Request for an Incidental Harassment Authorization
City of Cordova
Cordova Harbor Rebuild Project

Orca Inlet, Cordova, Alaska

April 2023

Prepared for:
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National Marine Fisheries Service

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ACRONYMS AND ABBREVIATIONS

4MP	Marine Mammal Monitoring and Mitigation Plan
ADA	Americans with Disabilities Act
ADF&G	Alaska Department of Fish and Game
ANSI	American National Standard Institute
AWC	Anadromous Waters Catalog
dB	decibel
DPS	Distinct Population Segment
DTH	down-the-hole
E	cumulative sound exposure level
EDPS	Eastern distinct population segment
EFH	Essential Fish Habitat
ESA	Endangered Species Act
HF	high frequency
HTL	high tide line
Hz	hertz
IHA	Incidental Harassment Authorization
kHz	kilohertz
LF	low frequency
LOA	Letter of authorization
M/SI	mortality/serious injury
MF	mid frequency
MLLW	Mean Lower Low Water
MMPA	Marine Mammal Protection Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OW	otariid
PBR	potential biological removal
pk	peak
PSO	protected species observer
PTS	Permanent Threshold Shift
PW	phocid
Rms	root mean squared
SEL	Sound Exposure Level
SPL	Sound Pressure Level
UME	unexpected mortality event
U.S.	United States
W	West
WDPS	Western distinct population segment
º	degree
µPa	micro pascal

1 DESCRIPTION OF SPECIFIED ACTIVITY

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

1.1 OVERVIEW

Through the Cordova Harbor Rebuild Project, the City of Cordova is proposing various replacements and improvements to the City's harbor. These improvements are summarized below.

The following components are proposed for Phase I:

- South Harbor float system replacements
- New South Harbor drive-down transfer bridge and service float (drive-down dock)
- New South Harbor bulkhead
- South Harbor parking improvements and new walkway

The following components are proposed for Phase II:

- Three-stage dock improvements
- Additional boat launch ramp lane
- New North Harbor net mending float
- New North Harbor bulkhead
- North Harbor parking improvements and new sidewalk
- Additional crane capacity on the T Dock

Under Phase I, the proposed replacements, repairs, and upgrades would remove all piles and floats for the existing 506 slips in the South Harbor, including 5 concrete main walk floats, one 40+ year-old timber main walk connected to a headwall, 3 timber trestles with steel gangways, and 1 concrete seaplane float. In the South Harbor, 130 existing creosote treated timber piles would be removed. For the new float system in the South Harbor, 255 steel piles would be installed to support between 5 main floats (G, H, I, J, K floats), 2 end floats (N, N' floats), 2 gangways, 1 access trestle, and a drive down transfer bridge and service float. These upgrades would provide 446 full-service slips for vessels ranging from 20 to 60 feet in length in the South Harbor. Electrical service lighting, potable water service, fire suppression lines, and safety equipment would be installed, and communications with wireless connections would be replaced within the South Harbor.

The existing South Harbor floatplane dock and associated pedestrian gangway would be replaced with a drive-down dock consisting of a new 15-foot by 125-foot vehicle access ramp and 80-foot by 80-foot service float. Two five-ton mounted hydraulic cranes and a sewer pump out station would be installed on the service dock to allow for convenient vessel loading. An approximately 1,150-linear-foot bulkhead would be installed above the high tide line (HTL, +16.2 feet) along the southside of the South Harbor floats that would be supported by H-piles and require excavating 10,000 cubic yards. There would be no dredging or excavation below HTL required within the South Harbor. Following excavation and installation of bulkhead H-piles, 15,000 cubic yards of a combination excavated soil and imported gravel fill would be placed behind the bulkhead. The South Harbor bulkhead would offer at a minimum 81 vehicle

parking spaces along the waterfront. There would be no changes to the adjacent parking areas available at the South Harbor on the south side of Nicholoff Way.

