Request for Incidental Harassment Authorization under the Marine Mammal Protection Act

for the Pier 62 Project

(2018–2019 In-Water Work)

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In accordance with the NOAA guidance provided at
http://www.nmfs.noaa.gov/pr/permits/incidental/instructions.htm

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City of Seattle

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS, ABBREVIATIONS AND DEFINITIONS

BMP	best management practice
CA-OR-WA	California/Oregon/Washington
City	City of Seattle
dB	decibels
dB_{peak}	decibels, greatest absolute instantaneous sound pressure during a given time interval
dB_{RMS}	decibels, root mean square pressure level
DPS	Distinct Population Segment
EBSP	Elliott Bay Seawall Project
ESA	Endangered Species Act
FR	Federal Register
HF	high frequency
Hz	hertz
IHA	Incidental Harassment Authorization
kHz	kilohertz
MMPA	Marine Mammal Protection Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
PK	peak sound pressure
PBR	potential biological removal
PTS	permanent threshold shift
RMS	root mean square
SDOT	Seattle Department of Transportation
SEL	sound exposure level over a 24-hour period
SEL_{cum}	cumulative sound exposure level
SPCC	spill prevention, control, and countermeasures
SPL	sound pressure level
SRKW	southern resident killer whale
TTS	temporary threshold shift
WSDOT	Washington State Department of Transportation
WSF	Washington State Ferries
ZOI	Zone of Influence

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SECTION 1. DESCRIPTION OF SPECIFIED ACTIVITY

The City of Seattle (City) is submitting this request to the National Oceanic and Atmospheric Administration (NOAA) for an Incidental Harassment Authorization (IHA) under the Marine Mammal Protection Act (MMPA) for the Pier 62 Project.

1.1 INTRODUCTION

Located along the waterfront in downtown Seattle, Pier 62 is an important community park asset (Figure 1). The structure has become dilapidated; the existing timber piers are failing due to age and need to be replaced. The original pier will be demolished and rebuilt with modern materials and designs, resulting in improved nearshore habitat for out-migrating salmonids. A separate, future project will rebuild Pier 63, which shares a southern border with Pier 62. Pier 62 is adjacent to the northern portion of the City of Seattle's separately authorized Elliott Bay Central Seawall Replacement Project (EBSP) (Figure 2).

The City of Seattle is requesting an IHA to address the potential for incidental take of the following marine mammal species that may occur in the project vicinity of Pier 62: Pacific harbor seal (*Phoca vitulina*), northern elephant seal (*Mirounga angustirostris*), California sea lion (*Zalophus californianus*), Steller sea lion (*Eumetopias jubatus*), harbor porpoise (*Phocoena phocoena*), Dall's porpoise (*Phocoenoides dalli*), long-beaked common dolphin (*Delphinus capensis),* common bottlenose dolphin (*Tursiops truncatus*) both southern resident and transient killer whales (*Orcinus orca*), humpback whale (*Megaptera novaeangliae*), gray whale (*Eschrichtius robustus*), and minke whale (*Balaenoptera acutorostrata*). Of these, the southern resident killer whale (SRKW) and humpback whale are protected under the Endangered Species Act (ESA). Pertinent information for each of these species is presented in this document to provide the necessary background to understand their demographics and distribution in the area.

This IHA application assesses potential and predicted effects on marine mammals from activities associated with the Pier 62 Project, in particular, the proposed pile installation and removal activities. The primary focus on in-water pile installation and removal activities is appropriate because these activities have the potential to produce noise in the aquatic marine environment at amplitude and frequencies that could affect marine mammals. Both vibratory (continuous) and impact (impulsive) pile driving are proposed as part of the Pier 62 Project.

Fundamental to this assessment is documenting compliance with the acoustic technical guidance issued by NOAA/National Marine Fisheries Service (NMFS; NOAA 2016a). The technical guidance provides acoustic thresholds for onset of permanent threshold shift (PTS) and temporary threshold shifts (TTS) in marine mammal hearing for all sound sources (NOAA 2016a). To demonstrate compliance with the NOAA/NMFS MMPA guidelines, this document identifies in-water noise thresholds for each marine mammal species based on the calculated behavioral effects levels and PTS isopleths identified using in-water sound transmission equations and spreadsheets provided by NOAA in the 2016 guidance (NOAA 2016a). The evaluation used in-water noise values from the most current available project data for pile-related activities and acoustic monitoring reports. Comparisons between calculated marine mammal noise thresholds and predicted noise values from pile-related activities are also presented in this

document and allow for projected effects to be assessed at varying distances from a noise source (i.e., the site of pile-related activities). To facilitate the development of take estimates and identify monitoring areas, this document identifies the PTS zone for each hearing group, which is then used as the basis for establishing the proposed Exclusion Zone for monitoring. The noise evaluation identifies Level B (non-injurious) noise thresholds for each hearing group and identifies an associated Zone of Influence (ZOI) for each hearing group based on the PTS zone and Level B threshold. Proposed mitigation and conservation strategies are also presented that would function to substantially reduce potential negative effects on marine mammals.

1.2 PROJECT DESCRIPTION

The Pier 62 Project will replace Pier 62 and make limited modifications to Pier 63 on the Seattle waterfront. The existing piers are constructed of creosote-treated timber piles and treated timber decking, which are failing. The proposed project includes demolishing and removing the existing timber piles and decking of Pier 62, and replacing them with concrete deck planks, concrete pile caps, and steel piling. Replacement of Pier 63, which is also deteriorated, will occur as a separate project in the future.

The footprint of the rebuilt Pier 62 will be largely consistent with the original Pier 62, with a small amount of additional over-water coverage (approximately 3,200 square feet) created by a new float system added to the south side of Pier 62. This float system is intended for moorage of transient, small-boat traffic, and will not be designed to accommodate mooring or berthing for larger vessels. To offset the additional over-water coverage associated with the new float system, approximately 3,700 square feet of Pier 63 was removed during Season 1 (2017–2018). This included removing 65 timber piles, and may require installation of up to nine steel piles to provide structural support for the remaining portion of Pier 63. In addition, approximately 4,760 square feet of grated decking will be installed to replace solid timber decking in the nearshore environment of both piers.

1.3 IN-WATER CONSTRUCTION

Season 1 (2017–2018 in-water work window)

In-water pile removal activity began on December 29, 2017, and was complete on February 21, 2018. During Season 1, Pier 62 was fully removed, including all support piles, structural components, and decking. The 3,700-square-foot portion of Pier 63 was also removed. A total of 831 piles were removed from Pier 62 and Pier 63. Marine mammal monitoring occurred on all days of vibratory pile removal. Hydroacoustic monitoring occurred on two days.

Season 2 (2018–2019 in-water work window)

In-water pile installation is anticipated to start on August 1, 2018, and finish by February 28, 2019. During the second season of in-water work, the contractor will rebuild Pier 62 and make minor modifications to Pier 63. Modifications to Pier 63 include installing grated decking, as described above. Work may also include additional timber pile removal, if the contractor encounters deteriorated piles that pose a safety hazard, or within the area where grated decking or habitat improvements are to be installed.

The new Pier 62 will be supported by 180 structural steel piles. An additional nine structural piles may be required to support portions of Pier 63. To accomplish this work, the contractor will need to first install a template, or guide, to work from.

Installing a temporary pile template to correctly position new structural piles is a standard practice for pier building. The template, which consists of two 24-inch pipe piles connected by a structural steel frame, is both installed and removed with a vibratory hammer; the contractor positions the template, installs a set of piles, then moves the template to a new area. Template piles typically do not need to be installed as deep as the structural piles; the necessary embedment will vary depending on the substrate conditions. The contractor anticipates moving the template daily, but this will not increase the total number of pile driving days. Table 1 lists the pile removal and installation totals for the project.

TABLE 1. IN-WATER PILE REMOVAL AND INSTALLATION PROJECT TOTALS

(SEASON 1 AND SEASON 2)

Structure	Pile Type and Number
Pier 62	815 Timber Piles (14-inch) Removed
	Up to 180 Steel Piles (30-inch) Installed
Pier 63	65 Timber Piles (14-inch) Removed
	Up to 9 Steel Piles (30-inch) Installed

Equipment

During Season 1, pile removal was started with a vibratory hammer. A total of 756 piles were removed entirely via vibratory hammer; 75 were broken and were removed via a clamshell bucket. The same equipment would be used for any pile removal that occurs during Season 2. The 30-inch steel piles will be installed with a vibratory hammer to the extent possible. An impact hammer will be used for proofing steel piles or when encountering obstructions or difficult ground conditions. A vibratory hammer would also be used to install, remove, and adjust the template piles.

Vibratory hammers are commonly used for pile removal and installation where sediments allow. The pile is placed into position using a choker and crane, and then vibrated between 1,200 and 2,400 vibrations per minute (WSDOT 2016). The vibrations liquefy the sediment surrounding the pile, allowing it to penetrate to the required seating depth, or to be removed (WSDOT 2016).

Impact hammers are typically used to install plastic/steel core, wood, concrete, or steel piles. An impact hammer is a steel device that works like a piston (WSDOT 2016). To drive the pile, the pile is first moved into position and set in the proper location using a choker cable or vibratory hammer. Once the pile is set in place, installation can take less than 15 minutes under good conditions, to over an hour under poor conditions, such as glacial till and bedrock, or exceptionally loose material in which the pile repeatedly moves out of position (WSDOT 2016).

Table 2 summarizes the proposed in-water pile installation and removal plan, and identifies the work accomplished during Season 1 and remaining work for Season 2.

TABLE 2. PILE INSTALLATION AND REMOVAL PLAN

Activity	Pile Type	Number of Piles	Completed During Season 1	Actual Duration Season 1	Remaining Work Season 2	Anticipated Duration Season 2	Hours per Day	Hammer Type	Single Source Sound Levels	Additive Source Sound Levels
Remove	Creosote-treated timber, 14-inch[1]	880	831 piles removed	19 days	49 timber piles	10 days	8	Vibratory	161 dB_{RMS}[2]	–
	Steel template pile, 24-inch	2	–	–	2	Daily[3]	–	Vibratory	177 dB_{RMS}[4]	–
Install	Steel pile, 30-inch	189	2 steel sheet piles[5] installed	1 day	189 steel piles	53 days	8	Vibratory	177 dB_{RMS}[6]	180 dB_{RMS}[7]
			–	–		64 days[8]	8	Impact	189 dB_{RMS}[9]	189 dB_{RMS}[10]
	Steel template pile, 24-inch	2	–	–	2	Daily[3]	–	Vibratory	177 dB_{RMS}[4]	–

Notes:

1. Assumed to be 14-inch diameter.
2. Hydroacoustic monitoring during Pier 62 Season 1 showed unweighted RMS ranging from 140 dB to 169 dB, the 75th percentile of these values is 161 dB_{RMS}. 161 dB_{RMS} was chosen to conservatively calculate thresholds.
3. The two template piles will be installed and removed daily. The time associated with this activity is included in the overall 8-hour pile driving day associated with installation of the 30-inch steel piles.
4. Assumed to be no greater than vibratory installation of the 30-inch steel pile.
5. Installation of two sheet piles was approved by Stephanie Egger (NOAA) in an email to Mark Mazzola dated December 21, 2017.
6. Source sound from Port Townsend Test Pile Project (WSDOT 2010).
7. For simultaneous operation of two vibratory hammers installing steel pipe piles, the 180 dB_{RMS} value is based on identical single-source levels, adding three dB based on WSDOT rules for decibel addition (2018).
8. Approximately 20 percent of the pile driving effort is anticipated to require an impact hammer, which results in approximately 11 cumulative days of impact hammer activity. However, the impact hammer activity is sporadic, often occurring for short periods each day. A total of 64 days represents the number of days in which pile installation with an impact hammer could occur, with the anticipation that each day's impact hammer activity would be short.
9. Source sound from Colman Dock Test Pile Project (WSDOT 2016).
10. For simultaneous operation of one impact hammer and one vibratory hammer installing 30-inch piles, the original dB_{RMS} estimates differ by more than 10 dB, so the higher value, 189 dB_{RMS}, is used based on WSDOT rules for decibel addition (2018).

RMS – root mean square: the square root of the energy divided by the impulse duration. This level is the mean square pressure level of the pulse. It has been used by NMFS to describe disturbance-related effects (i.e., harassment) to marine mammals from underwater impulse-type noises.

WSDOT – Washington State Department of Transportation

1.4 CONSTRUCTION SOUND LEVEL SOURCES

Hydroacoustic monitoring was conducted during the Season 1 removal of 63 timber piles (Greenbusch Group 2018). The results showed unweighted root mean square (RMS) ranging from 140 dB to 169 dB, with 161 dB at the 75th percentile, which is the sound level used for this analysis. This analysis assumes that the sound source levels associated with installation and removal of 24-inch steel template piles will be no greater than installation of 30-inch steel piles (177 dB_{RMS}). The sound source levels for installation of the 30-inch steel piles are based on surrogate data compiled by the Washington State Department of Transportation (WSDOT 2016).

1.4.1 Additive Noise

The contractor may elect to operate multiple pile crews for the Pier 62 Project. As a result, more than one vibratory or impact hammer may be active at the same time. Operating multiple noise sources at the same time results in a louder noise than one source alone, so the noises are added together to provide a more realistic source level of the sound for calculating the potential effects on marine mammals. Decibels cannot be added by standard addition because they are measured on a logarithmic scale. WSDOT provides guidance for adding decibel values from multiple noise sources (WSDOT 2018, Table 3). For example, when more than one impact or vibratory hammer is being used close enough to another hammer to create overlapping noise fields, the physical area of potential effects on marine mammals is larger, and must be accounted for through a multiple-source decibel addition rule (Table 3). The increased noise generated by multiple impact hammers would potentially create a larger ZOI. However, for the Pier 62 Project, there is a low likelihood that multiple impact hammers would operate in a manner that piles would be struck simultaneously.

Table 3 provides guidance on adding decibels to account for multiple sources (WSDOT 2018):

TABLE 3. MULTIPLE SOURCE DECIBEL ADDITION

When two decibel values differ by:	Add the following to the higher decibel value:
0 or 1 dBA	3 dBA
2 or 3 dBA	2 dBA
4 to 9 dBA	1 dBA
10 dBA or more	0 dBA

It is not possible to know in advance the location of the crews and hammers on a given day, or how many crews will be working each day. The multiple-source decibel addition method does not result in significant increases in the noise source when an impact hammer and vibratory hammer are working at the same time, because the difference in noise sources is greater than 10 dBA. For periods when two vibratory hammers are operating simultaneously, an increase in noise level could be generated, and this was accounted for when determining PTS and disturbance areas for all hearing groups, as noted in Table 2.

1.5 BACKGROUND NOISE

Background noise is the sound level that would exist without the proposed activity (pile driving, in this case), while ambient sound levels are those without human activity (NOAA 2009). The marine waterway of Elliott Bay is very active, and human factors that may contribute to background noise levels include ship traffic and fishing-boat depth sounders. Natural actions that contribute to ambient noise include waves, wind, rainfall, current fluctuations, chemical composition, and biological sound sources (e.g., marine mammals, fish, and shrimp; Carr et al. 2006). Background noise levels are compared to the NOAA/NMFS threshold levels designed to protect marine mammals to determine the ZOI for noise sources.

Based on hydroacoustic measurements conducted as part of Season 1 work for the Pier 62 project, the daytime background level of 127 dB_{RMS} will be used to calculate the attenuation for vibratory pile driving and removal (Greenbusch Group 2018).

1.6 UNDERWATER NOISE EVALUATIONS

The Pier 62 Project will generate underwater noise at levels described in the previous sections. To evaluate the potential impacts of these noise levels on marine mammals, NOAA requires an evaluation of separate thresholds for behavioral disturbance levels of sound (resulting in Level B take) as well as the potential for exposure to injurious levels of sound (PTS levels, or Level A take).

To evaluate potential for behavioral disturbances for marine mammals, NOAA requires that the 15 Log R practical (or semi-cylindrical) spreading loss model be used to estimate distances to marine mammal noise thresholds (NOAA 2016a), which are distinguished between cetaceans and pinnipeds by noise type. The current NOAA-directed disturbance thresholds are provided in Table 4, but it should be noted that for the Pier 62 Project, vibratory disturbance will be evaluated to background levels (127 dB_{RMS}).

TABLE 4. NOAA DISTURBANCE THRESHOLDS FOR MARINE MAMMALS

Marine Mammals	Vibratory Pile Driving Disturbance Threshold	Impact Pile Driving Disturbance Threshold
Cetaceans	120 dB_{RMS}	160 dB_{RMS}
Pinnipeds		

Note:
dB_{RMS} – decibels, root mean square pressure level

In August 2016, NMFS produced advanced acoustic threshold determination guidance for marine mammals to evaluate potential exposure to injurious levels of sound (NOAA 2016a). This guidance provides new methods to identify the received levels, or acoustic thresholds, at which individual marine mammals are predicted to experience changes in their hearing sensitivity (either temporary or permanent) for acute, incidental exposure to underwater anthropogenic sound sources.

The 2016 threshold determinations along with source sound characteristics, environmental factors influencing sound propagation, anticipated marine mammal occurrence and behavior near the activity, as well as other available activity-specific factors, inform the estimated number and types of takes of marine mammals. The threshold determinations rely upon weighting factors to evaluate the likelihood of an

underwater sound source being detectable within the hearing frequencies of certain families of marine mammals. NMFS indicates two options for determining PTS isopleths: 1) marine mammal auditory weighting functions can be used in conjunction with corresponding cumulative sound exposure level (SEL) over a 24-hour period for PTS onset acoustic thresholds to determine the PTS isopleth, or 2) project proponents may use an alternative tool to determine potential PTS isopleths, which was developed and provided by NMFS as part of the 2016 Technical Guidance update. The determination of the PTS onset isopleths in this document are based on the output of the alternative tool developed by NMFS, looking at noise levels generated by impact and vibratory noise sources. The PTS isopleths (or threshold areas) identified for each noise source and marine mammal hearing group are described in the next section. Tables 5 and 6 identify the new acoustic thresholds established in the 2016 guidance for each hearing group for onset of PTS.

