Vessel Monitoring ONLY During Pile Activities, and Vessel Might Traverse Plume, As Feasible. (Up to two vessels may be deployed, as needed.)**

***Blue Indicates Proposed LAND-based Pinniped Monitoring Location for All Construction Activities Other Than Pile Activities. (Construction activities excluding pile driving do not exceed acoustic thresholds, but may cause visual disturbance and flushing. A monitor will be present at local construction site, which will shift as jetty construction progresses).**

Jetty	Underwater Threshold[1]	Distance – m (ft)	Area Excluding Land & Jetty Masses - km^2 (mi^2)
South Jetty: ~ Station 270+00 Channel Side	Vibratory driving, pinniped injury (190 dB)	0	0
	Vibratory driving, cetacean injury (180 dB)	1 (3.3)	<0.000003 (0.000001)
	Vibratory driving, disturbance (120 dB)	7,356 (4.6 miles)	52.89 (20.42)

Airborne Threshold[1]	Distance – m (ft)	Total Area - km^2 (mi^2)
Vibratory Driving - Pinniped Disturbance (100 dB)	6 (19.7)	0.0001 (0.00004)
Vibratory Driving - Harbor Seal Disturbance (90 dB)	19 (62.3)	0.001 (0.0004)

16.4. Clatsop Spit Monitoring Locations



***Red Indicates Approximate LAND-based Location of Marine Mammal Observers Only During ALL Pile Driving Activities at South Jetty.**

***Green Is Proposed Vessel Monitoring ONLY During Pile Activities, and Vessel Might Traverse Plume, As Feasible. (One vessel may be deployed, as needed.)**

***Blue Indicates Proposed LAND-based Pinniped Monitoring Location for All Construction Activities Other Than Pile Activities. (Construction activities excluding pile driving do not exceed acoustic thresholds, but may cause visual disturbance and flushing. A monitor will be present at the local construction site, which will shift as jetty construction progresses).**

Jetty	Underwater Threshold[1]	Distance – m (ft)	Area Excluding Land & Jetty Masses - km^2 (mi^2)
South Jetty: ~ Station 270+00 Channel Side	Vibratory driving, pinniped injury (190 dB)	0	0
	Vibratory driving, cetacean injury (180 dB)	1 (3.3)	<0.000003 (0.000001)
	Vibratory driving, disturbance (120 dB)	7,356 (4.6 miles)	52.89 (20.42)

Airborne Threshold[1]	Distance – m (ft)	Total Area - km^2 (mi^2)
Vibratory Driving - Pinniped Disturbance (100 dB)	6 (19.7)	0.0001 (0.00004)
Vibratory Driving - Harbor Seal Disturbance (90 dB)	19 (62.3)	0.001 (0.0004)

16.5. Monitoring Narrative, Reporting Requirements, and Operations and Shutdown Criteria

16.5.1. Reporting Requirements for All Jetties

All Marine Mammal Observers will complete a daily report recording the information indicated below. This will summarize daily **Level B Take** and will be combined at the end of the day with previous reports to calculate a running total of overall take throughout the project duration.

Date
Event Code/ Activity Type
Time/Duration of Event; (Start/End Time if Continuous)
Construction Type During Sighting
Other Human Activity in Area
Event /Work Activity Location (latitude & longitude)
Species Type
Sighting Number (1 or 1.1.X if Re-sight)
Time/Duration Watching Sighting; (Start/End Time if Continuous)
of Animals/Group Size (min/max/best); # of calves
Gender (If Observable)
Age Class (If Observable)
Sighting Cue/ Behavior Code
Location of Species & Bearing/Direction of Travel Relative to Construction (latitude & longitude):
Location of Observer (latitude & longitude)
Distance/ Direction to Animal (from Observer)
Distance/Direction to Pile (Between Animal and Pile or Equipment)
Mitigation Used During Sighting
Mitigation Type
Visibility
% Glare
Weather Condition
Sea State & Wave Height
Tidal State
Swell Direction
Behavior Change/Response to Activity/Comments

In the event that there is an observed **injury, mortality, or possible Level A Take, *a shutdown will occur immediately***. *In addition to information gathered for the Level B take*, the following additional information will be collected for each animal involved:

Name and Type of Vessel or Equipment Involved
Vessel or Equipment Speed or Activity During and Leading Up to Incident
Description of Incident
Status of All Sound Sources in 24-hrs Preceding Incident
Water Depth
Description of All Marine Mammals Observed in 24-hr Preceding Incident
Fate of Animal(s)
Photo or Video Footage ID

The Corps will implement the following key codes on the monitoring forms:

Sighting Cue & Behavior Codes		
BR	Breaching	Leaps clear of water
CD	Change Direction	Suddenly changes direction of travel
CH	Chuff	Makes loud, forceful exhalation of air at surface
DI	Dive	Forward dives below surface
DE	Dead	Shows decomposition or is confirmed as dead by investigation
DS	Disorientation	An individual displaying multiple behaviors that have no clear direction or purpose
FI	Fight	Antagonistic interactions between two or more individuals
FO	Foraging	Confirmed by food seen in mouth
MI	Milling	Moving slowly at surface, changing direction often, not moving in any particular direction
PL	Play	Behavior that does not seem to be directed towards a particular goal; may involve one, two or more individuals
PO	Porpoising	Moving rapidly with body breaking surface of water
SL	Slap	Vigorously slaps surface of water with body, flippers, tail etc.
SP	Spyhopping	Rises vertically in the water to "look" above the water
SW	Swimming	General progress in a direction. Note general direction of travel when last seen [Example: "SW (N)" for swimming north]
TR	Traveling	Traveling in an obvious direction. Note direction of travel when last seen [Example: "TR (N)" for traveling north]
UN	Unknown	Behavior of animal undetermined, does not fit into another behavior
Pinniped only		
EW	Enter Water (from haul out)	Enters water from a haul-out for no obvious reason
FL	Flush (from haul out)	Enters water in response to disturbance
HO	Haul out (from water)	Hauls out on land
RE	Resting	Resting onshore or on surface of water
LO	Look	Is upright in water "looking" in several directions or at a single focus
SI	Sink	Sinks out of sight below surface without obvious effort (usually from an upright position)
VO	Vocalizing	Animal emits barks, squeals, etc.
Cetacean only		
LG	Logging	Resting on surface of water with no obvious signs of movement

Marine Mammal Species Codes	
CASL	California Sea Lion
HSEA	Harbor Seal
STSL	Steller Sea Lion
HPOR	Harbor Porpoise
DPOR	Dall's Porpoise
ORCA	Killer Whale
HUMP	Humpback Whale
GRAY	Gray Whale
UNLW	Unknown Large Whale
OTHR	Other
UNKW	Unknown

Event Codes	
E ON	Effort On
E OFF	Effort Off
PRE	Pre Watch
POST	Post Watch
SSV	Soft start-vibratory
WC	Weather Condition/Change
S	Sighting
M-DE	Mitigation Delay
M-SD	Mitigation Shutdown

Mitigation Codes	
DE	Delay onset of Pile Driving
SD	Shut down Pile Driving

Construction Type Codes	
SSV	Soft Start (Vibratory)
VI	Vibratory Pile Driving (Installation)
VR	Vibratory Pile Driving (Removal)
NONE	No Pile Driving
PLO	Rock Placement Only
OTH	Other

Visibility Codes	
B	Bad (<0.5km)
P	Poor (0.5 – 1.5km)
M	Moderate (1.5 – 10km)
G	Good (10 - 15km)
E	Excellent (>15km)

Weather Condition Codes	
S	Sunny
PC	Partly Cloudy
L	Light Rain
R	Steady Rain
F	Fog
OC	Overcast

Sea State and Wave Height Codes	
Light	0 – 3 ft
Moderat	4 – 6 ft
Heavy	>6 ft

Glare	Indicate total glare of observers' area of responsibility. Determine if observer coverage is covering 90 degrees or 180 degrees and document daily. Then assess total glare for that area. This will provide needed information on percentage of field of view that was poor due to glare.
Swell	Indicate direction the swell is coming from (S for coming from the south). If possible, record direction relative to fixed location (Jetty A). Choose this location at beginning of monitoring project.
Tide	Indicate Ebb, Flood, Slack/Low/High Tide