Under Phase II, the City of Cordova proposes to remove the creosote-timber pile supported "Science Center approach" (or "Old Grid") which is no longer in use in the North Harbor. Approximately 800 linear feet of bulkhead supported by sheet and H-piles would be installed along the north side of the North Harbor that would require dredging 22,000 cubic yards. The existing 205 slips available to vessels in the North Harbor would remain. Following dredging and installation of sheet piles, 47,300 cubic yards of a combination of dredge soil and imported gravel fill would be placed behind the bulkhead. The North Harbor bulkhead would include approximately 120 vehicle parking spaces, add lease areas, and alleviate related traffic issues on Breakwater Avenue, north of the harbor. Phase II would also include adding a five-ton mounted hydraulic crane on the T Dock. A new pile-supported net mending dock with moorage for two float planes would be added in the North Harbor. In the South Harbor, creosote-treated timber fender piles (16) protecting the existing three-stage would be replaced with steel piles, and a new boat launch ramp lane with fender piles would be added.

1.2 DETAILED DESCRIPTION OF SPECIFIC ACTIVITIES

1.2.1 Location

The City of Cordova is located on Orca Inlet in Prince William Sound, approximately 150 air miles southeast of Anchorage (Figure 1). The harbor is located southeast of Spike Island and west of downtown Cordova and accessed via road from Nicholoff Way (from the south), Breakwater Avenue (from the north), and Railroad Avenue (from the east) at Township 15S, Range 3W, Section 28 in the Copper River Meridian (Figure 2). The harbor consists of two areas: the South Harbor and the North Harbor. The construction staging area would be located immediately adjacent to the harbor.