TABLE 5. ACOUSTIC THRESHOLDS FOR NON-IMPULSIVE SOUNDS

Hearing Group	Permanent Threshold Shift Onset
Low-frequency Cetaceans	199 dB SEL_{cum}
Mid-frequency Cetaceans	198 dB SEL_{cum}
High-frequency Cetaceans	173 dB SEL_{cum}
Phocid Pinnipeds (Underwater)	201 dB SEL_{cum}
Otariid Pinnipeds (Underwater)	219 dB SEL_{cum}

Notes:
dB – decibel
SEL_{cum} – cumulative sound exposure level over a 24-hour period

TABLE 6. ACOUSTIC THRESHOLDS FOR IMPULSIVE SOUNDS

Hearing Group	Permanent Threshold Shift Onset
Low-frequency Cetaceans	183 dB SEL_{cum}
Mid-frequency Cetaceans	185 dB SEL_{cum}
High-frequency Cetaceans	155 dB SEL_{cum}
Phocid Pinnipeds (Underwater)	185 dB SEL_{cum}
Otariid Pinnipeds (Underwater)	203 dB SEL_{cum}

Notes:
dB – decibel
SEL_{cum} – cumulative sound exposure level over a 24-hour period

1.6.1 PTS Isopleths

The distances from the pile removal or installation activity containing sound levels at or above the PTS levels (PTS isopleths) were identified for underwater noise generated by impact and vibratory pile installation and removal activities using the NMFS spreadsheet (Appendix B). The PTS isopleth defines the area within which auditory damage to marine mammal hearing groups could possibly occur. Under most situations, PTS isopleths would be confined within a relatively small area near the actual work activities.

For pile installation and removal activities, PTS isopleths are expected to begin immediately adjacent to the pile installation activity, and expand outward into the waters of Elliott Bay. The PTS isopleths are identified in Tables 7, 8, and 9 for each pile type, hammer type, and hearing group.

TABLE 7. 14-INCH TIMBER REMOVAL – VIBRATORY; 161 dB, 8 HOURS/DAY

Hearing Group	SEL_{cum} Threshold (dB)	PTS Isopleth to Threshold (meters)[1]
Low-frequency Cetaceans	199	27.3
Mid-frequency Cetaceans	198	2.4
High-frequency Cetaceans	173	40.4
Phocid Pinnipeds	201	16.6
Otariid Pinnipeds	219	1.2

Notes:
1. PTS isopleths for mid-frequency cetaceans and otariid pinnipeds are conservatively rounded to 10 meters for implementing project exclusion zones (see Marine Mammal Monitoring Plan, Appendix A).

PTS – permanent threshold shift
SEL_{cum} – cumulative sound exposure level

TABLE 8. 30-INCH PIPE PILE – VIBRATORY (UP TO TWO SIMULTANEOUS); 180 dB; 8 HOURS/DAY

Hearing Group	SEL_{cum} Threshold (dB)	PTS Isopleth to Threshold (meters)
Low-frequency Cetaceans	199	504.8
Mid-frequency Cetaceans	198	44.7
High-frequency Cetaceans	173	746.4
Phocid Pinnipeds	201	306.8
Otariid Pinnipeds	219	21.5

Notes:
PTS – permanent threshold shift
SEL_{cum} – cumulative sound exposure level

TABLE 9. 30-INCH PIPE PILE – IMPACT; 189 dB, 8 HOURS/DAY[1]

Hearing Group	SEL_{cum} Threshold (dB)	PTS Isopleth to Threshold (meters)[2]
Low-frequency Cetaceans	183	88.6
Mid-frequency Cetaceans	185	3.2
High-frequency Cetaceans	155	105.6
Phocid Pinnipeds	185	47.4
Otariid Pinnipeds	203	3.5

Notes:
1. PTS isopleths calculated based on four piles per day with activities occurring over an 8-hour work day
2. PTS isopleths for mid-frequency cetaceans and otariid pinnipeds are rounded to the minimum practical monitoring zone of 10 meters for implementing project exclusion zones (see Marine Mammal Monitoring Plan, Appendix A).

PTS – permanent threshold shift
SEL_{cum} – cumulative sound exposure level

Marine mammals may occur in the vicinity of the work area, but occurrence of larger marine mammal species is infrequent due to habitat conditions (e.g., piers and large boat traffic). Smaller pinnipeds, especially harbor seals and California sea lions, are most commonly seen in the vicinity of the work area. Because the PTS isopleths are bounded closely to the work area, it is proposed that work will halt if any individuals are within the boundaries of the PTS isopleths such that Level A take is avoided for all marine mammal species to the extent observable, and as such, the PTS isopleths become proposed Exclusion Zones.

1.6.2 Attenuation from PTS to Disturbance Thresholds

Disturbance levels were evaluated for each hearing group using the information on noise generated from installation of piling using vibratory and impact hammers described previously in this document. For the purposes of this evaluation, noise attenuation was calculated to the disturbance threshold of 160 dB_{RMS} for impact pile driving and calculated to the level of background noise at 127 dB_{RMS} for vibratory pile driving, as identified in Section 1.5.

For pile installation and removal activities, elevated noise levels beyond the PTS isopleth (Exclusion Zones) are expected to extend from the outer edge of the established PTS isopleth and expand outward into the waters of Elliott Bay. The disturbance threshold distances for vibratory and impact noise sources are identified in Table 10. The area of Level B disturbance will vary for each hearing group because the commencement of the Level B disturbance zone is at the outer boundary of the PTS isopleth. The areas between the edge of the Exclusion Zones and the outer boundary of the Level B Harassment Zone will form the ZOI for each type of noise source.

TABLE 10. LEVEL B DISTURBANCE THRESHOLDS

Action Type	Distance to 160 dB_{RMS} Impact Disturbance Threshold from Measured Sound (meters)	Distance to 127 dB_{RMS} Vibratory Disturbance Threshold (Background) from Measured Sound (meters)	Source Sound
Impact Driving – 30-inch Steel Pipe Piles	1,201	N/A	189 dB_{RMS}
Vibratory Driving – 30-inch Steel Pipe Piles	N/A	34,146	180 dB_{RMS}
Vibratory Removal – 14-inch Timber Piles	N/A	1,848	161 dB_{RMS}

Note:
dB_{RMS} – decibels, root mean square pressure level

Average peak noise levels (dB_{peak}, the greatest absolute instantaneous sound pressure during a given time interval) for impact driving of 30-inch steel pipe piles are reported to be 210 dB_{peak} (CalTrans 2014). This will not exceed PTS levels for any of the hearing groups, except for high-frequency (HF) cetaceans (porpoises), identified in the 2016 guidance (Table 11).

Potential peak sound levels from the Pier 62 project could affect High-Frequency cetaceans. Based on cumulative sound thresholds for impact pile driving (Table 11), an exclusion zone for these species has been established.

TABLE 11. ACOUSTIC THRESHOLDS FOR PEAK IMPULSIVE NOISE

Hearing Group	PTS Onset (Level A Take)	Threshold Distance
Low-frequency Cetaceans	219 dB_{peak}	No exceedance
Mid-frequency Cetaceans	230 dB_{peak}	No exceedance
High-frequency Cetaceans	202 dB_{peak}	34 meters to PTS
Phocid Pinnipeds (Underwater)	218 dB_{peak}	No exceedance
Otariid Pinnipeds (Underwater)	232 dB_{peak}	No exceedance

Notes:
dB_{peak} – greatest absolute instantaneous sound pressure during a given time interval
PTS – permanent threshold shift

1.7 AIRBORNE NOISE EVALUATION

Pile installation and removal activities are not anticipated to generate in-air noise at levels that would injure pinnipeds that spend time on land or make use of haul-outs within the vicinity of Pier 62. The in-air noise disturbance threshold is 90 dB_{RMS} (unweighted) for harbor seals and 100 dB_{RMS} (unweighted) for all other pinnipeds (e.g., sea lions; WSDOT 2018). Vibratory installation and/or removal of steel piles is expected to generate in-air noise of 97 dB_{RMS} at 15 meters (50 feet); impact installation of steel piles is expected to generate 111 dB_{RMS} at 15 meters (50 feet). For vibratory installation and/or removal of steel piles, the sound levels are expected to be at or above the threshold for harbor seals within approximately 62 meters (200 feet) of the construction activity. For other pinnipeds, the sound levels are expected to be at or above the threshold within approximately 20 meters (65 feet) of the construction activity. With impact installation of steel piles, the sound levels are expected to be at or above the threshold for harbor seals within approximately 305 meters (1,000 feet) from the construction activity. For other pinnipeds, the sound levels are expected to be at or above the threshold within approximately 98 meters (320 feet) from the construction activity.

The nearest documented harbor seal haul-out site to the Pier 62 Project is 10.3 km (6.4 miles) west on Blakely Rocks, though harbor seals also make use of docks, buoys, and beaches in the area. The nearest documented California sea lion haul-out sites are 3 km (2 miles) southwest of Pier 62, although sea lions also make use of docks and buoys in the area.

SECTION 2. DATES, DURATION, AND SPECIFIED GEOGRAPHIC REGION

All in-water work will occur during the in-water work window allowed by NMFS, U.S. Fish and Wildlife Service, and the Washington State Department of Fish and Wildlife. For the Pier 62 Project, this window is anticipated to be August 1 through February 28 of any year in which work is authorized for the project. Pile removal and installation will occur during daylight hours, typically during a work shift of eight hours or less.

Timber pile removal for the Pier 62 Project is anticipated to occur on 10 days during the 2018–2019 in-water work window. Pile installation will occur via vibratory and impact hammers. Vibratory hammer use is anticipated to occur on up to 53 days, and impact hammer use may occur on up to 64 days, for a total of up to 127 days of work. It is expected that many of the pile installation days will involve both a vibratory and an impact hammer, resulting in fewer cumulative days of pile installation. It is anticipated that the contractor will complete the pile installation during the 2018–2019 in-water work window.

The area of potential effects represents the maximum area of Puget Sound where marine mammals could be directly or indirectly affected by the proposed action and includes the construction zone, Elliott Bay, and portions of Puget Sound. For reasons described below, this area is defined by the distance to which noise from vibratory pile-related activities maintains high enough levels to disturb marine mammals. Of the two pile installation methods, vibratory installation has been shown to propagate over a larger area of potential effects on marine mammals than impact pile installation. Noise from vibratory pile installation and removal creates a continuous source of relatively low-frequency sound that perpetuates through water across long distances while maintaining intensities that could potentially cause behavioral effects in marine mammals. In contrast, impact pile installation creates pulses of noise of greater intensity but of higher frequency and shorter duration that more readily attenuates as it moves through water. Therefore, the outer limits of the area of potential effects has been defined by the calculated distance that noise from vibratory pile installation maintains an intensity that could affect marine mammals.

Sound waves propagate in all directions when they travel through water until they dissipate to background levels or encounter barriers that absorb or reflect their energy, such as a landmass. In the case of the proposed action, unobstructed impact pile installation of 30-inch steel pipe piles using a bubble curtain was calculated to propagate up to 1,201 meters to Level B disturbance threshold levels for impact pile driving (160 dB_{RMS}). In comparison, unattenuated and unobstructed vibratory pile installation of 30-inch steel pipe piles was calculated to propagate up to 34,146 meters to background of 127 dB_{RMS} (which is the de facto Level B disturbance threshold because background noise is higher than the NMFS guidance of 120 dB_{RMS}). Therefore, it is expected that pile-related construction noise would extend throughout the nearshore and open water environments to just west of Alki Point and a limited distance into the East Waterway of the Lower Duwamish River, a highly industrialized waterway. Because landmasses block in-water construction noise, a “noise shadow” created by Alki Point is expected to be present immediately west of this feature. The calculated range of the Level B disturbance threshold for unattenuated and unobstructed pile removal using a vibratory hammer is 1,848 meters.

SECTION 3. SPECIES AND NUMBERS OF MARINE MAMMALS

Twelve marine mammal species, including two stocks of killer whales, may have the potential to occur in the area of potential effects considered in this application (Table 12). For the purpose of this application, the relative frequency of occurrence is either common, occasional, or rare. All species have been observed in Puget Sound at certain periods of the year. Marine mammals are managed as stocks, and individuals from those stocks may occur over a broader geographic area than just the area of potential effects; therefore, they may be encountered throughout the Puget Sound, Strait of Juan de Fuca, Strait of Georgia, and the outer coast. Estimated population numbers or expected sightings are included in Section 4.

TABLE 12. MARINE MAMMAL SPECIES WITH LIKELIHOOD OF OCCURRENCE IN THE AREA OF POTENTIAL EFFECTS

Marine Mammal Species	Functional Hearing Group	ESA Listing Status	MMPA Status	Likelihood of Occurrence	Timing in Area
Pinnipeds					
Pacific harbor seal (*Phoca vitulina*)	Phocid	Not Listed	Non-depleted	Common	Year-round
Northern elephant seal (*Mirounga angustirostris*)	Phocid	Not listed	Non-depleted	Rare	Year-round
California sea lion (*Zalophus californianus*)	Otariid	Not Listed	Non-depleted	Common	August–April
Steller sea lion (*Eumetopias jubatus*)	Otariid	Delisted	Strategic/ Depleted	Rare	August–April
Cetaceans					
Harbor porpoise (*Phocoena phocoena*)	High-frequency Cetacean	Not Listed	Non-depleted	Rare	Year Round
Dall's porpoise (*Phocoenoides dalli*)	High-frequency Cetacean	Not Listed	Non-depleted	Rare	Winter–Spring
Long-beaked common dolphin (*Dephinus capensis)*	Mid-frequency Cetacean	Not Listed	Non-depleted	Rare	Undetermined
Common bottlenose dolphin *(Tursiops truncates)*	Mid-frequency Cetacean	Not Listed	Non-depleted[1]	Rare	Undetermined
Southern resident killer whale DPS (*Orcinus orca*)	Mid-frequency Cetacean	Endangered	Depleted	Occasional	Year Round
Transient killer whale (*Orcinus orca*)	Mid-frequency Cetacean	Not Listed	Depleted	Rare	Year Round
Humpback whale (*Megaptera novaeangliae*)	Low-frequency Cetacean	Threatened/ Endangered[2]	Depleted	Rare	February–June
Gray whale (*Eschrichtius robustus*)	Low-frequency Cetacean	Delisted	Depleted	Rare	January–September
Minke whale (*Balaenoptera acutorostrata*)	Low-frequency Cetacean	Not listed	Non-depleted	Occasional	September–January

Notes:

1. There are five stocks of bottlenose dolphins listed as "depleted" under the MMPA, and others listed as "strategic." Stocks potentially occurring within the project area are non-depleted under the MMPA and are not listed as strategic.
2. There are 14 identified Distinct Population Segments (DPS) of humpback whales. The Central America DPS is endangered, and the Mexico DPS is threatened; both have the potential to occur in the project area during feeding periods, in addition to other non-endangered DPSs.

ESA – Endangered Species Act | MMPA – Marine Mammal Protection Act

Marine mammals are divided into five functional hearing groups, as follows:

- **Low-frequency Cetaceans:** Consists of the mysticetes with a collective generalized hearing range of 7 hertz (Hz) to 35 kilohertz (kHz).
- **Mid-frequency Cetaceans:** Includes most of the dolphins, all toothed whales except for *Kogia* spp., and all beaked and bottlenose whales with a generalized hearing range of approximately 150 Hz to 160 kHz.
- **High-frequency Cetaceans:** Incorporates all the true porpoises, the river dolphins, plus *Kogia* spp., *Cephalorhynchid* spp. (genus in the dolphin family *Delphinidae*), and two species of *Lagenorhynchus* (Peale's and hourglass dolphins) with a generalized hearing range estimated from 275 Hz to 160 kHz.
- **Phocids Underwater:** Consists of true seals with a generalized underwater hearing range from 50 Hz to 86 kHz.
- **Otariids Underwater:** Includes sea lions and fur seals with a generalized underwater hearing range from 60 Hz to 39 kHz.

SECTION 4. AFFECTED SPECIES STATUS AND DISTRIBUTION

The area surrounding Pier 62 has been an active construction zone for many years. Marine mammal monitoring frequently occurred for projects such as the EBSP, WSF projects, and the Seattle Aquarium. Monitoring information from those projects was used to inform current estimates of species density and expected sightings, and is included in the following sections, in addition to general species information.

4.1 PACIFIC HARBOR SEAL

4.1.1 General Biology

The small, stocky Pacific harbor seal is found throughout the temperate and arctic waters of the Northern hemisphere and has the widest distribution of any pinniped (Jeffries et al. 2000). It is considered a non-migratory species, breeding and feeding in the same area throughout the year. In water, harbor seals use their hind flippers for propulsion, but on land they hitch along using only the fore flippers (Jeffries et al. 2000). The harbor seal is the most common and widely distributed pinniped found in Washington waters and is frequently sighted by recreational boaters, ferry passengers, and other users of the marine environment.

Harbor seals use hundreds of sites to rest or haul-out along coastal and inland waters, including intertidal sand bars and mudflats in estuaries; intertidal rocks and reefs; sandy, cobbley, and rocky beaches; islands; and log booms, docks, and floats in all marine areas of the state (Jeffries et al. 2000). Group sizes typically range from small numbers of animals on some intertidal rocks to several thousand animals found seasonally in coastal estuaries. Males and females are similar in size (to 250 pounds) and coloration. Females produce one pup per year, beginning at age four or five. Pups are precocious at birth, capable of swimming and following their mothers into the water immediately after birth, and typically remain with their mothers until weaning at four to six weeks of age (Jeffries et al. 2000).

4.1.2 Abundance, Productivity, and Trends

The harbor seal is the only pinniped species that is found year-round and breeds in Washington waters (Jeffries et al. 2000). Pupping seasons vary by geographic region, with pups born in coastal estuaries (Columbia River, Willapa Bay, and Grays Harbor) from mid-April through June; Olympic Peninsula coast from May through July; San Juan Islands and eastern bays of Puget Sound from June through August; southern Puget Sound from mid-July through September; and Hood Canal from August through January (Jeffries et al. 2000). The Washington inland population includes Hood Canal, Puget Sound, and the Strait of Juan de Fuca out to Cape Flattery (Carretta et al. 2007). In 1999, Jefferies et al. (2003) recorded a mean count of 9,550 harbor seals in Washington's inland marine waters. The most recent estimate for the Washington Northern Inland Waters Stock is 11,036 (NOAA 2014a).