16.5.2. Species and Number for Which Level B Take Coverage Has Been Authorized

Species	Take under IHA – Only Valid thru April 30, 2017 at Jetty A	Take under LOA and ITS (*) – Year 2 of Jetty A, North, & South Jetty
Western Transient Killer Whale (*Orcinus orca*) **Only After July 1**	8	TBD
Humpback Whale () *Also listed under ESA; **ITS applies**	**0**	TBD
Gray Whale(*Eschrichtius robustus*)	4	TBD
Harbor Porpoise (*Phocoena phocoena*)	850	TBD
Steller Sea Lion (*Eumatopius jubatus*)	12,750	TBD
California Sea Lion (*Zalophus californianus*)	2,788	TBD
Harbor Seal (*Phoca vitulina richardii*)	493	TBD

16.5.3. Operational Requirements and Mitigation Measures for All Jetties:

- **Notify** NMFS, Monica DeAnglelis of West Coast Regional Office (562-980-3232), at least **24-hours prior to start** of activities impacting marine mammals.
- Pile activities are limited to the use of a **vibratory hammer**. Impact hammers are prohibited.
- Pile installation/maintenance/removal activities are limited to the time frame **starting May 1 and ending September 30** each season.
- Each Marine Mammal Observer (MMO) will maintain a **copy of the IHA/LOA** at their respective monitoring location, as well as a copy in the main construction office.
- Qualified marine mammal observer(s) must **monitor shutdown and disturbance zone** during all pile installation, removal, and maintenance activities. All construction activities will be monitored at South Jetty, including pre- and post-construction counts. Disturbance Zones of Influence (ZOIs) are indicated in previous figures. The radii generally extend the distance indicated in the summary tables above.
- Monitoring will take place from **30 minutes prior** to initiation, **during**, and through **30 minutes post-**completion of pile driving/removal/maintenance activities. Pile driving will only commence once observers have declared the shutdown zone clear of marine mammals. **If any species for which take is not authorized are observed within the area of potential sound effects, or if it appears that an authorized take will be exceeded** during or 30 minutes before pile driving, the observer(s) will immediately notify the on-site supervisor or inspector, and require that **pile driving either not initiate or temporarily cease** until the animals have moved outside of the area of potential sound effects.
- The **shutdown zone** will include all areas encompassed within **20m radius** (the Corps is proposing a more conservative shutdown zone to reduce confusion) from pile installation. The shutdown zone will always be a minimum of 20 meters (66 feet) to prevent injury from physical interaction of marine mammals with construction equipment.

- Visual monitoring will be conducted by **qualified, trained marine mammal observers** (hereafter "observer" or MMO). Visual monitoring will be implemented during all pile installation activities at all jetties. An observer must meet the qualifications stated in the application, have prior training and experience conducting marine mammal monitoring or surveys, and who have the ability to identify marine mammal species and describe relevant behaviors that may occur in proximity to in-water construction activities.
- **MMOs must be approved** in advanced by NMFS.
- Trained MMO will be placed at the **best vantage points** practicable (at the pile location on construction barges, on shore, or jetty-side, in vessels, etc. as noted in the figures) to monitor for marine mammals and implement shutdown/delay procedures when applicable by calling for the shutdown to the hammer operator.
- During land-based rock placement, vehicles and personnel will **avoid** as much as possible **direct approach** towards pinnipeds that are hauled out. If it is absolutely necessary to make movements towards pinnipeds, approach in a slow and steady manner to reduce the behavioral harassment to the animals as much as possible. These actions will be recorded as a take.
- For **inwater heavy machinery work other than pile driving** (e.g. standard barges, tug boats, barge mounted excavators, or clamshell equipment or cranes used to place or move materials), **if a marine mammal comes within 20 meters, operations shall cease and vessel shall reduce speed** to minimum level required to maintain safe steerage and safe work conditions. This type of work could include the following activities: (1) movement of the barge to the pile location; (2) positioning of the pole on the substrate via crane (i.e. stabbing the pile).
- If the 20 m shutdown zone is obscured by fog or poor lighting conditions or sea conditions, pile driving will not be initiated until the **entire shutdown zone is visible**.
- Pile installation will be limited to **daylight hours only** from sunrise to sunset when it is possible to visually monitor marine mammals.
- If **weather or sea conditions** restrict the observer's ability to observe, or become unsafe for the monitoring vessel(s) to operate, cease pile installation until conditions allow for monitoring to resume.
- **If a marine mammal **approaches or enters the shutdown zone** during pile driving, work will be **halted and delayed until either the animal has voluntarily left and visually confirmed beyond the disturbance zone, or 15 minutes for pinnipeds or 30 minutes for cetaceans** have passed without re-detection of the animal.
- If a marine mammal is observed in the acoustic disturbance zone (or Zone of Influence - see figures and radius indicated above), but not approaching or entering the shutdown zone, a **"take" will be recorded on NMFS-approved data forms** and the work will be allowed to proceed without cessation. Marine mammal behavior and information will be monitored and documented with the information indicated above, as applicable and available. Record marine mammal behavior and any communication between the observer and the contractor during pile activities at all jetties, as well as applicable non-pile construction activities at the South Jetty that disturb pinnipeds.
- Use a hand-held or boat-mounted **GPS device *and* rangefinder** to verify the required monitoring distance from the project site. MMOs will use range finders to determine distance to marine mammals, boats, buoys, and construction equipment.