Figure 1. Cordova Harbor Rebuild Project Vicinity Map

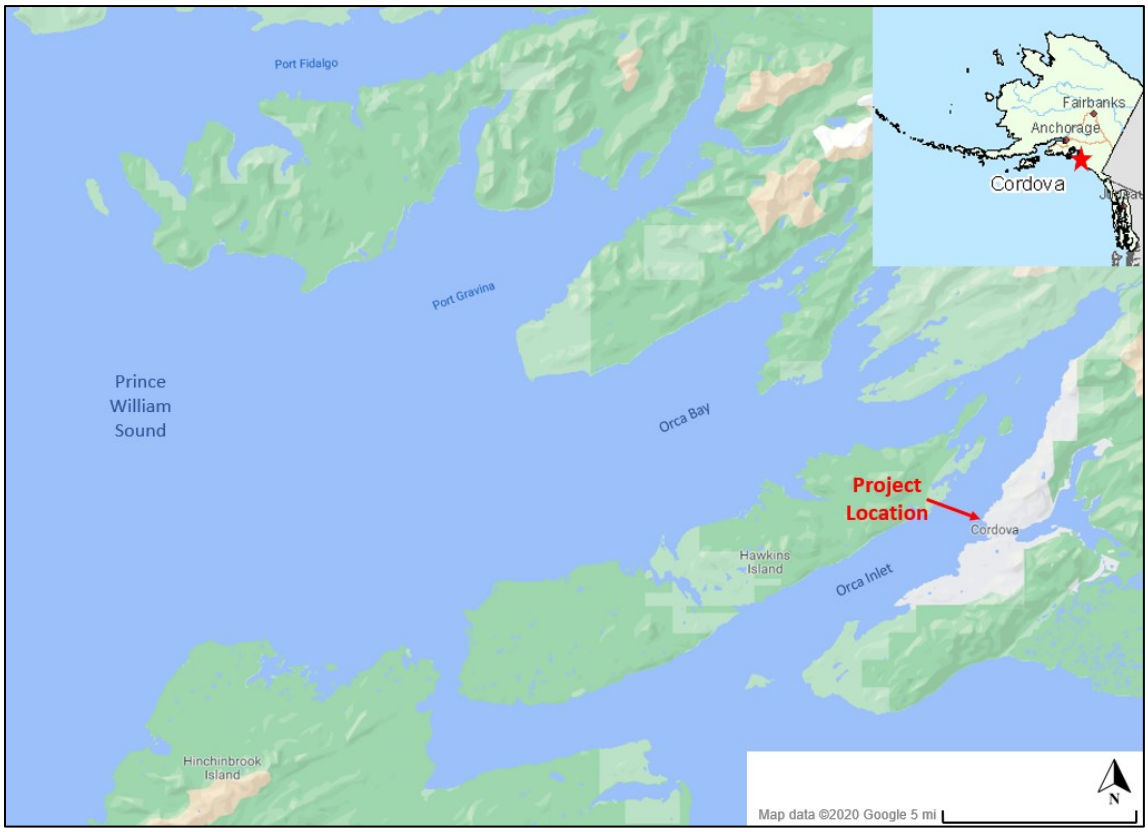


Figure 2. Cordova Harbor Rebuild Project Location

1.2.2 Purpose and Need

The purpose of this project is to improve Cordova's Harbor to offer safe vessel mooring and better accommodate the current and future commercial fishing industry and associated freight to support the local economy. Improvements would include replacing all the floats and gangways and adding a new drive-down floatplane and vessel service facility (drive-down dock) in the South Harbor. It would also include adding bulkheads and expanded upland areas to the North and South Harbors.

The harbor is the center of the Cordova's economy. With a capacity of 711 vessels, the harbor is one of Alaska's largest single basin harbors and houses one of the largest commercial fishing fleets in the country. Fishing vessels and seafood processors working out of the harbor are the reason Cordova ranked sixteenth in the US in 2018 for fishery landings with 59 million pounds delivered and eighteenth in the nation for value. In 2018, the total landings were worth $55 million. Out of approximately 2,600 year-round residents in Cordova, roughly 400 people hold commercial fishing licenses and work out of the harbor (City of Cordova 2022; City of Cordova 2023). About 950 employees work at five seafood processing facilities that are process fish supplied by vessels that use the harbor. The city estimates that over 1,000 jobs in Cordova (not counting fishermen) are related to fisheries.

The South Harbor float and gangway replacements are deteriorated and unsafe and need to be replaced to improve the function of critical infrastructure central to the city's economic stability. Gangways, access ramps, floats, and piles throughout the South Harbor show serious signs of wear, and the floats lack proper buoyancy. After 37 years of heavy use, the South Harbor has exceeded its design life and has reached the end of its service life. Prior to an extension of the harbor basin's breakwater in 2014, the South Harbor float system experienced excessive wear and damage from inadequate wave protection. A commissioned assessment of the harbor facilities in 2016 by PND Engineering rated the condition of the float system as "poor to serious." Many of the South Harbor issues present safety risks and without action, further deterioration is expected to advance those risks. Additionally, South Harbor gangways have a steep slope during low tide and are not compliant with the Americans with Disabilities Act (ADA; PND 2016).

The drive-down dock at the South Harbor is needed to facilitate essential commercial activities, including freight loading and unloading, the transfer of products to market by small independent fishers, direct waterside access for service trucks to complete repairs, and direct access for emergency response vehicles to the inner harbor facilities, vessels, and medivac floatplanes. The current loading areas (three-stage dock, seaplane float, boat launch ramp, and North Harbor loading dock) are overcrowded and have limited vessel use at a time, resulting in traffic congestion. The South Harbor drive-down dock would decrease congestion and improve safety and efficiency. Additionally, the drive-down dock would enable vessel repairs at all tide levels.

The North and South Harbor bulkheads and uplands are needed to provide additional vehicle parking and laydown areas to improve the overall productivity and functionality of the harbor. As a result of the current lack of parking availability at the North Harbor, fisherfolk must park far from the harbor and carry heavy supplies and equipment over long distances to their boats.

In addition, Breakwater Avenue is sloughing into the North Harbor and may become impassible without repair. These aspects of the harbor past their useful life and are no longer able to adequately support the vessels using the harbor, and some facilities are vacant and no longer in use. (Prince William Sound Science Center relocated to a new facility.)