4.1.3 Species Status

The Pacific harbor seal is not currently listed under the ESA. No critical habitat has been designated for this species. Harbor seals are not considered to be a "depleted" or "strategic" stock under the MMPA.

4.1.4 Occurrence in the Area of Potential Effects

Individuals occur along the Elliott Bay shoreline. There is one documented harbor seal haul-out area near Bainbridge Island, approximately six miles from Pier 62. The haul-out, which is estimated at less than 100 animals, consists of intertidal rocks and reef areas around Blakely Rocks and is within the area of potential effects but at the outer extent near Bainbridge Island (Jefferies et al. 2000). Harbor seals are perhaps the most commonly observed marine mammal in the potential effects area and are known to be comfortable and seemingly curious around anthropomorphic disturbance.

Marine mammal monitoring occurred on 175 days during Seasons 1, 2, 3, and 4 of the EBSP, during which 267 harbor seals were documented as takes in the Pier 62 Project area (Anchor QEA 2014, 2015, 2016, and 2017). Numbers of harbor seals observed on the project varied from zero to seven per day, with an average of 1, 1, 2, and 3 observed daily in 2014, 2015, 2016, and 2017, respectively. Results of non-EBSP marine mammal monitoring in the vicinity of the project in recent years are as follows:

- 2012 Seattle Slip 2 Batter Pile Project: Six harbor seals were observed during this one-day project in the area that corresponds to the upcoming project ZOIs (WSF 2012).
- 2016 Seattle Test Pile Project: 56 harbor seals were observed over 10 days in the area that corresponds to the upcoming project ZOIs (WSF 2016).

4.2 NORTHERN ELEPHANT SEAL

4.2.1 General Biology

Northern elephant seals breed and give birth in California (U.S.) and Baja California (Mexico), primarily on offshore islands (Stewart et al. 1994), from December to March (NOAA 2015a). Males migrate to the Gulf of Alaska and western Aleutian Islands along the continental shelf to feed on benthic prey, while females migrate to pelagic areas in the Gulf of Alaska and the central North Pacific Ocean to feed on pelagic prey (Le Beouf et al. 2000). Adults return to land between March and August to molt, with males returning

later than females. Adults return to their feeding areas again between their spring/summer molting and their winter breeding seasons (NOAA 2015a).

4.2.2 Abundance, Productivity, and Trends

Northern elephant seals are found in the eastern and central North Pacific Ocean. Though they range as far north as Alaska and as far south as Mexico, they typically breed in the Channel Islands of California or Baja California in Mexico. Once thought to be extinct due to commercial sealing in the 1800s, the population began to steadily increase in the early 1900s (NOAA 2016b, 2016c). The population is currently estimated to be 179,000 (NOAA 2017a).

4.2.3 Species Status

Northern elephant seals are not currently listed under the ESA. No critical habitat has been designated for this species. Northern elephant seals are not considered to be a "depleted" or "strategic" stock under the MMPA.

4.2.4 Occurrence in the Area of Potential Effects

Marine mammal monitoring occurred on 175 days during Seasons 1, 2, 3, and 4 of the EBSP, during which no elephant seals were observed in the project area (Anchor QEA 2014, 2015, 2016, and 2017). Similarly, no elephant seals were observed during monitoring for the 2012 Seattle Slip 2 Batter Pile Project or the 2016 Seattle Test Pile Project (WSF 2012, 2016).

4.3 CALIFORNIA SEA LION

4.3.1 General Biology

The California sea lion is the most frequently sighted pinniped found in Washington waters and uses haul-out sites along the outer coast, Strait of Juan de Fuca, and in Puget Sound (Jeffries et al. 2000). Haul-out sites are located on jetties, offshore rocks and islands, log booms, marina docks, and navigation buoys. This species also may be frequently seen resting in the water, rafted together in groups in Puget Sound (Jeffries et al. 2000). Only male California sea lions migrate into Pacific Northwest waters, with females remaining in waters near their breeding rookeries off the coast of California and Mexico. Sea lions feed on a variety of fish including various salmonids, rockfish, forage fish, shellfish, and squid (Jeffries et al. 2000).

4.3.2 Abundance, Productivity, and Trends

The California sea lion was considered rare in Washington waters prior to the 1950s. More recently, peak numbers of 3,000 to 5,000 animals move into Pacific Northwest waters (i.e., Washington and British Columbia) during the fall and remain until late spring, when most return to breeding rookeries in California and Mexico (Jeffries et al. 2000).

The U.S. stock of California sea lion breeds in California and southern Oregon between May and July; California sea lions do not breed in Washington. Because California sea lions do not breed in Washington, accurate and up-to-date estimates of the non-breeding population in Washington alone are difficult to

determine and not available. Estimates from the 1980s suggest that the population size was fewer than 3,000 by the mid-1980s (Bigg 1985). The number of California sea lions in Washington had stabilized by the 1990s (Calambokidis and Baird 1994). For the 2007 breeding season, NOAA estimates the minimum population size for the entire California breeding area to be 153,337, but this is a much larger estimate than what can be expected in Puget Sound (NOAA 2015b). California sea lion populations increased between 1975 and 2011, and years in which growth was low often correspond to El Niño weather patterns (NOAA 2015b). The population is currently estimated to be 296,750 (NOAA 2017a).

4.3.3 Species Status

California sea lions are not currently listed under the ESA. No critical habitat has been designated for this species. California sea lions are not considered to be a "depleted" or "strategic" stock under the MMPA.

4.3.4 Occurrence in the Area of Potential Effects

California sea lions are often observed in the area of potential effects and are known to be comfortable and seemingly curious around anthropomorphic disturbance. There are four documented haul-out areas near Bainbridge Island, approximately six miles from Pier 62, and two documented haul-out areas between Bainbridge Island and Magnolia (Jefferies et al. 2000). The haul-outs consist of buoys and floats, and some are within the area of potential effects, but at the outer extent, and some are just outside the area of potential effects (Jefferies et al. 2000). Marine mammal monitoring occurred on 175 days during Seasons 1, 2, 3, and 4 of the EBSP, during which 951 California sea lions were documented as takes in the project area (Anchor QEA 2014, 2015, 2016, and 2017). California sea lions were frequently observed (average seven per day in 2014 and 2015, and three per day in 2016 and 2017) hauled out on two navigational buoys within the project area (near Alki Point) and swimming along the shoreline near the project. Results of non-EBSP marine mammal monitoring in the vicinity of the project in recent years are as follows:

- During the 2012 Seattle Slip 2 Batter Pile project, 15 California sea lions were observed during this one-day project in the area that corresponds to the upcoming project ZOIs (WSF 2012).
- During the 2016 Seattle Test Pile project, 12 California sea lions were observed over 10 days in the area that corresponds to the upcoming project ZOIs. The maximum number sighted during one day was four (WSF 2016).

4.4 STELLER SEA LION

4.4.1 General Biology

Steller sea lions are colonial breeders. Adult males, known as bulls, establish and defend territories on rookeries to mate with females. Bulls sexually mature between three and eight years of age, but typically are not large enough to hold territory successfully until nine or 10 years old. Mature males may go without eating for one to two months while aggressively defending their territory. Females, known as cows, typically reproduce for the first time at four to six years of age, usually giving birth to a single pup each year. At birth, pups are about 3.3 feet (1 meter) in length and weigh 35 to 50 pounds (16 to 22.5 kilograms). Adult females stay with their pups for a few days after birth before beginning a regular routine of alternating foraging trips at sea with nursing their pups on land. Female Steller sea lions use

smell and distinct vocalizations to recognize and create strong social bonds with their newborn pups. Females usually mate again with males within two weeks after giving birth. Males can live to be up to 20 years old, while females can live to be 30 (summarized from NOAA 2014b).

Steller sea lions prefer the colder temperate to sub-arctic waters of the North Pacific Ocean. Haul-outs and rookeries usually consist of beaches (gravel, rocky, or sand), ledges, and rocky reefs. In the Bering Sea and Okhotsk Sea, this species may also haul-out on sea ice, but this is considered atypical behavior (NOAA 2017b).

Steller sea lions are opportunistic predators, foraging and feeding primarily at night on a wide variety of fishes such as salmonids, rockfish, forage fish, bivalves, cephalopods, and gastropods. Steller sea lions forage in the nearshore and in pelagic waters. They are capable of traveling long distances in a season and can dive to approximately 1,300 feet (400 meters). Their diet may vary seasonally, depending on the abundance and distribution of prey. They may disperse and range far distances to find prey but are not known to migrate.

4.4.2 Abundance, Productivity, and Trends

There are two separate stocks of Steller sea lions: the eastern stock and the western stock. The two populations are delineated at Cape Suckling, Alaska (NOAA 2014b). The estimated Steller sea lion population is estimated at 41,638 individuals (NOAA 2018).

4.4.3 Species Status

The eastern stock of Steller sea lions is “depleted/strategic” under the MMPA and was “delisted” under the ESA on November 4, 2013 (78 Federal Register [FR] 66140).

4.4.4 Occurrence in the Area of Potential Effects

Steller sea lions are, at most, a rare visitor to the Pier 62 area of potential effects. Steller sea lions use haul-out locations in Puget Sound, and may occur at the same haul-outs as California sea lions.

Marine mammal monitoring occurred on 175 days during Seasons 1, 2, 3, and 4 of the EBSP, during which three Steller sea lions were observed and documented as takes in the project area (Anchor QEA 2014, 2015, 2016, and 2017).

No Steller sea lions were observed during monitoring for the 2012 Seattle Slip 2 Batter Pile Project and the 2016 Seattle Test Pile Project (WSF 2012, 2016).

4.5 HARBOR PORPOISE AND DALL’S PORPOISE

Harbor porpoise and Dall’s porpoise species are analogous in natural history and distribution in regard to the proposed project and are therefore described and assessed together.

4.5.1 General Biology

Harbor porpoises have a small, robust body with a short, blunt beak. Females are slightly larger than males. Harbor porpoises inhabit northern temperate and subarctic coastal and offshore waters. They are

commonly found in bays, estuaries, harbors, and fjords less than 650 feet (200 meters) deep. They feed on demersal and benthic species, mainly schooling fish and cephalopods.

Dall's porpoises are fast-swimming members of the porpoise family and are common in the North Pacific Ocean. They prefer temperate or cooler waters that are more than 600 feet (180 meters) deep and with temperatures between 36 °F and 63 °F (2 °C and 17 °C). They can be found in offshore, inshore, and nearshore oceanic waters. They feed on small schooling fish, mid- and deep-water fish, cephalopods, and occasionally crabs and shrimp. Feeding usually occurs at night, when their prey vertically migrates up toward the water surface. Dall's porpoises can dive up to 1,640 feet (500 meters) in order to reach their prey.

4.5.2 Abundance, Productivity, and Trends

There are 10 stocks of harbor porpoises in U.S. waters. National Marine Fishery Service Stock Assessment Reports include estimated population sizes for the 10 U.S. stocks. The population is currently estimated to be 11,233 (NOAA 2017a).

For management purposes, Dall's porpoises inhabiting U.S. waters have been divided into two stocks: the Alaska stock and the California/Oregon/Washington (CA-OR-WA) stock (NOAA 2011b and 2015c). For both stocks, insufficient data are available to understand their current population trends. The Alaska population estimate is approximately 417,000 Dall's porpoises (NOAA 2015c). The population of CA-OR-WA stock is currently estimated to be 25,750 (NOAA 2017a).

4.5.3 Species Status

Neither harbor porpoise nor Dall's porpoise are currently listed under the ESA. No critical habitat has been designated for these species. They are not considered to be "depleted" or "strategic" stocks under the MMPA.

4.5.4 Occurrence in the Area of Potential Effects

Harbor porpoises are known to occur year-round in the inland trans-boundary waters of Washington and British Columbia, Canada (NOAA 2011a). Although differences in density exist between coastal Oregon/Washington and inland Washington waters, a specific stock boundary line cannot be identified based upon biological or genetic differences. However, harbor porpoise movements and rates of intermixing within the eastern North Pacific Ocean are restricted, and there has been a significant decline in harbor porpoise sightings within southern Puget Sound since the 1940s; today, harbor porpoises are rarely observed but may be increasing in abundance (NOAA 2011a). The minimum annual human-caused mortality of Washington Inland Waters stock is at minimum 2.2 individuals annually (NOAA 2011c). It is likely that harbor porpoises only rarely occur in the area of potential effects.

Dall's porpoises are endemic to temperate waters of the North Pacific Ocean. Off the U.S. West Coast, they are commonly seen in shelf, slope, and offshore waters. Sighting patterns from aerial and shipboard surveys conducted in California, Oregon, and Washington at different times suggest that north-south movement between these states occurs as oceanographic conditions change, both on seasonal and inter-annual time scales. Dall's porpoises are rarely reported in the area of potential effects. The mean annual human-caused mortality in Puget Sound is approximately 0.2 individuals, or approximately one individual

every five years (NOAA 2011b). It is likely that Dall's porpoise only rarely occur in the area of potential effects.

Marine mammal monitoring occurred on 175 days during Seasons 1, 2, 3, and 4 (2014, 2015, 2016, and 2017) of the EBSP, during which one harbor porpoise was observed and documented as a take in the project area; no Dall's porpoises were observed (Anchor QEA 2014, 2015, and 2016).

Neither harbor porpoise nor Dall's porpoise were observed during monitoring for the 2012 Seattle Slip 2 Batter Pile Project and the 2016 Seattle Test Pile Project (WSF 2012, 2016).

4.6 LONG-BEAKED COMMON DOLPHIN

4.6.1 General Biology

Long-beaked common dolphins are relatively small dolphins that can reach lengths of 6 to 8.5 feet (NOAA 2016d). Long-beaked common dolphins generally prefer shallow, tropical, subtropical and warmer temperate waters closer to the coast (usually within 50 to 100 nautical miles and on the continental shelf). Long-beaked common dolphins are usually found in large social groups averaging from 100 to 500 animals, but have been occasionally seen in larger herds of thousands of individuals. These large schools are thought to consist of smaller sub-groups of 10 to 30 animals that are possibly related or separated by age and/or sex. These gregarious, energetic dolphins are commonly seen swimming rapidly, breaching, porpoising, and frequently engaging in other surface active behavior (NOAA 2016d).

4.6.2 Abundance, Productivity, and Trends

Long-beaked common dolphins are commonly found along the U.S. West Coast, from Baja, California (including the Gulf of California), northward to about central California (NOAA 2016d). Long-beaked common dolphins inhabiting west coast U.S. waters are considered to be in the California stock, which is currently estimated at 101,305 (NOAA 2017a).

4.6.3 Species Status

The California stock of long-beaked common dolphins is not currently listed under the ESA. No critical habitat has been designated for this species. They are not considered to be a "depleted" or "strategic" stock under the MMPA.

4.6.4 Occurrence in the Area of Potential Effects

Marine mammal monitoring occurred on 175 days during Seasons 1, 2, 3, and 4 (2014, 2015, 2016, and 2017) of the EBSP, during which no common dolphins were observed in the project area (Anchor QEA 2014, 2015, 2016, and 2017).

No long-beaked common dolphins were observed during monitoring for the 2012 Seattle Slip 2 Batter Pile Project or the 2016 Seattle Test Pile Project (WSF 2012, 2016). However, there were reported sightings in the Puget Sound in the summer of 2016. Beginning on June 16, common dolphins were observed near Victoria, B.C. Over the following weeks, a pod of 15 to 20 (including a calf) was observed in central and

southern Puget Sound. They were positively identified as long-beaked common dolphins (Orca Network 2016a). This is the first confirmed observation of a pod of long-beaked common dolphins in Washington waters—NMFS states that as of 2012, long-beaked common dolphins had not been observed during surveys in Washington waters (NOAA 2016d). Two individual long-beaked common dolphins were observed in 2011: one in August and one in September (Whale Museum 2015).

4.7 COMMON BOTTLENOSE DOLPHIN

4.7.1 General Biology

Common bottlenose dolphins are light gray to black with a robust body and short, thick beak (NOAA 2017c). They primarily feed on invertebrates, squids, and fishes, and forage individually and in groups. They range in size from 6 to 12.5 feet and 300 to 1,400 pounds, with males slightly larger than females (NOAA 2017c). Bottlenose dolphins use echolocation to locate and capture prey, and strike fish with their flukes to knock them out of the water as one feeding strategy, termed "fish-whacking." They are found in temperate and tropical waters around the world, and coastal and offshore stocks generally inhabit different waters. Female bottlenose dolphins reach sexual maturity between 5 and 13 years and calve on average every 3 to 6 years. Bottlenose dolphins are long-lived and females can be greater than 50 years old. They commonly are found in groups of 2 to 15 individuals, and in offshore environments can herd with hundreds of individuals (NOAA 2017c).

4.7.2 Abundance, Productivity, and Trends

Common bottlenose dolphins inhabiting west coast U.S. waters are considered to be in either the California coastal stock, which ranges from Mexico to the San Francisco area within approximately 1 kilometer of shore, or the California/Oregon/Washington offshore stock, for which NOAA surveys range into Washington, but most individuals are sighted off the shore of California. Common bottlenose dolphins in the California/Oregon/Washington offshore stock are commonly found along the California coast, northward to about the Oregon border (NOAA 2017d). This application addresses the California/Oregon/Washington offshore stock due to its higher likelihood to occur in the project area. This stock is currently estimated at 1,924 (NOAA 2017d). Trend analyses for this stock have not been performed to date because other stocks have more urgent conservation concerns (NOAA 2017d).

4.7.3 Species Status

The California/Oregon/Washington offshore stock of common bottlenose dolphins is not currently listed under the ESA. No critical habitat has been designated for this species. They are not considered to be a "depleted" or "strategic" stock under the MMPA.