- MMOs will be **equipped with camera and video** capable of recording any necessary take information, including data required in the event of an unauthorized Level A take.
- Scan the waters within the area of potential sound effects using high-quality **binoculars** (e.g Zeiss **10x42**, or similar) or **spotting scopes (20-60 zoom or equivalent)**, and by making visual observations.
- MMOs shall be equipped with **radios or cell phones** for maintaining **immediate contact with other observers, Corps engineers, and personnel operating pile equipment**.
- A **Water Quality Protection and Monitoring Plan** will be implemented at the North Jetty and Jetty A, and turbidity monitoring will be implemented per CWA conditions at all three MCR jetties. No petroleum products, fresh cement, lime, fresh concrete, chemicals, or other toxic or harmful materials will be allowed to enter surface waters. Wash water resulting from wash-down of equipment or work areas will be contained for proper disposal and will not be discharged unless authorized. Equipment that enters surface waters will be maintained to prevent any visible sheen from petroleum products.
- The Corps will use **environmentally acceptable lubricants** for equipment on the jetties, and will employ a **Wiggins Fast Fuel system or equivalent** when it is required to refuel stationary equipment on the jetties.
- A **spill prevention and response plan** will also be developed and kept onsite with appropriate supplies. No oil, fuels, or chemicals will be discharged to surface waters, or onto land where there is a potential for re-entry into surface waters to occur. Fuel hoses, oil drums, oil or fuel transfer valves, fittings, etc. will be checked regularly for leaks and will be maintained and stored properly to prevent spills. No cleaning solvents or chemicals used for tools or equipment cleaning will be discharged to ground or surface waters.
- An **Environmental Protection Plan** will be developed and implemented prior to the commencement of any construction activities. The plan identifies construction elements and recognizes spill sources at the site. The plan outlines BMPs, response actions in the event of a spill or release, and notification and reporting procedures. The plan also outlines contractor management elements such as personnel responsibilities, project site security, site inspections, and training.
- **Construction materials** will not be stored where high tides, wave action, or upland runoff could cause materials to enter surface waters.
- The Corps will **conduct briefings** between construction supervisors and crews, the marine mammal monitoring team, and Corps staff prior to the start of all pile driving activity, and when new personnel join the work, in order to explain responsibilities, communication procedures, marine mammal monitoring protocol, and operational procedures.
- The Corps will **implement a soft-start procedure** for pile installation. The objective of a soft-start is to provide a warning and/or give animals in close proximity to pile driving a chance to leave the area prior to a vibratory driver operating at full capacity thereby, exposing fewer animals to loud underwater and airborne sounds. A soft start procedure will be used at the beginning of each day when in-water pile driving or any time pile driving has ceased for more than 30 minutes. For vibratory pile driving, the contractor will initiate noise from vibratory hammers for 15 seconds at reduced energy followed by a 30-second waiting period. The procedure shall be repeated two additional times.