The harbor improvements are also needed to support the community's year-round access to goods and services outside of Cordova. The State of Alaska dramatically reduced the Marine Highway sailing schedule, reducing the Cordova sailings from weekly service 11 months a year to no sailings at all between October and April. Consequently, Cordova residents rely on privately owned vessels to access Alaska's road system for half of each year. The proposed drive-down dock would facilitate convenient loading and transfer of equipment, goods, and supplies.

1.2.3 Anticipated Changes in Vessel Traffic

Currently, Cordova Harbor hosts a variety of vessels, including fishing and freight vessels, year-round. These types of vessels have used the harbor since its completion in 1983. This project will not increase the number of slips in the harbor, but will provide safer access to the existing slips. An increase in vessel traffic is not expected as a direct result of the proposed project.

1.2.4 Proposed Action

1.2.4.1 Phase I

Phase I of the Cordova Harbor Rebuild Project would involve improvements and repairs to the South Harbor over two construction phases.

Under Phase I, the proposed project would remove the following existing components from the South Harbor:

- All (5) concrete main walk floats and associated creosote-treated timber piles and steel piles that access 506 boat slips
- All (3) timber trestles and associated piles attached to steel gangways that connect to the main walk floats
- Concrete seaplane float and associated piles
- Approximately 10,000 cubic yards of material from above HTL on the south side of the harbor

Phase I of the proposed project would add the following within the South Harbor (Table 1; Figure 3; Figure 4):

- Two (2) 6- foot-wide by 80-foot-long ADA-compliant pedestrian gangways with 28-foot by 15-foot gangway floats connected to the main float complexes and accessed by a trestle (south access) or fixed dock (north access)
- Five (5) main walk floats (G, H, I, J, K floats) each with an end float and numerous stall floats arranged in two complexes
    - G main float: 8-foot by 1,000-foot
    - H main float: 8-foot by 1,084-foot
    - I main float: 8-foot by 1,035-foot
    - J main float: 8-foot by 952-foot
    - K main float: 8-foot by 884-foot

- A total of 450 slips of the following sizes:
    - 4-foot by 32-foot
    - 4-foot by 40-foot
    - 5-foot by 50-foot
    - 6-foot by 60-foot
- Two (2) 8-foot-wide main walk floats connecting the main walk floats and gangways (N [419-foot-long] and N' [119-foot-long] floats)
- A 15-foot by 125-foot drive-down transfer bridge leading to an 80-foot by 80-foot drive-down dock with 5-ton mounted hydraulic cranes (2), sewer pump out station, potable water, electrical connections, and access to the eastward float complex
- Other float components such as bull rail, floating fenders, mooring cleats, electricity connections, potable water service, fire suppression waterlines, wireless connections, lighting, and hand rails
- Uplands service area with a parking area expansion, a walkway connecting the Fisherman's Memorial with the Veterans Memorial (to remain in the same location), greenspace, and stormwater treatment capabilities to include an oil water grit separator (note: all upland components would be installed out of the water)
- Steel piles to support floats and access ramp infrastructure (see Table 1)
- Approximately 1,150 linear feet of bulkhead wall supported by H-piles

Table 1. Cordova Harbor Rebuild Project Pile Installation and Removal Summary – Phase I

Project Component	Piles							
	Permanent Pile Remove		Temp. Pile Install	Temp. Pile Remove	Permanent Pile Install			
Diameter of Piles (inches)	12	12	24	24	16	18	30	H
Pile Type	Timber	Steel						
South Harbor Demolition	130	61	--	--	--	--	--	--
G Float	--	--	11	11	--	28	--	--
H Float	--	--	12	12	42	20	2	--
I Float	--	--	11	11	55	--	2	--
J Float	--	--	10	10	37	--	2	--
K Float	--	--	9	9	--	15	--	--
N and N' Floats	--	--	8	8	15	7	--	--
Drive Down Float and Trestle	--	--	10	10	--	--	24	--
Gangway Trestle	--	--	--	--	6	--	--	--
South Harbor Bulkhead	--	--	60	60	--	70	--	140
Phase I Total	**130**	**61**	**131**	**131**	**155**	**140**	**30**	**140**