4.7.4 Occurrence in the Area of Potential Effects

Bottlenose dolphins are approximately distributed worldwide from latitudes 45 degrees north to 45 degrees south. It is not expected that they would occur in the project area (NOAA 2017d). NOAA offshore surveys from 1991 to 2014 resulted in no sightings during study transects off the Oregon or Washington coasts (NOAA 2017d). In October 2017, however, multiple sightings of a bottlenose dolphin were reported

to Orca Network throughout the Puget Sound and in Elliott Bay. One sighting in Carr Inlet on October 10, 2017, was confirmed by John Calambokidis of Cascadia Research (Orca Network 2017b), and during marine mammal monitoring for the Colman Dock Multimodal Project, two bottlenose dolphins were observed in Elliott Bay in 1 week of monitoring (WSDOT 2017). It is acknowledged that bottlenose dolphins could occur within the project area.

No bottlenose dolphins were observed during monitoring for the EBSP, the 2012 Seattle Slip 2 Batter Pile Project or the 2016 Seattle Test Pile Project (Anchor QEA 2014, 2015, 2016, and 2017; WSF 2012, 2016).

4.8 KILLER WHALE

Individuals from the SRKW DPS are expected to have the highest potential to occur in the area of potential effects. As a result, they will be the DPS of primary focus in this document. Transient killer whales may occasionally occur and are discussed where appropriate.

4.8.1 General Biology

Although relatively little is known about the winter movements and range of SRKW, they have been seen in coastal waters off Oregon, Washington, Vancouver Island, central California, and the Queen Charlotte Islands (NOAA 2006). They are known to move through Elliott Bay on occasion but typically remain offshore and out of the area of potential effects. Killer whale pods aggregate temporarily throughout the year and are often seen traveling and socializing together (Osborne et al. 1988; Osborne 1999; Ford et al. 2000; Kriete 2007). Breeding is assumed to also take place during these social encounters, although it has never reliably been observed in the wild. Though mating is thought to occur from May to October, young are born year-round (Osborne et al. 1988; Osborne 1999; Ford et al. 2000; Kriete 2007). Gestation averages 17 months in captive situations (Asper et al. 1988, Walker et al. 1988, Duffield et al. 1995). Killer whales are known to be polygamous, and males commonly mate with females outside their pods (Dahlheim and Heyning 1999; Barrett-Lennard 2000; Barrett-Lennard and Ellis 2001). Female and male SRKWs reach sexual maturity at about 15 years of age.

Killer whale females are estimated to live between 80 and 90 years and 50 to 60 years for males (Olesiuk et al. 1990). The life expectancy at birth ranges from 17 years for males to 29 years for females (Olesiuk et al. 1990). That number increases greatly for whales that survive the first six months of life, from 29 years for males to between 50 and 60 years for females.

Southern resident killer whales feed primarily on salmonids and other marine fishes. They are often found in and around Puget Sound during the summer and early fall pursuing migrating salmon (Osborne et al. 1988; Osborne 1999; Kriete 2007). At times, they have also been observed preying on marine mammals including pinnipeds and other cetaceans (NOAA 2006). Their unique foraging strategies include cooperative hunting, food sharing, and innovative learning (Smith et al. 1981; Pitman et al. 2003). However, very little is known about winter feeding habits of SRKWs.

4.8.2 Abundance, Productivity, and Trends

The SRKW DPS is composed of three pods: J, K, and L pods, totaling 76 whales (CWR 2017). They are found in and around Puget Sound and the San Juan Islands during the summer and early fall feeding on migrating

salmon, and J pod is the most commonly observed pod in that area (Osborne et al. 1988; Osborne 1999 and 2008; Kriete 2007). More commonly, the pods are found in Haro Strait, Boundary Passage, the southern Gulf Islands, eastern portions of the Strait of Juan de Fuca, and in the southern Strait of Georgia (Heimlich-Boran 1988; Felleman et al. 1991; Olson 1998; Ford et al. 2000). This DPS has experienced a marked decline in recent years, and several pods along the Strait of Juan de Fuca and in Hood Canal may be moving towards extinction (NOAA 2006).

The West Coast transient stock is composed of two populations: the outer coast and the inner coast subpopulations. Currently estimate of the inner coast population is 240 individuals (NOAA 2017a).

4.8.3 Species Status

The SRKW DPS was listed as endangered under the ESA on November 18, 2005 (70 FR 69903). Critical habitat was designated on November 29, 2006 (71 FR 69054), and includes all marine waters greater than 20 feet in depth. Critical habitat for the this DPS includes three specific areas: the summer core area in Haro Strait and waters around the San Juan Islands, Puget Sound, and the Strait of Juan de Fuca (NOAA 2006). By formally receiving a listing status as endangered under the ESA, SRKW were automatically considered as a "strategic" stock under the MMPA. This stock was considered "depleted" prior to its 2005 listing under the ESA. Transient killer whales are currently listed as "depleted" but have no listing status under the ESA.

4.8.4 Occurrence in the Area of Potential Effects

A long-term database maintained by the Whale Museum contains sightings and geospatial locations of SRKWs, among other marine mammals, in inland waters of Washington State (Osborne 2008). Data are largely based on opportunistic sightings from a variety of sources (i.e., public reports, commercial whale watching, Soundwatch, Lime Kiln State Park land-based observations, and independent research reports) but is regarded as a robust but difficult to quantify inventory of occurrences. The data provide the most comprehensive assemblage of broad-scale habitat use by the DPS in inland waters.

Based on reports from 1990 to 2008, the greatest number of unique killer whale sighting-days near or in the area of potential effects occurred from November through January, although observations were made during all months except May (Osborne 2008). Most observations were of SRKWs passing west of Alki Point (82 percent of all observations), which lies on the edge or outside the area of potential effects; this pattern is potentially due to the high level of human disturbance or highly degraded habitat features currently found within Elliott Bay. Of the pods that compose this DPS, J Pod, with an estimated 24 members, is the pod most likely to appear year-round near the San Juan Islands, in the lower Puget Sound near Seattle, and in Georgia Strait at the mouth of the Fraser River. J Pod tends to frequent the west side of San Juan Island in mid to late spring (CWR 2017).

Marine mammal monitoring occurred on 175 days during Seasons 1, 2, 3, and 4 (2014, 2015, 2016, and 2017) of the EBSP, during which one killer whale was documented as a take in the project area (unknown if SRKW or transient), and one pod of six killer whales was also observed in Elliott Bay more than 30 minutes before or after pile driving activity (Anchor QEA 2014, 2015, 2016, and 2017). The killer whales were not identified as SRKW or transients.

No SRKW were observed during monitoring for the 2012 Seattle Slip 2 Batter Pile Project or the 2016 Seattle Test Pile Project (WSF 2016).

4.9 HUMPBACK WHALE

4.9.1 General Biology

Humpback whales are baleen whales known for their long pectoral fins. They feed primarily on krill, plankton, and small fish, consuming up to 3,000 pounds per day. As with other baleen whales, the adult females are larger than adult males, with lengths reaching 60 feet. Humpbacks are grey in color, with significant variation such that the patterns on the undersides of the flukes can be used to identify individual whales.

Humpback whales have the longest migration of any mammal. Individuals of the Mexico DPS have been observed to make the 3,000-mile trip between Alaska and Hawaii in as little as 36 days. Humpbacks spend the warmer months in norther latitudes feeding and building fat stores; they migrate south during the winter for the breeding season (NOAA 2017e). However, it is not uncommon to observe individuals in Washington waters during the winter.

4.9.2 Abundance, Productivity, and Trends

The global humpback whale population was significantly reduced by commercial whaling in the 1800s and early 1900s. However, protections were implemented in the 1960s and 1970s, and humpback whale populations are recovering (Best et al. 2015).

There are two potential DPSs occurring within the project area: the Mexico DPS and the Central America DPS. The Mexico DPS is estimated to be 3,264 individuals and the Central America DPS is estimated at 411 individuals (81 FR 62259). The current estimate for the CA-OR-WA stock is 1,918 (NOAA 2017a).

4.9.3 Species Status

For the MMPA stock assessment reports (NOAA 2016b), the CA-OR-WA 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. The Mexico DPS of humpback whales feeds along the Washington coast, and is listed as “threatened” under the ESA (81 FR 62259). The Central America DPS also is known to feed in the Washington-southern British Columbia area, and is listed as “endangered” (81 FR 62259). Consequently, the CA-OR-WA stock is automatically considered as a "depleted" and "strategic" stock under the MMPA. A recovery plan was adopted in 1991 (NOAA 1991).

4.9.4 Occurrence in the Area of Potential Effects

Humpback whales are found in coastal waters of Washington as they migrate from feeding grounds in Alaska to California to winter breading grounds in Mexico. Humpbacks are only rare visitors to Puget Sound. In 1976 and 1978, two sightings were reported in Puget Sound and one sighting was reported in 1986 (Osborne et al. 1988; Calambokidis and Steiger 1990; Calambokidis and Baird 1994).

Marine mammal monitoring occurred on 175 days during Seasons 1, 2, 3, and 4 (2014, 2015, 2016, and 2017) of the EBSP, during which two humpback whales were observed in the project area (Anchor QEA 2014, 2015, 2016, and 2017), with one documented take during Season 2.

No humpback whales were observed during monitoring for the 2012 Seattle Slip 2 Batter Pile Project or the 2016 Seattle Test Pile Project (WSF 2012, 2016).

4.10 GRAY WHALE

4.10.1General Biology

Gray whales spend April through November in Arctic feeding grounds and December through April in Mexican breeding areas. Between October and February, the species migrates south along the West Coast, returning north between February and July. This annual round-trip migration of 7,400 to 12,400 miles is believed to be the longest of any mammal (Rugh et al. 2001).

The gray whale is unique among cetaceans as a bottom-feeder that rolls onto its side, sucking up sediment from the seabed. Benthic organisms that live in the sediment are trapped by baleen plates as water and silt are filtered out. Gray whales feed in shallow waters, usually 150 to 400 feet deep. Adults can consume 1 to 1.5 tons of food per day during peak feeding periods (Rugh et al. 2001).

4.10.2Abundance, Productivity, and Trends

Systematic counts of Eastern North Pacific gray whales migrating south along the central California coast have been conducted by shore-based researchers most years since 1967 (NOAA 2015e). The current population estimate is 20,990 gray whales (NOAA 2017a). In contrast, the Western North Pacific population remains highly depleted, and its continued survival is questionable. This population is estimated to include fewer than 100 individuals.

4.10.3Species Status

The Eastern North Pacific stock of the gray whale, which is found in Washington waters, has been delisted under the ESA. The Western North Pacific stock of gray whales that does not occur in the Pacific Northwest has not recovered and remains listed as endangered. No critical habitat is currently established in the EBSP area of potential effects. Gray whales currently have no formal designation under the MMPA.

4.10.4Occurrence in the Area of Potential Effects

Eastern North Pacific gray whales occur frequently off the coast of Washington during their southerly migration in November and December, and northern migration from March through May (Rugh et al. 2001). Gray whales are observed in Washington inland waters regularly between the months of January and September, with peaks between March and May (CWR 2017). Gray whale sightings are typically reported in February through May and include an observation of a gray whale off the ferry terminal at Pier 52 heading toward the East Waterway in March 2010 (CWR 2017). It is assumed that gray whales might rarely occur in the area of potential effects.

No gray whales were observed during monitoring for the EBSP, the 2012 Seattle Slip 2 Batter Pile Project or the 2016 Seattle Test Pile Project (Anchor QEA 2014, 2015, 2016, 2017; WSF 2012, 2016.

4.11 MINKE WHALE

4.11.1 General Biology

Minke whales have small dark sleek bodies and a small dorsal fin; they are often recognized by surfacing snout first and a shallow but visible “bushy” blow. These baleen whales are usually sighted individually or in small groups of two to three, but there are reports of loose aggregations of up to 400 animals associated with feeding areas in higher latitudes (NOAA 2016e). Minke whales prefer temperate to boreal waters, but are also found in tropical and subtropical region; they can be found in both coastal/inshore and oceanic/offshore areas. They feed most often in cooler waters at higher latitudes (NOAA 2016e).

4.11.2 Abundance, Productivity, and Trends

Minke whales migrate seasonally and are capable of traveling long distances. Some animals and stocks of this species have resident home ranges and are not highly migratory. The distribution of minke whales varies by age, reproductive status, and sex. Older mature males are commonly found in the polar regions in and near the ice edge, and often in small social groups, during the summer feeding season. Mature females will also migrate farther into the higher latitudes, but generally remain in coastal waters. Immature animals are more solitary and usually stay in lower latitudes during the summer. In U.S. waters, minke whales in Alaskan waters are migratory, but animals in the inland waters of CA-OR-WA are considered "residents" because they establish home ranges (NOAA 2016e). The population is currently estimated to be 636 (NOAA 2017a).

4.11.3 Species Status

Minke whales are not listed under the ESA and are classified as “non-depleted” under the MMPA.

4.11.4 Occurrence in the Area of Potential Effects

The CA-OR-WA stock of minke whale may be found near the project site. The CA-WA-OR stock is considered a resident stock (NOAA 2011c), and includes minke whales within the inland Washington waters of Puget Sound and the San Juan Islands (Dorsey et al. 1990; Carretta et al. 2007).

Minke whales are reported in Washington inland waters year-round, although few are reported in the winter (Calambokidis and Baird 1994). They are relatively common in the San Juan Islands and Strait of Juan de Fuca (especially around several of the banks in both the central and eastern Strait), but are relatively rare in Puget Sound. For example, on October 1, 2017, one Minke whale was reported on the west side of Whidbey Island (Orca Network 2017b); however, none have been reported inside the project area by Orca Network.

No minke whales were observed during monitoring for the EBSP, the 2012 Seattle Slip 2 Batter Pile Project or the 2016 Seattle Test Pile Project(Anchor QEA 2014, 2015, 2016, and 2017; WSF 2012, 2016).

SECTION 5. TYPE OF INCIDENTAL TAKE AUTHORIZATION REQUESTED

The MMPA defines "harassment" as:

> any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment] (50 C.F.R., Part 216, Subpart A, Section 216.3 Definitions).

Level A is the more severe form of harassment because it may result in injury or death, whereas Level B harassment causes only disturbance, with no potential for injury.

The new NMFS acoustical guidance, and PTS specifically, identifies the received levels, or acoustic thresholds, at which individual marine mammals are predicted to experience changes in their hearing sensitivity for acute, incidental exposure to all underwater anthropogenic sound sources.

PTS onset acoustic thresholds (Level A harassment) for all sound sources are divided into two broad categories: impulsive and non-impulsive. Acoustic thresholds are also presented as dual metric acoustic thresholds using cumulative sound exposure level (SEL_{cum}) and peak sound pressure (PK) metrics for impulsive sounds. As dual metrics, NMFS considers onset of PTS to have occurred when either one of the two metrics is exceeded. NMFS' alternative methods for development of PTS isopleths apply only to acoustic thresholds in the SEL_{cum} metric. Based on the proposed project details, no component of the action will include work that is expected to exceed the Peak SPL PK thresholds for PTS or TTS, as identified in Table 11, and no evaluations were required to identify take related to PK thresholds. Therefore, the type of incidental take requested is based on exceedance of the acoustic thresholds in the SEL_{cum} metric and the disturbance thresholds identified in Table 10.

5.1 INCIDENTAL TAKE AUTHORIZATION REQUEST

Under Section 101(a)(5)(D) of the MMPA, the Seattle Department of Transportation (SDOT) requests an IHA for activities beginning as soon as practicable upon receipt of the IHA (expected to be August 1, 2018). Level A and Level B incidental take by acoustical harassment are requested for marine mammals as described in this application that may occur in the project impact area during the construction activities at Pier 62. Vibratory and impact pile installation are the construction activities with the greatest potential for causing take.

The PTS isopleths were identified for each hearing group for impact and vibratory installation and removal methods that will be used in the Pier 62 Project, as described in Section 1. The PTS isopleth distances were calculated using the NMFS acoustic threshold calculator (NOAA 2016a), with inputs based on measured and surrogate noise measurements taken during EBSP construction and from other sources and estimating conservative working durations. Injury within the PTS isopleth would be consistent with Level A take, and therefore an Exclusion Zone will be established such that work will stop if animals are present within the Exclusion Zone established for each hearing group based on the PTS isopleth calculated for the proposed pile installation and removal actions. Take requested in this application is primarily Level B acoustical harassment. Based on project minimization measures, it is expected that work would stop prior to an individual mammal entering an Exclusion Zone and being present within the PTS isopleths. However,

after discussion with NOAA (2017f), the City of Seattle is also requesting limited Level A take for Pacific harbor seals, Dall's porpoise, and harbor porpoise.

5.2 METHOD OF INCIDENTAL TAKING

The method of incidental take requested is primarily Level B acoustical harassment. It would occur within the 160 dB_{RMS} disturbance threshold during impact pile driving of 30-inch pipe piles; the 127 dB_{RMS} disturbance threshold for vibratory pile driving of 30-inch pipe piles; and the 127 dB_{RMS} disturbance threshold for vibratory removal of 14-inch timber piles. These thresholds have been established as the three different ZOIs that will be in place during active pile removal or installation of the different types of piles, as described in Section 1.6.2. Vibratory pile installation and removal activities associated with the 24-inch template piles are not listed as a separate activity, as they will be occurring within the same general work period as vibratory installation of the 30-inch pipe piles, during which the monitoring and stop-work protocols for the more conservative 30-inch piles will apply.

Limited Level A take may also occur with the PTS isopleth for Pacific harbor seals, Dall's porpoise, and harbor porpoise.

SECTION 6. TAKE ESTIMATES FOR MARINE MAMMALS

This application uses the species density data from the 2015 Pacific Navy Marine Species Density Database (U.S. Navy 2015) and Jefferson et al. (2016), supplemented by data from the Washington State Department of Transportation (WSDOT 2016) to estimate take for marine mammals.