16.5.4. Shutdown Triggers Applicable At All Jetties

- If a marine mammal **approaches or enters the 20 m shutdown zone** during pile driving, work will be **halted and delayed until either the animal has voluntarily left and visually confirmed beyond the disturbance zone, or 15 minutes for pinnipeds or 30 minutes for cetaceans** have passed without re-detection of the animal.
- If the **Corps or its Contractor observes any injured, dead, or dying marine mammal species in the action area**, regardless of known cause, the Corps and its Contractor **will immediately cease activities and record information** supplementing the Level B form with information from the Level A Take form (see above):
    - Date, time, and location of the observation (latitude and longitude) – Level B Form;
    - Species Identification or Description of Animal Involved– Level B Form;
    - Environmental Conditions (e.g. wind speed and direction, Beaufort sea state, cloud cover, and visibility – Level B Form;
    - Name and Type of Vessel or Equipment Involved
    - Vessel or Equipment Speed or Activity During and Leading Up to Incident
    - Description of Incident
    - Status of All Sound Sources in 24-hrs Preceding Incident
    - Water Depth
    - Description of All Marine Mammals Observed in 24-hr Preceding Incident
    - Fate of Animal(s)
    - Photo or Video Footage ID
- The Corps with its Contractor will **immediately notify NOAA Fisheries** – Jolie Harrison, 301-427-8401; Jolie.Harrison@NOAA.gov; Chief of Permits and Conservation Division, Office of Protected Resources, and Brent Norberg, Brent.Norberg@noaa.gov, the West Coast Regional Stranding Coordinator. Available photographs, videos, and full monitoring reports with information indicated above will be provided.
- In the unanticipated event that the Corps or Contractors' **specified activity clearly causes the take** of a marine mammal in a manner prohibited by the IHA or LOA, such as an injury (Level A harassment), serious injury or mortality (e.g., ship-strike, gear interaction, and/or entanglement), **or in the event the MMO determines the cause of injury or death is unknown and the injury or death is relatively recent (i.e. in less than moderate state of decomposition), immediately cease the specified activities and immediately report** the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, and the West Coast Regional Stranding Coordinators, and the Marine Mammal Stranding Network Hotline 866-767-6114, and Portland State University / Seaside Aquarium (503) 738 - 6211. Include the information indicated. Provide photographs or video footage (if available) or other documentation of the stranded animal sighting to NMFS and the Marine Mammal Stranding Network. **The Corps and its Contractors shall not resume activities until notified by NMFS.**
- In the event that the Corps or its Contractors **discover an injured or dead marine mammal**, **all activities will cease**, and applicable information recording and reporting will occur immediately as indicated. **Immediately report** the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, the West Coast Regional Stranding Coordinators, the Marine Mammal Stranding Network Hotline 866-767-6114, and

Portland State University / Seaside Aquarium (503) 738 - 6211. Include the information indicated. Provide photographs or video footage (if available) or other documentation of the stranded animal sighting to NMFS and the Marine Mammal Stranding Network. **Activities will remain ceased until and unless the lead MMO determines that the injury or death is *NOT* associated with or related to the activities authorized** in the LOA/IHA (e.g., previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage).

- **If the shutdown zone is obscured** by fog, sea conditions, or poor lighting conditions, pile driving will not be initiated until the entire shutdown zone is visible.
- Scan the waters for 30 minutes before and during all pile driving. If at any time any **species for which take is not authorized** are observed within the area of potential sound effects (ZOI), **or if it appears that authorized take will be exceeded** during or 30 minutes before pile driving, the observer(s) will immediately notify the on-site supervisor or inspector, and require that pile driving **either shutdown or not initiate** until the animals have moved outside of the area of potential sound effects.
- **If between May 1 and July 1 any killer whales are observed** within the area of potential sound effects (ZOI), **immediately shut-down** all pile installation, removal, or maintenance activities. **Either remain shutdown or do not initiate** pile activities until all killer whales have moved outside of the area of potential sound effects. **After July 1, no shutdown** is required for Level B killer whale take, but animals must be recorded as Level B take in the monitoring forms described above.