The three ZOI for the Pier 62 Project are described in Table 13, and are based on the overall area of disturbance generated by pile removal and installation given modeled or calculated distances to attenuation below disturbance (Level B) thresholds. Unless otherwise described, incidental take is estimated by the following equation:

Incidental take estimate = species density * zone of influence * days of pile-related activity

TABLE 13. ZONES OF INFLUENCE DESCRIPTIONS AND DURATION OF ACTIVITY

Zone of Influence	Activity	Construction Method	ZOI Area (km^2)	Days of Activity in ZOI
1	Removal of 14-inch Timber Piles	Vibratory	4.8	10
2	Installation of 30-inch Steel Piles	Vibratory	91	53
3	Installation of 30-inch Steel Piles	Impact	2.3	64

Notes:
The Zone of Influence area is a conservative approximation, based on the slight variation of distances for the Level B harassment zones for each hearing group.
km^2 – square kilometers

6.1 HARBOR SEAL

Based on U.S. Navy species density estimates (U.S. Navy 2015) for the inland waters of Puget Sound, potential take of harbor seal is estimated as shown in Table 14.

TABLE 14. HARBOR SEAL ESTIMATED TAKE

Zone of Influence	Species Density	ZOI Area (km^2)	Days of Activity	Estimated Take
1	1.219	4.8	10	58
2	1.219	91	53	5,879
3	1.219	2.3	64	180

Note: km^2 – square kilometers

Based on these calculations, total take is estimated to be 6,117 individuals. However, based on coordination with NOAA (2017f), the City of Seattle is requesting Level A take of four harbor seals and Level B take of 1,465 harbor seals.

6.2 NORTHERN ELEPHANT SEAL

Based on U.S. Navy species density estimates, potential take of northern elephant seal is expected to be zero. However, the Whale Museum (as cited in WSDOT 2016) reported one sighting in the relevant area between 2008 and 2014. Orca Network also reported one sighting in 2017 near Edmonds, Washington (Orca Network 2017b). Therefore, the City of Seattle is requesting authorization for Level B acoustical harassment of one northern elephant seal.

6.3 CALIFORNIA SEA LION

Based on U.S. Navy species density estimates (U.S. Navy 2015) for the inland waters of Washington, including Eastern Bays and Puget Sound, potential take of California sea lion is estimated as shown in Table 15.

TABLE 15. CALIFORNIA SEA LION ESTIMATED TAKE

Zone of Influence	Species Density	ZOI Area (km^2)	Days of Activity	Estimated Take
1	0.1266	4.8	10	6
2	0.1266	91	53	611
3	0.1266	2.3	64	18

Note:
km^2 – square kilometers

Although this results in a take estimate of 635 individuals, the City of Seattle believes that this estimate is unrealistically low, when compared to marine mammal monitoring during in-water pile driving for EBSP. During monitoring for that project, a maximum of 15 California sea lions were observed on one day, which is used as the basis for a take request of 1,695. This take request was estimated when the IHA application was initially submitted in December 2017, with a project duration of 113 days. The estimate has not increased even though the project duration is now longer, because 1,695 takes is sufficiently conservative for the duration of Season 2 of the project.

6.4 STELLER SEA LION

Based on U.S. Navy species density estimates, potential take of Steller sea lion is estimated as shown in Table 16.

TABLE 16. STELLER SEA LION ESTIMATED TAKE

Zone of Influence	Species Density	ZOI Area (km^2)	Days of Activity	Estimated Take
1	0.0368	4.8	10	2
2	0.0368	91	53	178
3	0.0368	2.3	64	5

Note:
km^2 – square kilometers

Based on these calculations, the City of Seattle is requesting authorization for Level B take of 185 Steller sea lions.

6.5 HARBOR PORPOISE

Based on species density estimates from Jefferson et al. (2016), potential take of harbor porpoise is estimated as shown in Table 17.

TABLE 17. HARBOR PORPOISE ESTIMATED TAKE

Zone of Influence	Species Density	ZOI Area (km^2)	Days of Activity	Estimated Take
1	0.69	4.8	10	33
2	0.69	91	53	3,328
3	0.69	2.3	64	101

Note:
km^2 – square kilometers

Based on these calculations, total take is estimated to be 3,462 individuals. However, based on coordination with NOAA (2017f), the City of Seattle is requesting Level A take of 32 harbor porpoise and Level B take of 3,430 harbor porpoise.

6.6 DALL'S PORPOISE

Based on U.S. Navy (2015) species density estimates, potential take is estimated as shown in Table 18.

TABLE 18. DALL'S PORPOISE ESTIMATED TAKE

Zone of Influence	Species Density	ZOI Area (km^2)	Days of Activity	Estimated Take
1	0.039	4.8	10	1
2	0.039	91	53	190
3	0.039	2.3	64	5

Note:
km^2 – square kilometers

Based on these calculations and after coordinating with NOAA (2017f), the City of Seattle is requesting authorization for Level A take of two Dall's porpoise and Level B take of 194 Dall's porpoise.

6.7 LONG-BEAKED COMMON DOLPHIN

Based on U.S. Navy species density estimates, potential take of long-beaked common dolphin is expected to be zero. However, in 2016, the Orca Network (2016c) reported a pod of up to 20 long-beaked common dolphins. Therefore, the City of Seattle is requesting authorization for Level B acoustical harassment of 20 long-beaked common dolphins.

6.8 COMMON BOTTLENOSE DOLPHIN

Based on U.S. Navy species density estimates, potential take of common bottlenose dolphin is expected to be zero. However, in 2017 the Orca Network (2017b) reported sightings of a bottlenose dolphin in Puget Sound and in Elliott Bay, and WSDOT observed two bottlenose dolphins in 1 week during monitoring for the Colman Dock Multimodal Project (WSDOT 2017). NOAA indicates that in coastal waters, bottlenose dolphins typically travel in groups of 2 to 15 (NOAA 2017c). Therefore, the City of Seattle is requesting authorization for Level B acoustical harassment of two common bottlenose dolphins.

6.9 SOUTHERN RESIDENT KILLER WHALE

Based on the U.S. Navy Species Density Estimates (U.S. Navy 2015), the density for the SRKW is variable across seasons and across the range. The inland water density estimates vary from 0.000000 to 0.000090/km^2 in summer, 0.001461 to 0.004760/km^2 in fall, and 0.004761-0.020240/km^2 in winter. Therefore, the take estimated as shown in Table 19 is based on the highest density estimated during the winter (0.020240/km^2) for the SRKW population, which was 76 individuals as of October 19, 2017.

TABLE 19. SOUTHERN RESIDENT KILLER WHALE ESTIMATED TAKE

Zone of Influence	Species Density	ZOI Area (km^2)	Days of Activity	Estimated Take
1	0.020240	4.8	10	1
2	0.020240	91	53	98
3	0.020240	2.3	64	3

Note:
km^2 – square kilometers

With the variable winter density, the estimated take ranges from 24 to 102 SRKW, with the upper take estimate greater than the estimated population and the lower take estimate still greater than 20 percent of the population. After coordinating with NOAA (2017f), the City of Seattle is requesting Level B take of 24 southern resident killer whales. This request is based on a single occurrence of one pod.

6.10 TRANSIENT KILLER WHALE

Based on U.S. Navy (2015) species density estimates, potential take of transient killer whale is estimated as shown in Table 20. As with the SRKW, the density estimate of transient killer whales is variable between seasons and regions. Density estimates range from 0.000575 to 0.001582/km^2 in summer, from 0.001583

to 0.002373/km^2 in fall, and from 0.000575 to 0.001582/km^2 in winter. Work could occur throughout summer, fall and winter, so the highest estimate, fall density, will be used to conservatively estimate take.

TABLE 20. TRANSIENT KILLER WHALE ESTIMATED TAKE

Zone of Influence	Species Density	ZOI Area (km^2)	Days of Activity	Estimated Take
1	0.002373	4.8	10	0
2	0.002373	91	53	12
3	0.002373	2.3	64	0

Note:
km^2 – square kilometers

Although this results in a take estimate of 12 individuals, the City of Seattle believes that this estimate is unrealistically low, based on reports of transient killer whales in Elliott Bay by the Orca Network (2016b). Therefore, the City of Seattle is requesting Level B take of 42 transient killer whales, which is based on two groups of up to seven transient whales entering Elliott Bay and staying in the vicinity for three days.

6.11 HUMPBACK WHALE

Based on U.S. Navy species density estimates (U.S. Navy 2015), potential take of humpback whale is estimated as shown in Table 21.

TABLE 21. HUMPBACK WHALE ESTIMATED TAKE

Zone of Influence	Species Density	ZOI Area (km^2)	Days of Activity	Estimated Take
1	0.00001	4.8	10	0
2	0.00001	91	53	0
3	0.00001	2.3	64	0

Note:
km^2 – square kilometers

Although the standard take calculations would result in an estimated take of less than one humpback whale, the City of Seattle is requesting authorization for Level B take of five humpback whales, based on take during previous work in Elliott Bay, where two humpback whales were observed, including one take, during the 175 days of work during the previous four years.

6.12 GRAY WHALE

Based on U.S. Navy species density estimates (U.S. Navy 2015), potential take of gray whale is estimated as shown in Table 22.

TABLE 22. GRAY WHALE ESTIMATED TAKE

Zone of Influence	Species Density	ZOI Area (km^2)	Days of Activity	Estimated Take
1	0.00051	4.8	10	0
2	0.00051	91	53	3
3	0.00051	2.3	64	0

Note:
km^2 – square kilometers

Based on these calculations, the City of Seattle is requesting authorization for Level B take of three gray whales.

6.13 MINKE WHALE

Based on U.S. Navy species density estimates (U.S. Navy 2015), potential take of minke whales is expected to be zero (Table 23). However, between 2008 and 2014, the Whale Museum (as cited in WSDOT 2016) reported one sighting in the relevant area.

TABLE 23. MINKE WHALE ESTIMATED TAKE

Zone of Influence	Species Density	ZOI Area (km^2)	Days of Activity	Estimated Take
1	0.00003	4.8	10	0
2	0.00003	91	53	<1
3	0.00003	2.3	64	0

Note:
km^2 – square kilometers

Although the standard take calculations would result in an estimated take of less than one minke whale, the City of Seattle is requesting authorization for Level B take of two minke whales, based on previous sightings in the construction area by the Whale Museum.

6.14 SUMMARY OF INCIDENTAL TAKE REQUESTED

The City of Seattle has evaluated the potential for Level A and Level B acoustical harassment for all the species anticipated to occur within the ZOI for each type of pile installation or removal activities. Table 24 presents a summary of the total take for each species and the take as a percentage of the total estimated stock size.

TABLE 24. SUMMARY OF REQUESTED LEVEL A AND LEVEL B HARASSMENT TAKE, BY SPECIES

Marine Mammal Species	Stock Size	Requested Level A	Requested Level B	Total Take Requested	Take, as Percentage of Total Stock
Pacific harbor seal (*Phoca vitulina*)	11,036	4	1,465	1,469	13
Northern elephant seal (*Mirounga angustirostris*)	179,000	0	1	1	Less than 1
California sea lion (*Zalophus californianus*)	296,750	0	1,695	1,695	Less than 1
Steller sea lion (*Eumetopias jubatus*)	41,638	0	185	185	Less than 1
Harbor porpoise (*Phocoena phocoena*)	11,233	32	3,430	3,462	31
Dall's porpoise (*Phocoenoides dalli*)	25,750	2	194	196	Less than 1
Long-beaked common dolphin (*Dephinus capensis)*	101,305	0	20	20	Less than 1
Common bottlenose dolphin (*Tursiops truncatus*)	1,924	0	2	2	Less than 1
Southern resident killer whale DPS (*Orcinus orca*)	76	0	24	24	32
Transient killer whale (*Orcinus orca*)	240	0	42	42	18
Humpback whale (*Megaptera novaeangliae*)	1,918	0	5	5	Less than 1
Gray whale (*Eschrichtius robustus*)	20,990	0	3	3	Less than 1
Minke whale (*Balaenoptera acutorostrata*)	636	0	2	2	Less than 1

SECTION 7. ANTICIPATED IMPACT OF THE ACTIVITY

Incidental take estimates are provided in Section 6. Based on previous monitoring for work occurring at the EBSP, incidental takes often involve multiple individuals, rather than single takes of unique individuals. The stock take calculations identified in Tables 14 to 23 in Section 6 assume takes of individuals; therefore, the stock take percentage calculations summarized in Table 24 are very conservative.

The project is not anticipated to cause permanent harm or lethal take of any marine mammal species. Behavioral impacts of the activity are not expected to include impacts to important feeding or breeding behaviors, as the project area is typically only sporadically utilized for transit by most marine mammals. If incidental takes occur, they are expected to result in only short-term changes and potential temporary hearing threshold shift. Further, the redevelopment of Pier 62 will not create barriers to entrance or egress from biologically important areas, nor will work occur during a critical time or in a critically important habitat location.

Overall, the potential Level A and Level B harassment takes identified in Section 6 is not expected to have any impact on stock recruitment or survival, and therefore would have a negligible impact on the stocks of any of the species evaluated.

SECTION 8. ANTICIPATED IMPACTS ON SUBSISTENCE USES

Not applicable. The proposed activity will take place in Seattle, Washington; therefore, there are no relevant subsistence uses of marine mammals implicated by this action.

Currently, there are no authorized ceremonial and/or subsistence hunts for marine mammals in Puget Sound or the San Juan Islands (Norberg 2007, as cited in WSDOT 2016), with the possible exception of some coastal tribes, which may allow a small number of directed take for subsistence purposes.

SECTION 9. ANTICIPATED IMPACTS ON HABITAT

The Pier 62 Project could potentially affect habitat and the overall Elliott Bay ecosystem via effects to water quality (increases in turbidity levels), prey species distribution, and passage obstructions. However, as there are no permanent passage obstructions within the project area, any negative effects would be temporary in nature and would not result in long-term effects to habitat.

9.1 WATER QUALITY

The types of water quality effects from the Pier 62 Project include the generation of short-term turbidity or resuspension of contaminated sediments during pile removal and pile driving. These effects would be minimized by the use of silt curtains. The Washington State Department of Ecology will require that water quality standards be met throughout the construction duration; thus, no adverse effects are expected to marine mammals, and only minor short-term disturbance would occur to their prey species, such as salmonids and marine invertebrates. The short-term changes in turbidity affect only a small proportion of the available habitat in the Puget Sound (i.e., within 100 feet of the construction activity).

Water quality monitoring was conducted for the EBSP between 2013 and 2016. Turbidity generated from project activities was only observed to disperse up to approximately 50 feet and then quickly dissipated (SDOT 2014, 2015, 2016).

9.2 EFFECTS TO PREY SPECIES

Prey species for the various marine mammals discussed in this document include marine invertebrates and fish species. Short-term effects would occur to marine invertebrates during removal of existing piles. This effect is expected to be minor and short-term on the overall population of marine invertebrates in Elliott Bay. Construction will also have temporary effects on salmonids and other fish species in the project area due to disturbance, turbidity, noise, and the potential resuspension of contaminants. All in-water work will occur during the designated in-water work window, to avoid and minimize effects on juvenile salmonids. Additionally, marine resident fish species are only present in limited numbers along the seawall during the in-water work season and primarily occur during the summer months, when work would not be occurring (Anchor QEA 2012).

The Pier 62 Project is not expected to have measurable effects on the distribution or abundance of potential marine mammal prey species, because any adverse effects on prey species will be short term, there are many fish and prey species in Puget Sound, and mitigation measures to protect fish during construction will be used.

SECTION 10. ANTICIPATED EFFECTS OF HABITAT IMPACTS ON MARINE MAMMALS

The proposed project will not result in a significant permanent loss or modification of habitat for marine mammals or their food sources. The most likely effects on marine mammal habitat for the proposed project are temporary, short-duration in-water noise; temporary prey (fish) disturbance; and localized, temporary water quality effects. The direct loss of habitat available to marine mammals during the project is expected to be minimal.

SECTION 11. MITIGATION MEASURES

Several conservation measures are proposed for mitigating effects on marine mammals from the pile installation and removal at Pier 62. During pile removal and/or installation, trained protected-species observers will monitor for marine mammals in the area of potential effects during all periods of pile removal and/or installation.

A bubble curtain will be used during pile driving with an impact hammer.

Exclusion Zones will be established outside of the PTS isopleths to protect marine mammals from Level A harassment. If a marine mammal is observed at or within the Exclusion Zone, work will stop until the individual has been observed outside of the zone, or has not been observed for at least 15 minutes for pinnipeds and 30 minutes for whales. In addition, acoustic monitoring will occur on up to six days per in-water work season to evaluate, in real time, sound production from construction activities. More information on marine mammal monitoring is provided in Section 13, and in Appendix A (Marine Mammal Monitoring Plan for the Pier 62 Project, May 2018).

Although marine mammals would be mostly protected from Level A harassment by employing observers and stopping work when marine mammals enter the appropriate Exclusion Zones, these protection measures may not be completely effective at all times. Therefore, a "soft-start" technique will be required at the beginning of each day's in-water pile installation via impact hammer and when impact hammer pile-related activities have ceased for more than one hour. The contractor will be required to provide an initial set of three strikes from the impact hammer at reduced energy, followed by a one-minute waiting period, then two subsequent three-strike sets.

All Pier 62 construction activities will be performed in accordance with the established standards. These activities are subject to state and local permit conditions and use the best guidance available to accomplish the necessary work while avoiding and minimizing environmental effects to the greatest extent possible, including the following best management practices (BMPs):

- The contractor shall be responsible for the preparation of a Spill Prevention, Control, and Countermeasures (SPCC) plan to be used for the duration of the project. The plan shall be submitted to the project engineer prior to the commencement of any construction activities. A copy of the plan with any updates would be maintained at the work site by the contractor.
- The SPCC shall outline BMPs, responsive actions in the event of a spill or release, and identify notification and reporting procedures. The SPCC shall also outline contractor management elements such as personnel responsibilities, project site security, site inspections, and training.
- The SPCC would outline what measures shall be taken by the contractor to prevent the release or spread of hazardous materials, either found on site and encountered during construction but not identified in contract documents, or any hazardous materials that the contractor stores, uses, or generates on the construction site during construction activities. These items include, but are not limited to, gasoline, oils, and chemicals.
- The contractor shall maintain, at the job site, the applicable spill response equipment and material designated in the SPCC plan.
- The contractor shall regularly check fuel hoses, oil drums, oil or fuel transfers valves, and fittings for leaks, and shall maintain and store materials properly to prevent spills.

SECTION 12. ARCTIC PLAN OF COOPERATION

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

SECTION 13. MONITORING AND REPORTING

Marine mammal monitoring and acoustic monitoring will be conducted as described in the Marine Mammal Monitoring Plan for the Pier 62 Project (Appendix A). A summary is provided below.

13.1 MARINE MAMMAL MONITORING

Marine mammal monitoring will be conducted at all times during in-water pile driving and removal in strategic locations around the area of potential effects. During pile removal or installation with a vibratory hammer, a three-to-four-monitor protocol would be used, positioned such that each monitor has a distinct view-shed

and the monitors collectively have overlapping view-sheds. Three or more monitors will be used for vibratory timber removal and four monitors will be used for vibratory steel installation. When pile driving activities are limited to an impact hammer, one monitor, based at or near the construction site, will conduct the monitoring. In the case where visibility becomes limited, additional land-based monitors and/or boat-based monitors may be deployed.

Monitors will record take when marine mammals enter the relevant Level B Harassment Zone based on type of construction activity. If a marine mammal approaches the Exclusion Zone, the observation will be reported to the Construction Manager and the individual will be watched closely. If the marine mammal crosses into the Exclusion Zone, a stop-work order will be issued. If a stop-work order is triggered, the observed marine mammal(s) will be closely monitored while it remains in or near the Exclusion Zone, and only when it moves well outside of the Exclusion Zone or has not been observed for at least 15 minutes for pinnipeds and 30 minutes for whales will the lead monitor allow work to recommence. It will be up to the best scientific judgment of the monitor(s) observing the marine mammal to determine when it has moved far enough away from the Exclusion Zone.

13.2 ACOUSTIC MONITORING

Acoustic monitoring will be conducted during in-water pile installation and removal during season 2. Hydroacoustic monitoring for vibratory removal of timber piles was conducted during Season 1 activities. If feasible, it will also be conducted for that activity during Season 2 as well. However, because Season 2 vibratory timber pile removal will be based on safety hazards and immediate project needs, it might not be possible to arrange for acoustic monitoring. It is likely that vibratory and impact installation will be occurring concurrently. Acoustic monitoring will be conducted on 6 days during Season 2, with a goal of recording sound data during each scenario of equipment operating (vibratory, impact, or both concurrently).

Collection of the acoustic data will be accomplished using a minimum of two hydrophones. At least one land-based microphone would also be deployed to record airborne sound levels. For underwater acoustic monitoring, the hydrophones will be placed such that there is a direct line of acoustic transmission through the water column between the impact or vibratory hammer and the hydrophones, without any interposing structures (including other piles) that could impede sound transfer, when possible. All acoustical recordings will be conducted approximately one meter below the water surface and one meter above the sea floor, or as applicable to optimize sound recordings in the nearshore environment.

Background noise recordings (in the absence of pile-related work) will also be made during the study to provide a baseline background noise profile. The results and conclusions of the study will be summarized and presented to NOAA/NMFS with recommendations on any modifications to this proposed plan or Exclusion Zones.

13.3 REPORTING

The City of Seattle will consult with NOAA/NMFS for direction on how to proceed in the following situations:

- The allowable Level B harassment take is met, and work is not complete.
- The acoustic monitoring data show that noise levels are consistently higher than anticipated.

The City of Seattle will submit written reports for each in-water construction season detailing the results of marine mammal monitoring and acoustic monitoring. The Marine Mammal Monitoring Report will include a description of the pile driving or removal activities and the monitoring effort. It will also provide total takes, takes by day, stop-work orders for each species, and information on observed behavior. The Acoustic Monitoring Report will provide details on the monitored piles, method of installation, monitoring equipment, and sound levels documented during monitoring.

SECTION 14. SUGGESTED MEANS OF COORDINATION

The project team will monitor and coordinate with local marine mammal sighting networks (i.e., Orca Network and/or the Center for Whale Research) to gather information on the location of whales prior to initiating pile removal. Marine mammal monitoring will be conducted to collect information on the presence of marine mammals within the ZOIs for this project. The project team will also coordinate with WSF to discuss marine mammal sightings on days when vibratory or impact removal is occurring on their nearby projects. In addition, reports will be made available to interested parties upon request.

During Season 1, Seattle DOT carried out additional voluntary mitigation measures during pile driving and removal activities to minimize impacts from noise on the Seattle Aquarium's captive marine mammals as well as for air and water quality concerns. These measures were successfully coordinated and implemented, and Seattle DOT will implement the same measures during Season 2 work, as follows:

1. If aquarium animals are determined by the Aquarium veterinarian to be distressed, Seattle DOT will coordinate with Aquarium staff to determine appropriate next steps, which may include suspending pile driving work for 30 minutes, provided that suspension does not pose a safety issue for the Pier 62 project construction crews.
2. Seattle DOT will make reasonable efforts to take at least one regularly scheduled 20-minute break in pile driving each day.
3. Seattle DOT will regularly communicate with the Aquarium staff when pile driving is occurring.
4. Seattle DOT will further coordinate with the Aquarium to determine appropriate methods to avoid and minimize impacts to water quality.
5. Seattle DOT does not anticipate the project resulting in impacts associated with airborne dust. If, during construction, odors associated with the project are an issue, Seattle DOT will coordinate with its contractor to determine appropriate mitigation measures.

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FIGURES

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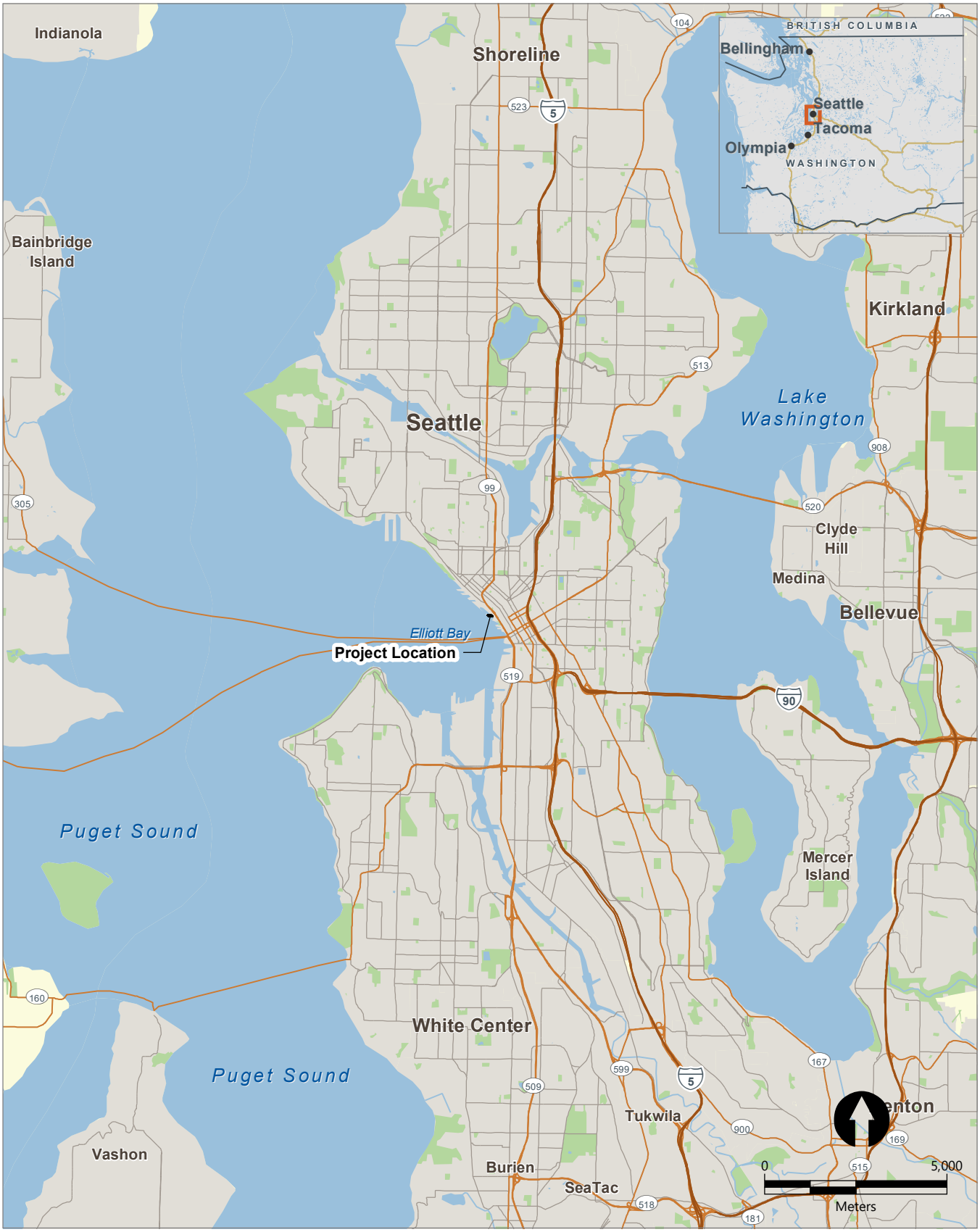

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ANCHOR QEA

Figure 1
Project Vicinity Map
Pier 62 Project
Seattle, Washington

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LEGEND:

Extent of Pile-related Activity

0 150

Meters

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ANCHOR QEA

Figure 2
Project Site Map
Pier 62 Project
Seattle, Washington

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APPENDIX A
MARINE MAMMAL MONITORING PLAN

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Marine Mammal Monitoring Plan for the Pier 62 Project

May 16, 2018

Initial Submittal: December 5, 2017

Submitted by:

City of Seattle
Department of Transportation
700 5th Avenue, Suite 3900
Seattle WA 98124

Prepared by:
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City of Seattle

Marine Mammal Monitoring Plan

Pier 62 Project

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS, ABBREVIATIONS AND DEFINITIONS

dB	decibel
Hz	hertz
kHz	kilohertz
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
RMS	root mean square
SEL	sound exposure level

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SECTION 1. INTRODUCTION

The proposed monitoring plan for the Pier 62 Project includes a construction monitoring protocol as well as guidelines for construction activities associated with pile installation and removal. Monitoring would occur by observing construction activities and the surrounding marine environment for signs of marine mammals and/or potential threats to marine mammals, as well as measuring underwater noise produced by in-water, pile-related activities. This Monitoring Plan is intended to retaining enough flexibility for the monitors to use their best scientific judgment for unforeseen events that will allow for optimal protection of marine mammals.

1.1 CONSTRUCTION MONITORING

For the Pier 62 Project, monitoring of in-water, pile-related construction would be accomplished by land-based, protected-species observers. For work with a vibratory hammer, up to 4 monitors would be required. One monitor would be located at the construction site to survey the nearshore environment immediately surrounding active pile-related construction, and would be in close contact with construction personnel. Two monitors would be located on the north and south entrances to Elliott Bay. The forth monitor would be on a ferry travelling the Seattle to Bainbridge Island Ferry route. All observers would monitor the designated Exclusion and Level B Harassment Zones, which are listed in Table 1 and shown on Figures 1 through 3.

TABLE 1. SUMMARY OF EXCLUSION ZONE THRESHOLDS

Hearing Group	Exclusion Zone Thresholds[1]	Pile Driver Type	Pile Type
Low-frequency cetaceans	27.3 meters	Vibratory	Timber extraction
	504.8 meters	Vibratory	Steel pile
	88.6 meters	Impact	Steel pile
Mid-frequency cetaceans	10 meters	Vibratory	Timber extraction
	44.7 meters	Vibratory	Steel pile
	10 meters	Impact	Steel pile
High-frequency cetaceans	40.4 meters	Vibratory	Timber extraction
	746.4 meters	Vibratory	Steel pile
	105.6 meters	Impact	Steel pile
Phocid pinnipeds	16.6 meters	Vibratory	Timber extraction
	306.8 meters	Vibratory	Steel pile
	47.4 meters	Impact	Steel pile
Otariid pinnipeds	10 meters	Vibratory	Timber extraction
	21.5 meters	Vibratory	Steel pile
	10 meters	Impact	Steel pile

Note:
1. Radius distance from point-source, pile-related noise. Stop-work order will be issued if threshold is crossed.

When pile driving is limited to installation with an impact hammer, one monitor, based at or near the construction site, will conduct monitoring. In the case where visibility becomes limited, additional land-based monitors and/or boat-based monitors may be deployed.

Acoustic monitoring would also occur during in-water pile driving and removal activities to document actual sound levels generated. Details regarding these aspects are discussed in the following sections.

1.1.1 Exclusion Zone Monitoring

Proposed Exclusion Zone Thresholds are provided in Table 1. Each Exclusion Zone Threshold and Level B harassment zone was determined by using the Practical Spreading Model for the pile types proposed; ambient acoustic data for collected during Season 1 of the Pier 62 project (Greenbusch Group 2018); hydroacoustic monitoring for Season 1 of the Pier 62 project (Greenbusch Group 2018); hydroacoustic monitoring for the Elliott Bay Seawall Project Seasons 1, 2, 3, and 4 (Anchor QEA 2014, 2015, 2016, and 2017); and the National Oceanic and Atmospheric Administration's 2016 guidance (NOAA 2016). All thresholds represent radii distances from the point-source, pile-related work, and each is specific to marine mammal hearing groups. In addition, the Exclusion Zones and Level B Harassment Zones are specific to the type of pile activity (installation via impact or vibratory hammer, removal via vibratory hammer), and pile type (steel or timber).

Exclusion Zones, which have been established by hearing group per NOAA's 2016 guidance, are intended to provide a physical threshold that, when crossed by a given marine mammal species, will trigger a stop-work order for in-water pile installation or removal (NOAA 2016). In the event that a stop-work order is triggered, the observed marine mammal(s) will be closely monitored while it remains in or near the Exclusion Zone, and only when it moves well outside of the Exclusion Zone or has not been observed for at least 15 minutes for pinnipeds and 30 minutes for whales, will the lead monitor allow work to recommence. It will be up to the best scientific judgment of the monitor(s) observing the marine mammal to determine when it has moved far enough away from the Exclusion Zone.

All marine mammals that are near an applicable Exclusion Zone Threshold will be closely monitored, and every precaution will be taken to ensure they are not harmed in any way. If an individual marine mammal shows signs of distress or unexpected behavior, even while they are well outside of an applicable Exclusion Zone Threshold, a stop-work order will be issued and further consultation will be made with NOAA/National Marine Fisheries Service (NMFS).

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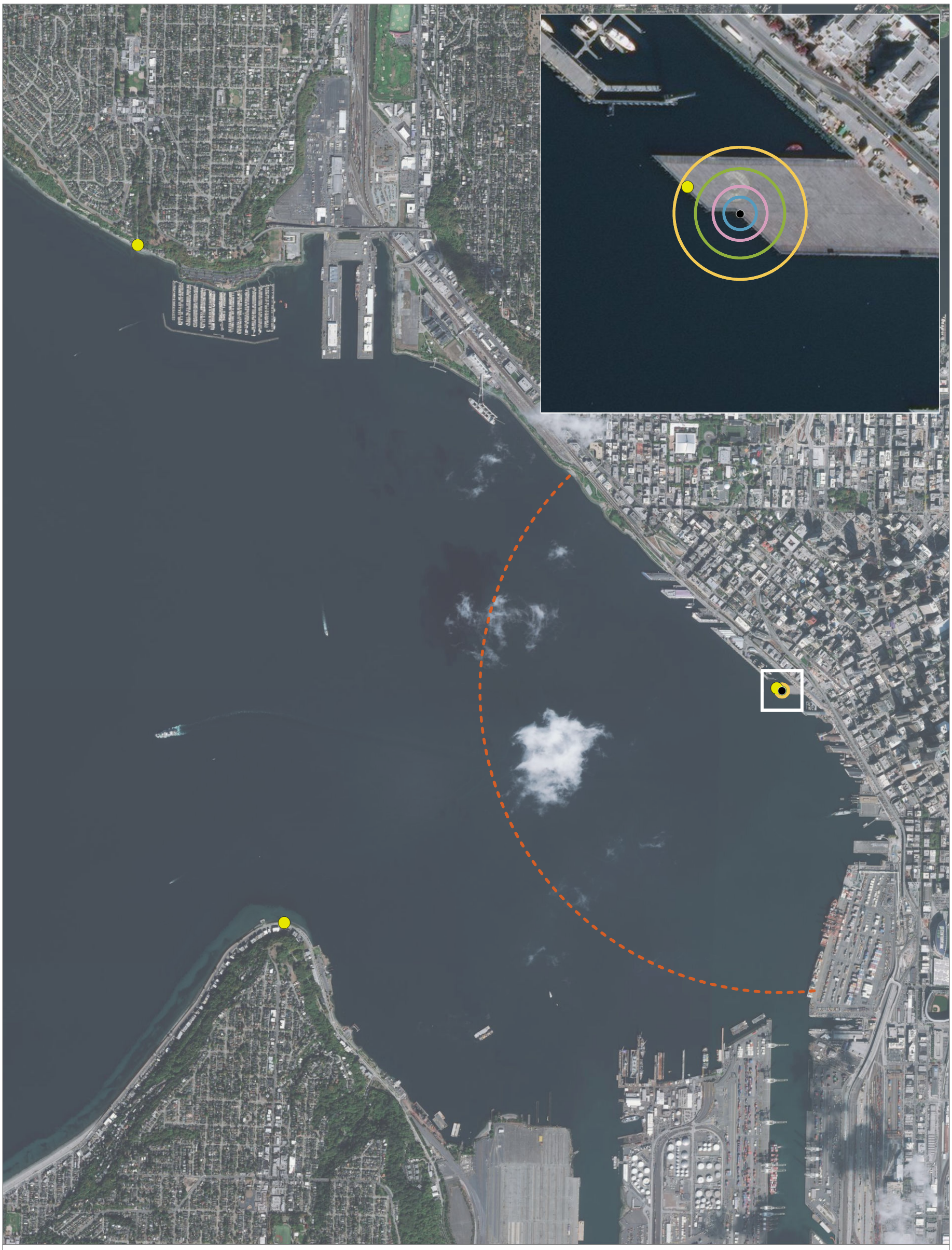

LEGEND:

Exclusion Zone – Vibratory Removal (Timber Pile)[1]

- High-Frequency Cetaceans (133 feet / 40.4 meters)
- Low-Frequency Cetaceans (90 feet / 27.3 meters)
- Phocid Pinnipeds (54 feet / 16.6 meters)
- Mid-Frequency Cetaceans and Otariid Pinnipeds (33 feet / 10 meters)

Level B Harassment Zone – All Hearing Groups[2]

- 14-inch Timber Pile Vibratory Removal (6,063 feet / 1.1 miles / 1,848 meters to Exclusion Zone)

- Marine Mammal Monitor Location
- Hammer Location

NOTES:
1. Exclusion zones will be adjusted as needed, based on location of hammer operations.
2. Harassment zone extends from the dashed line (1,848 meters) to the exclusion zone for each hearing group.

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Meters

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ANCHOR QEA

Figure 1
Exclusion and Level B Harassment Zones for Vibratory Pile Removal
Pier 62 Project – Marine Mammal Monitoring Plan
Seattle, Washington

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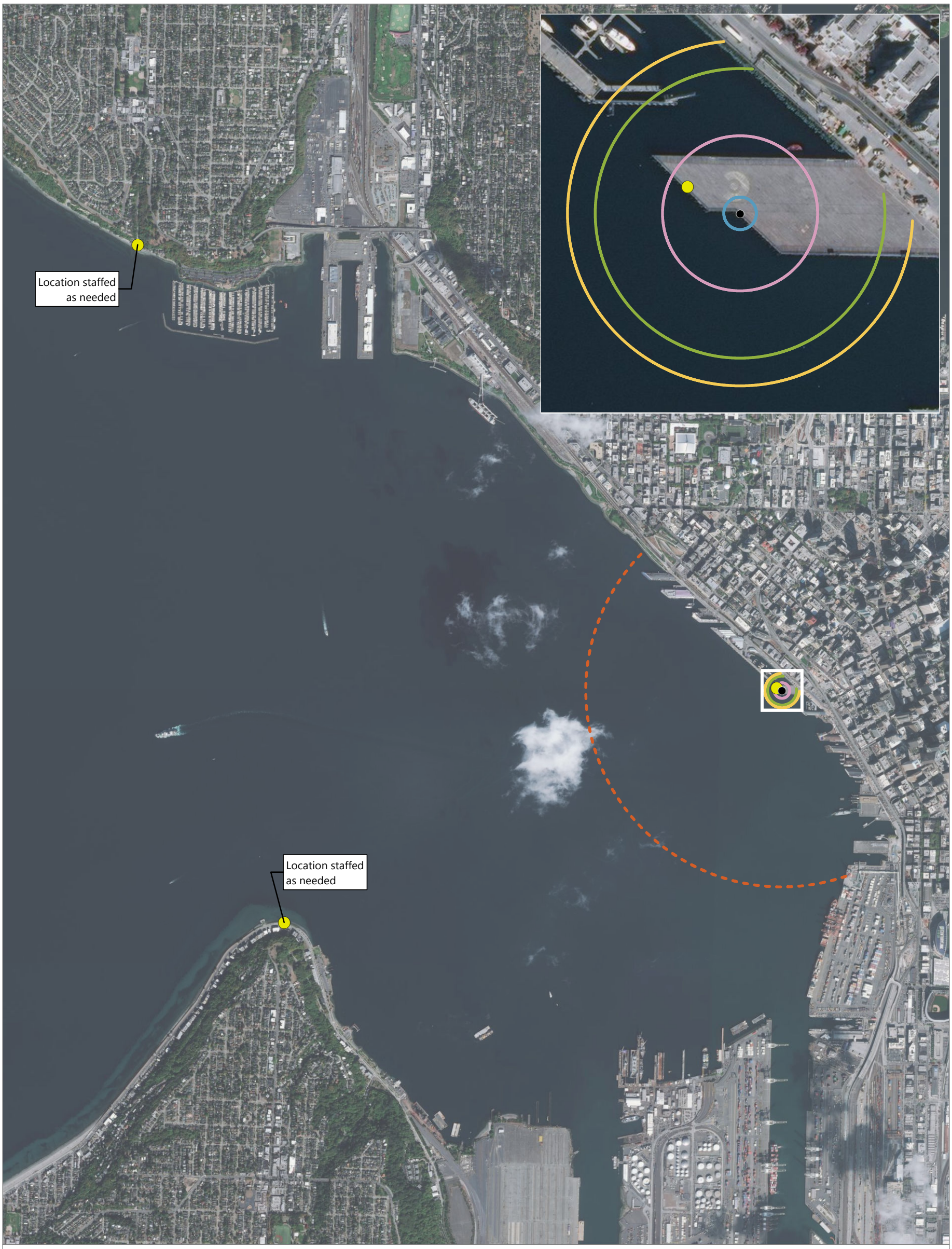

LEGEND:

Exclusion Zone – 30-inch Impact Installation[1]

- Mid-frequency Cetaceans and Otariid Pinnipeds (33 feet / 10 meters)
- Phocid Pinnipeds (156 feet / 47.4 meters)
- Low-frequency Cetaceans (291 feet / 88.6 meters)
- High-frequency Cetaceans (347 feet / 105.6 meters)

Level B Harassment Zone

Mid-Frequency Cetaceans and Otariid Pinnipeds[2]

- All Cetaceans, Otariids, and Phocids (3,940 feet / 0.8 miles / 1,201 meters)

- Marine Mammal Monitor Location
- Hammer Location

NOTES:
1. Exclusion zones will be adjusted as needed, based on location of hammer operations.
2. Harassment zone extends from the dashed line (1,201 meters) to the exclusion zone for each hearing group.

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Meters

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Figure 2
Exclusion and Level B Harassment Zones for Impact Pile Driving
Pier 62 Project – Marine Mammal Monitoring Plan
Seattle, Washington

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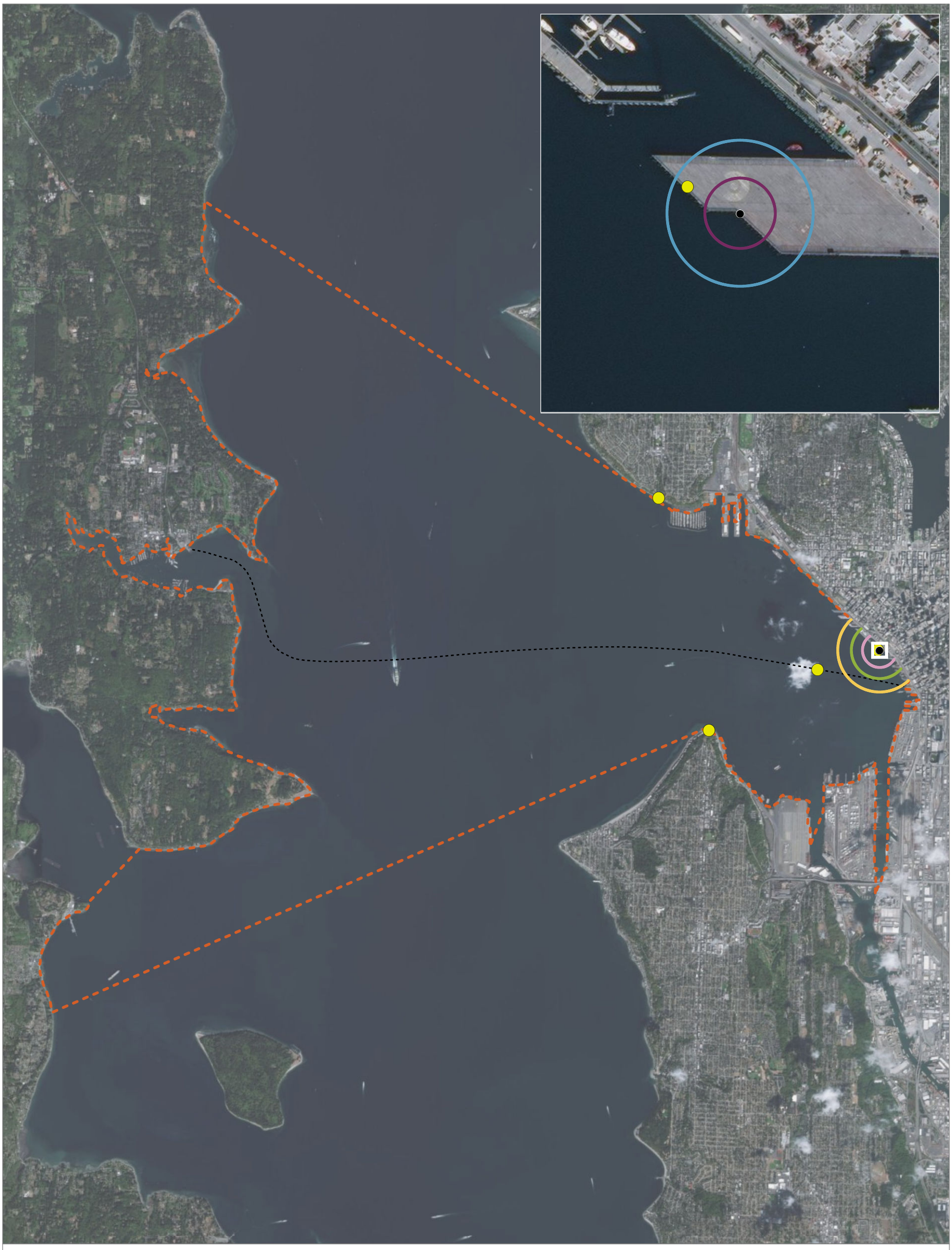

LEGEND:

Exclusion Zone – Vibratory Installation (Steel Pile)

- Otariid Pinnipeds (72 feet / 22 meters)
- Mid-Frequency Cetaceans (148 feet / 45 meters)
- Phocid Pinnipeds (1,007 feet / 307 meters)
- Low-Frequency Cetaceans (1,656 feet / 505 meters)
- High-Frequency Cetaceans (2,449 feet / 746 meters)

Level B Harassment Zone - All Hearing Groups[1]

- All Cetaceans, Otariids, and Phocids (112,027 feet / 21.2 miles / 34,146 meters)

- Marine Mammal Monitor Location
- Hammer Location
- Seattle-Bainbridge Island Ferry

NOTES:

1. Level B zone measured from end of permanent threshold shift for each hearing group out to common land-based attenuation points shown on map.
2. Harassment zone extends from the dashed line (34,146 meters) to the exclusion zone for each hearing group.

0 1,980

Meters

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ANCHOR QEA

Figure 3
Exclusion and Level B Harassment Zones for Vibratory Pile Driving
Pier 62 Project – Marine Mammal Monitoring Plan
Seattle, Washington

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1.1.2 Stop-work Order Protocol

When a marine mammal is observed approaching the applicable Exclusion Zones (see Table 1 and Figures 1 through 3), the monitor(s) will immediately notify the construction manager of the direction of travel and distance of the marine mammal relative to the Exclusion Zone. A stop-work order would be immediately issued if a monitor observes a marine mammal clearly crossing an applicable Exclusion Zone, regardless of observed marine mammal behavior. In response, the construction manager will immediately require the operator of the vibratory or impact hammer to stop work.

Following issuance of a stop-work order, the marine mammal will be closely monitored and updates of location and behavior will be provided to the construction manager at appropriate intervals, likely less than 15 minutes apart. The marine mammal will continue to be monitored while it is within the Exclusion Zone until it has clearly moved out of and away from the threshold, has not been observed for at least 15 minutes for pinnipeds or 30 minutes for whales, or when the end of the work day is reached.

Work will resume after the marine mammal monitor(s) has notified the construction manager that the marine mammal has moved outside of, and is headed away from, the Exclusion Zone or has not been observed for at least 15 minutes for pinnipeds or 30 minutes for whales. At times, unanticipated scenarios may be encountered by the marine mammal monitors, who will use their best scientific judgment to make conservative decisions to ensure no marine mammal will be harmed by in-water operation of a vibratory or impact hammer.

1.1.3 Level B Behavioral Harassment Zones

In addition to monitoring the Exclusion Zones described above, protected-species observers will also monitor the Level B Harassment Zones. These zones vary by activity but are the same for all hearing groups. Table 2 provides a summary of the Level B Harassment Zones for each activity. The Level B Harassment Zone starts at the activity-specific Exclusion Zone for the relevant hearing group and extends in a radial arc out to the distance indicated in the table. The distance to the Level B Harassment Zone for vibratory installation of steel piles stops short of the modeled distance due to intervening land masses.

TABLE 2. SUMMARY OF LEVEL B HARASSMENT ZONES

Pile Type and Activity	Pile Driver Type	Distance to Level B Harassment Zone
Timber extraction	Vibratory	1,848 meters
Steel pile installation	Impact	1,201 meters
	Vibratory	34,146 meters

Within this monitoring area, the cumulative daily number of take will be documented throughout each pile-related work day. All sightings of marine mammals will be documented by the monitors on a marine mammal sighting form (Attachment A). A take will be documented for each individual marine mammal no more than once in a 24-hour period. The monitors will keep an accurate take count of marine mammals sighted within their applicable Level B Harassment Zone, document each take on the sighting form, and notify the construction crew and other appropriate staff if any marine mammal has the potential to cross an applicable Exclusion Zone Threshold. Once a marine mammal is within the area of potential effects, the observers will track its movements and document its behaviors until it moves well out of the area.

1.2 ESTIMATED TAKE

Table 3 provides the number of takes for each marine mammal species requested by the City of Seattle for the Pier 62 Project. If the authorized total take for any particular species is reached at any point prior to the completion of in-water pile driving and/or removal, NOAA/NMFS will be immediately notified that the take has been reached and will be consulted for further guidance.

TABLE 3. REQUESTED INCIDENTAL LEVEL B HARASSMENT TAKE

Marine Mammal Species	Stock Size	Total Take Requested	Take, as Percentage of Total Stock
Pacific harbor seal (*Phoca vitulina*)	11,036	1,469	13
Northern elephant seal (*Mirounga angustirostris*)	179,000	1	Less than 1
California sea lion (*Zalophus californianus*)	296,750	1,695	Less than 1
Steller sea lion (*Eumetopias jubatus*)	41,638	185	Less than 1
Harbor porpoise (*Phocoena phocoena*)	11,233	3,462	31
Dall's porpoise (*Phocoenoides dalli*)	25,750	196	Less than 1
Long-beaked common dolphin (*Dephinus capensis)*	101,305	20	Less than 1
Common bottlenose dolphin (*Tursiops truncatus*)	1,924	2	Less than 1
Southern resident killer whale DPS (*Orcinus orca*)	76	24	32
Transient killer whale (*Orcinus orca*)	240	42	18
Humpback whale (*Megaptera novaengliae*)	1,918	5	Less than 1
Gray whale (*Eschrichtius robustus*)	20,990	3	Less than 1
Minke whale (*Balaenoptera acutorostrata*)	636	2	Less than 1

1.1.1 Marine Mammal Monitoring Protocol

Marine mammal monitors would be deployed in strategic locations around the area of potential effects at all times during in-water pile driving and removal. Monitors would be positioned as shown in Figure 3. In the case where visibility becomes limited, additional land-based monitors and/or boat-based monitors may be deployed.

It is anticipated that one monitor, located at or near the construction site, would be able to sufficiently monitor the Level B Harassment and Exclusion Zones during impact installation of steel piles (Figure 2).

However, up to three additional observers would be required at all times during vibratory pile driving or removal (Figures 1 and 3). Collectively, monitors positioned at these locations would be able to monitor the outer Exclusion Zone and surrounding marine environment at all times during pile-related construction. These zones would vary depending on the type of pile and method of installation.

One monitor will be stationed at the construction site near the activity. Two additional monitors would be stationed at designated viewpoints on the north and south entrance of Elliott Bay, likely at Hamilton Viewpoint Park (Alki Point) and at West 32nd Avenue (city pump station), providing them broad, unobstructed view-sheds. The fourth monitor would be stationed on a ferry traveling the Seattle-to-Bainbridge Island route. During vibratory pile installation, the monitor stationed at Alki Point will walk between the east and west sides of the point so that the full Level B Harassment Zone can be viewed.

Each marine mammal monitor will be tasked with continuously scanning their view-shed within the zone of influence, documenting all marine mammals and, if seen, closely tracking their behaviors and locations, and communicating their observations to the rest of the monitoring crew. Proper coordination between the team of monitors and the construction manager will be facilitated by a designated monitoring coordinator who will establish coordination details each morning prior to the start of construction, and strictly maintain them throughout the construction day. Monitors will have a clear understanding of the location of various zones that pertain to each type of pile activity and the associated marine mammal hearing groups, and will continually coordinate and update each other as well as other crew members, as appropriate. Communication will be primarily via cellular phone. Each monitor will have a list of contact phone numbers, including for the monitoring coordinator, construction manager, and other management and staff.

Coordination between monitors and construction contractors would occur at least once each day prior to the start of work. This coordination would include a review of the pile-related work schedule and any marine mammal issues that could potentially occur. Other details provided to the monitors would include construction location, number and type of piles, timing, whether work would be pile installation or removal, and the type of hammer to be used. Any changes in pile-related work schedule will be conveyed to the monitors at least 30 minutes prior to their implementation, when possible.

Marine mammal monitoring will begin at least 30 minutes prior to the start of all pile driving and removal each day, and will continue at all times during active pile driving and removal. If necessary due to the presence of a marine mammal within or near the Exclusion Zone at the end of the pile-driving or removal shift, marine mammal monitoring will continue for up to 30 minutes following construction. If visibility precludes monitors from viewing their designated view-shed (due to fog or poor lighting), then pile-driving activities would not be allowed or alternate methods of monitoring must be employed (i.e., boat-based monitoring). Monitors will be continually updated on pile-related construction activities in a manner that would allow them to make adjustments to provide accurate and appropriate marine mammal observations.

All monitors will be trained protected-species observers with good eyesight and identification skills. Monitors will have received NOAA-approved training that covers detection, identification, and distance estimation (i.e., estimating the distance a marine mammal is from an observer) of all marine mammal species potentially found in and around Elliott Bay. Each monitor must pass an identification test conducted at the training. Each will have the experience and ability to conduct field observations and collect data according to this protocol. They will be experienced with directional orienteering, using binoculars and spotting scopes, efficiently accessing and

referencing marine mammal identification materials, understanding safety protocol, and writing field notes and entering data into the field datasheets (Attachment A). Each monitor will be properly equipped with necessary gear during their shift, including binoculars, field guides, compass, cellular phone, and back-up power.

Each monitor would work, on average, eight to 10 daylight hours per day and would be relieved by a new monitor if pile-related activities occur over a longer day or fatigue and/or lack of preparedness begins to decrease ability to detect marine mammals. If necessary, the number of monitors would be increased and/or their positions would be changed to ensure full visibility of the area of potential effects and to ensure early sighting of any marine mammal that enters the area. Monitors shall have no other responsibilities while making observations.

A comprehensive marine mammal monitoring plan manual will be assembled for the monitoring team prior to the start of in-water work. The manual will contain all relevant permit requirements and will describe the procedures the City of Seattle and its contractors will implement to comply with the conditions of applicable permits.

1.2.1 Marine Mammal Sighting Form

The sighting form will capture all necessary details important to marine mammal identification and protection during pile-related activities. See Attachment A for the sample sighting form.

The monitoring form will be used to record the following information:

- Background information
  - Date, observer name, and location.
  - Environmental conditions (weather, wind, waves), plus notes on conditions that could confound marine mammal detections and the time and location that they occurred.
- For marine mammal sightings
  - Species observed, number, pod composition, distance to pile-related activities, and behavior of marine mammals throughout duration of sighting.
  - Time of first and last sighting.
  - Discrete behavioral reactions to construction, if apparent.
  - Pile-related activities taking place concurrently with each sighting.
  - Monitor response including whether a stop-work order was issued, why, and for how long, or if a take was recorded.
  - The number of take(s) (by species), their locations, and behavior.

1.2.2 Acoustic Monitoring

Acoustic monitoring will be conducted during in-water pile installation and removal during season 2. Acoustic monitoring for vibratory removal of timber piles was conducted during Season 1 activities. If feasible, it will also be conducted during Season 2. However, because Season 2 vibratory timber pile removal will be based on safety hazards and immediate project needs, it might not be possible to arrange for acoustic monitoring. It is likely that vibratory and impact installation will be occurring concurrently.

Acoustic monitoring will be conducted on six days during Season 2, with a goal of recording sound data during each scenario of equipment operating (vibratory, impact, or both concurrently).

Collection of the acoustic data will be accomplished using a minimum of two hydrophones. At least one stationary land-based microphone would also be deployed to record airborne sound levels. For underwater acoustic monitoring, the hydrophones will be placed such that there is a direct line of acoustic transmission through the water column between the impact or vibratory hammer and the hydrophones, without any interposing structures (including other piles) that could impede sound transfer, when possible. All acoustic recordings will be conducted approximately one meter below the water surface and one meter above the sea floor, or as applicable to optimize sound recordings in the nearshore environment.

Background noise recordings (in the absence of pile installation or removal) will also be made during the study to provide a baseline background noise profile. The results and conclusions of the study will be summarized and presented to NOAA/NMFS with recommendations on any modifications to this proposed plan or Exclusion Zones.

All sensors, signal conditioning equipment, and sampling equipment will be calibrated at the start of the monitoring period to National Institute of Standards and Technology standards and will be re-checked at the start of each day.

A stationary two-channel hydrophone recording system will be deployed to record continuous sound associated with pile driving and removal activities during the monitoring period. Key methodological details are as follows:

- Prior to monitoring, water depth measurements will be made to ensure that hydrophones will not drag on the bottom during tidal changes. The hydrophones will be placed approximately one meter below the surface and one meter above the seafloor. The depth with respect to the bottom may vary somewhat due to tidal changes and current effects.
- The hydrophone systems will be deployed to maintain a constant distance of approximately 10 meters from the pile-related noise source.
- The hydrophones, signal conditioning, and recording equipment will be configured to acquire maximum source levels without clipping recorded data.

To empirically verify the modeled behavioral disturbance zones, underwater and airborne acoustic monitoring would occur for two days during each type of pile installation or removal activity. In the event that underwater sound monitoring shows that noise generation from pile installation or removal consistently exceeds the anticipated noise levels, as documented in the Incidental Harassment Authorization application, NOAA/NMFS will be consulted.

Post-analysis of underwater sound level signals would include the following:

- Impact Pile Driving
  - Determination of the maximum absolute value of the instantaneous pressure within each strike.
  - Root mean square (RMS) value for the period of which 90 percent of the energy is represented (RMS 90, 5 percent to 95 percent) for each absolute peak pile strike.

  - Mean and standard deviation/error of the RMS 90 percent for all pile strikes of each pile.
  - Rise time.
  - Number of strikes per pile and per day.
  - Number of strikes exceeding 206-decibel (dB) peak.
  - Sound exposure level (SEL) of the single pile strike with the absolute peak sound pressure, mean SEL.
  - Cumulative SEL (cumulative SEL = single strike SEL + 10*LOG (number of pile strikes)).
  - Frequency spectrum, between 20 hertz (Hz) and 20 kilohertz (kHz), for up to eight successive strikes with similar sound level.
- Vibratory Pile Driving and Removal
  - RMS values (average, standard deviation/error, minimum, and maximum) for each recorded pile. The 10-second, RMS-averaged values will be used for determining the source value and extent of the 120 dB underwater isopleth.
  - Frequency spectra will be provided for each functional hearing group as outlined in NOAA's 2016 guidance (NOAA 2016).
  - All underwater source levels will be standardized to a reference distance of 10 meters (33 feet).

Post-analysis of airborne noise will be presented in an unweighted format, and will include the following:

- The unweighted RMS values (average, minimum, and maximum) for each recorded pile. The average values will be used for determining the extent of the airborne isopleths relative to species specific criteria.
- Frequency spectra will be provided from 10 Hz to 20 kHz for representative pile-related activity.
- All airborne source levels will be standardized to a reference distance of approximately 15 meters (50 feet).

Acoustic monitoring will be performed using a standardized method that will facilitate comparisons with other studies. In the event that pile-related noise trends toward consistently surpassing calculated levels, NOAA/NMFS will be contacted immediately to discuss the situation. Table 4 provides the anticipated noise levels by pile type and method.

TABLE 4. METHOD AND SOUND LEVEL SUMMARY

Construction Phase	Type	Installation/Removal Method	Source Sound Levels
Installation			
Pier 62	Steel pile 30-inch[1]	Vibratory	177 dB RMS[1,2,3] / 180 dB RMS[4]
	Steel pile 30-inch	Impact	189 dB RMS[5]
Removal			
Pier 62	Timber pile 14-inch	Vibratory	161 dB RMS[6]

Notes:

1. A template consisting of two 24-inch pipe piles connected by a structural steel frame will also be installed and removed as part of the general 30-inch steel pile installation activities, to correctly position the steel 30-inch piles. Sound source levels associated with installation and removal of 24-inch steel template piles are assumed to be no greater than installation of 30-inch steel piles (177 dB_{RMS}), and all monitoring for template pile installation and removal will conservatively occur using the thresholds identified for 30-inch steel pile installation.
2. Source sound level obtained from Port Townsend Test Pile Project: Underwater Noise Monitoring Final Report (Laughlin 2011).
3. Single source pile driving sound level
4. Additive source sound level for two piles driven simultaneously. For simultaneous operation of two vibratory hammers installing steel pipe piles, the 180 dB_{RMS} value is based on identical single-source levels, adding three dB based on WSDOT rules for decibel addition (2018).
5. Source sound level obtained from Colman Dock Test Pile Project 2016 (WSDOT 2016).
6. Hydroacoustic monitoring during Pier 62 Season 1 showed unweighted RMS ranging from 140 to 169 dB (Greenbusch Group 2018); the 75th percentile of these values is 161 dB_{RMS}. 161 dB_{RMS} was chosen to conservatively calculate thresholds.

dB – decibels
RMS – root mean square

1.3 REPORTING

In addition to capturing marine mammal monitoring data on field datasheets, a daily monitoring log and annual marine mammal monitoring and acoustic monitoring reports will be prepared.

1.3.1 Daily Monitoring Log

A running daily monitoring log will be maintained and updated at the end of each survey day, summarizing important observations and applicable aspects of construction. The daily monitoring log will summarize important details noted by the monitors in a format that readily conveys these details to interested and appropriate parties.

1.3.2 Annual Monitoring Reports

Each year, an annual monitoring report would be drafted and submitted to NOAA Office of Protected Resources, and NMFS Northwest Regional Office, at the end of each construction season. Each annual report would summarize information presented in the daily monitoring logs in a manner to effectively convey important marine mammal observations made during that year. The annual monitoring report would include the following:

- Data and time collected for each distinct marine mammal species observed in the project area.
- Weather conditions.
- Approximate distance between the marine mammal and the noise source.
- Activity at the construction site when a marine mammal was sited.
- A summary of take issued per species that year and to date.
- A summary of any stop-work orders given that year including number, species involved, and circumstances.
- Descriptions of marine mammal species observed, overall numbers of individuals observed, frequency of observation, behavior and any behavioral changes, and context of the changes relative to construction activities.
- Other important details that would provide context to the marine mammal observations made that year.

1.3.3 Acoustic Monitoring Report

Each year, a report providing the results of all acoustic monitoring would also be drafted and submitted to NOAA/NMFS. This reports would include the following:

- Size and type of piles monitored.
- A detailed description of any sound attenuation device used, including design specifications.
- The impact hammer energy rating used to drive the piles, description of the vibratory hammer, and make and model of the hammer(s).
- A description of the sound monitoring equipment.
- The distance between hydrophones and depth of water and the hydrophone locations.
- The depth of the hydrophones.
- The distance from the pile to the water's edge.
- The depth of water in which the pile was driven.
- The depth into the substrate that the pile was driven.
- The physical characteristics of the bottom substrate into which the pile was driven.
- The total number of strikes to drive each pile.
- The results of the hydroacoustic monitoring, including the frequency spectrum, ranges and means for the peak and RMS sound pressure levels, and an estimation of the distance at which RMS values reach the relevant marine mammal thresholds and background sound levels. Vibratory driving results would include the maximum and overall average RMS calculated from 10-second RMS values during the drive of the pile.
- A description of any observable marine mammal behavior in the immediate area and, if possible, correlation to underwater sound levels occurring at that time.

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ATTACHMENT A
PIER 62 MARINE MAMMAL MONITORING FORMS

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Pier 62 Marine Mammal Monitoring Form

Monitoring Location: ○ Const Site ○ Alki ○ Magnolia ○ Ferry	Observer:	Date:
Weather Conditions: ○ Sunny ○ Overcast ○ Rain ○ Whitecaps Average temp: Other conditions:		
Environmental Conditions Limiting MMM: ○ None ○ Yes - describe:		
MMM Start Time:	MMM End Time:	
Pile Activity (Begin, End, Breaks):		
Monitoring Type: ○ Vibe ○ Impact	Communication during Monitoring:	

Species	Species #	Time Begin	Time End	Duration	PD Distance (feet)	Take #	Behavior	Reactions to Pile Activity
				______ Hours ______ Minutes			○ Swimming ○ Foraging ○ Resting[1] ○ Intermittent ○ Other[2]	○ No pile activity ○ None observed ○ Yes[2]
				______ Hours ______ Minutes			○ Swimming ○ Foraging ○ Resting[1] ○ Intermittent ○ Other[2]	○ No pile activity ○ None observed ○ Yes[2]
				______ Hours ______ Minutes			○ Swimming ○ Foraging ○ Resting[1] ○ Intermittent ○ Other[2]	○ No pile activity ○ None observed ○ Yes[2]
				______ Hours ______ Minutes			○ Swimming ○ Foraging ○ Resting[1] ○ Intermittent ○ Other[2]	○ No pile activity ○ None observed ○ Yes[2]
				______ Hours ______ Minutes			○ Swimming ○ Foraging ○ Resting[1] ○ Intermittent ○ Other[2]	○ No pile activity ○ None observed ○ Yes[2]
				______ Hours ______ Minutes			○ Swimming ○ Foraging ○ Resting[1] ○ Intermittent ○ Other[2]	○ No pile activity ○ None observed ○ Yes[2]
				______ Hours ______ Minutes			○ Swimming ○ Foraging ○ Resting[1] ○ Intermittent ○ Other[2]	○ No pile activity ○ None observed ○ Yes[2]
				______ Hours ______ Minutes			○ Swimming ○ Foraging ○ Resting[1] ○ Intermittent ○ Other[2]	○ No pile activity ○ None observed ○ Yes[2]
				______ Hours ______ Minutes			○ Swimming ○ Foraging ○ Resting[1] ○ Intermittent ○ Other[2]	○ No pile activity ○ None observed ○ Yes[2]

Notes:

1. Resting on mooring buoy (hauled out), debris, or shoreline.
2. Describe behavior or reaction to pile activity here.

Total Daily Takes: CSL Takes = HS Takes = Other Takes =

Pier 62 Construction Site Lead Form

Lead Monitor:

Date	Vibe Ramp-up Time	Impact Ramp-up Time	Unable to Confirm Ramp-up[1]	Start and Stop Times,[2] Comments

Notes:

1. If unable to confirm proper ramp up procedures were followed, notify Jennifer Horwitz or the construction manager.
2. For breaks longer than one hour, ramp up procedures must be repeated. Please start a new data line.

APPENDIX B
NMFS SPREADSHEET FOR ASSESSING EFFECTS OF ANTHROPOGENIC NOISE ON MARINE MAMMAL HEARING

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E.1: IMPACT PILE DRIVING (STATIONARY SOURCE: Impulsive, Intermittent)

KEY	
	Action Proponent Provided Information
	NMFS Provided Information (Acoustic Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Pier 62 Reconstruction (Steel Pile Impact Installation)
PROJECT/SOURCE INFORMATION	Source information is from "Underwater Sound Level Report: Colman Dock Test Pile Project 2016". A bubble curtain was used during the test pile evaluation.
Please include any assumptions	
PROJECT CONTACT	Jill Macik, City of Seattle, 206-684-0602

STEP 2: WEIGHTING FACTOR ADJUSTMENT Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment[¥]	2	Relying on default due to lack of project-specific information

[¥] Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 64), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

NOTE: Choose either E1-1 OR E.1-2 method to calculate isopleths (not required to fill in sage boxes for both)

E.1-1: METHOD USING RMS SPL SOURCE LEVEL

Source Level (RMS SPL)	189
Activity Duration (h) within 24-h period OR Number of piles per day	4
Pulse Duration[Δ] (seconds)	0.45
Number of strikes in 1 h OR Number of strikes per pile	20
Activity Duration (seconds)	36
10 Log (duration)	15.56
Propagation (xLogR)	15
Distance of source level measurement (meters)	14

[Δ]Window that makes up 90% of total cumulative energy (5%-95%) based on Madsen 2005

RESULTANT ISOPLETHS* *Note: For impulsive sounds, action proponent must also consider isopleths peak sound pressure level (PK) thresholds (dual thresholds).

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS Isopleth to threshold (meters)	**382.9**	**13.6**	**456.1**	**204.9**	**14.9**

E.1-2: ALTERNATIVE METHOD (SINGLE STRIKE EQUIVALENT)

SEL_{cum} = SEL_{ss} + 10 Log (# strikes)	**195.0**

Source Level (Single Strike/shot SEL)	176
Number of strikes in 1 h OR Number of strikes per pile	20
Activity Duration (h) within 24-h period OR Number of piles per day	4
Propagation (xLogR)	15
Distance of single strike SEL measurement (meters)	14

RESULTANT ISOPLETHS* *Note: For impulsive sounds, action proponent must also consider isopleths peak sound pressure level (PK) thresholds (dual thresholds).

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS Isopleth to threshold (meters)	**88.6**	**3.2**	**105.6**	**47.4**	**3.5**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)[†]	**-0.01**	**-19.74**	**-26.87**	**-2.08**	**-1.15**

A: STATIONARY SOURCE: Non-Impulsive, Continuous

KEY	
	Action Proponent Provided Information
	NMFS Provided Information (Acoustic Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Pier 62 Reconstruction (Steel Pile Vibratory Installation)
PROJECT/SOURCE INFORMATION	Source level for 30-in steel piles was from test pile driving at Port Townsend Ferry Terminal in 2010. SPLrms for vibratory pile driving was 177 dB re 1 µPa. 3 dB was added for use of two hammers.
Please include any assumptions	
PROJECT CONTACT	

STEP 2: WEIGHTING FACTOR ADJUSTMENT — Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment[¥]	2.5

Relying on default due to lack of project-specific information.

[¥] Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 43), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

Source Level (RMS SPL)	180
Activity Duration (hours) within 24-h period	8
Activity Duration (seconds)	28800
10 Log (duration)	44.59
Propagation (xLogR)	15
Distance of source level measurement (meters)	10

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	199	198	173	201	219
PTS Isopleth to threshold (meters)	**504.8**	**44.7**	**746.4**	**306.8**	**21.5**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.05**	**-16.83**	**-23.50**	**-1.29**	**-0.60**

A: STATIONARY SOURCE: Non-Impulsive, Continuous

KEY	
	Action Proponent Provided Information
	NMFS Provided Information (Acoustic Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Pier 62 Reconstruction (Vibratory Timber Removal)
PROJECT/SOURCE INFORMATION	The Greenbusch Group 2018 (Draft Report for Year 1 Pier 62)
Please include any assumptions	
PROJECT CONTACT	Jill Macik, City of Seattle, 206-684-0602

STEP 2: WEIGHTING FACTOR ADJUSTMENT — Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment[¥]	2.5	Relying on default due to lack of project-specific information.
[¥] Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab		
		† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 43), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

Source Level (RMS SPL)	161
Activity Duration (hours) within 24-h period	8
Activity Duration (seconds)	28800
10 Log (duration)	44.59
Propagation (xLogR)	15
Distance of source level measurement (meters)	10

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	199	198	173	201	219
PTS Isopleth to threshold (meters)	**27.3**	**2.4**	**40.4**	**16.6**	**1.2**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.05**	**-16.83**	**-23.50**	**-1.29**	**-0.60**

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