Figure 3. Cordova Harbor Rebuild Project South Harbor Site Plans – Phase I

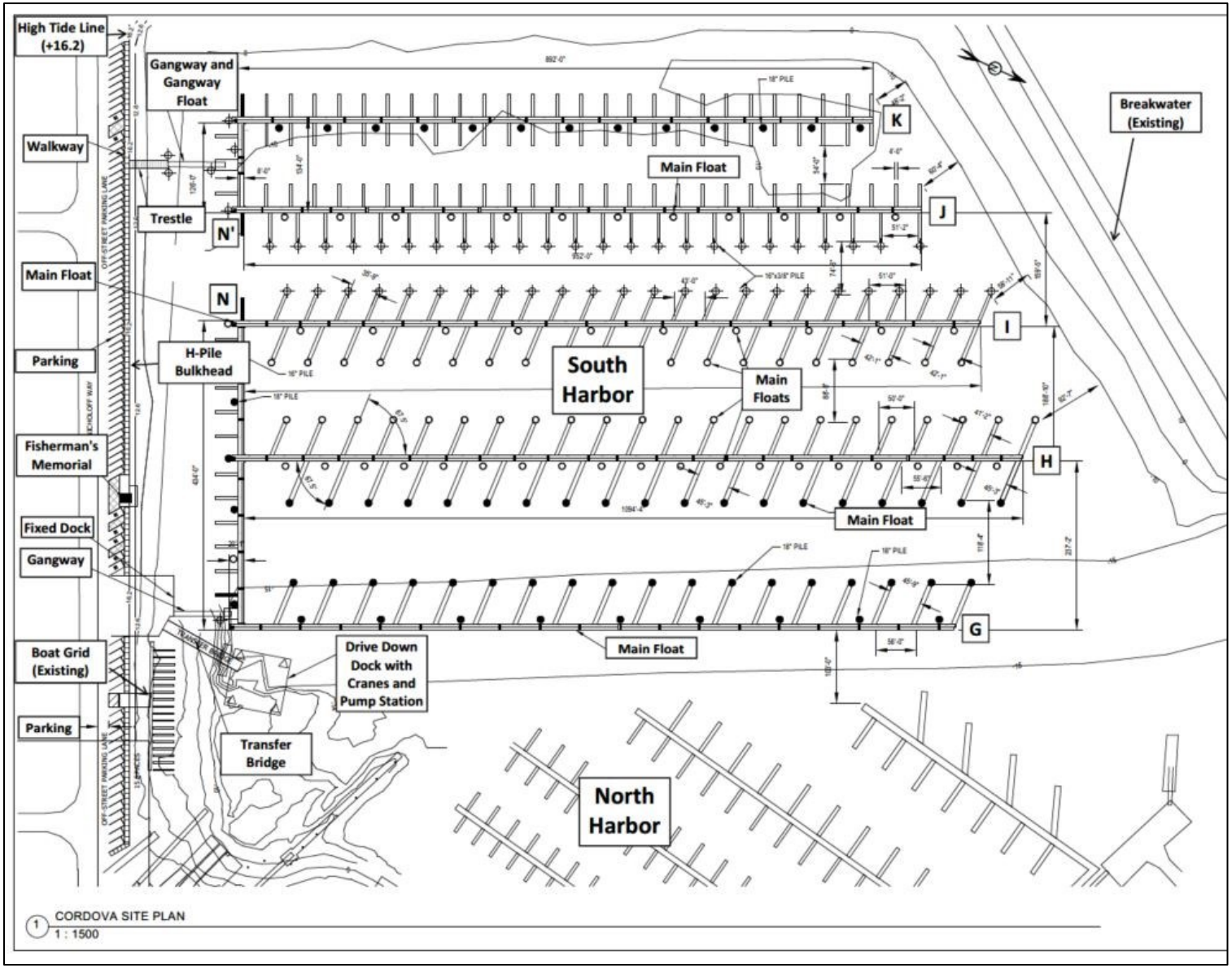
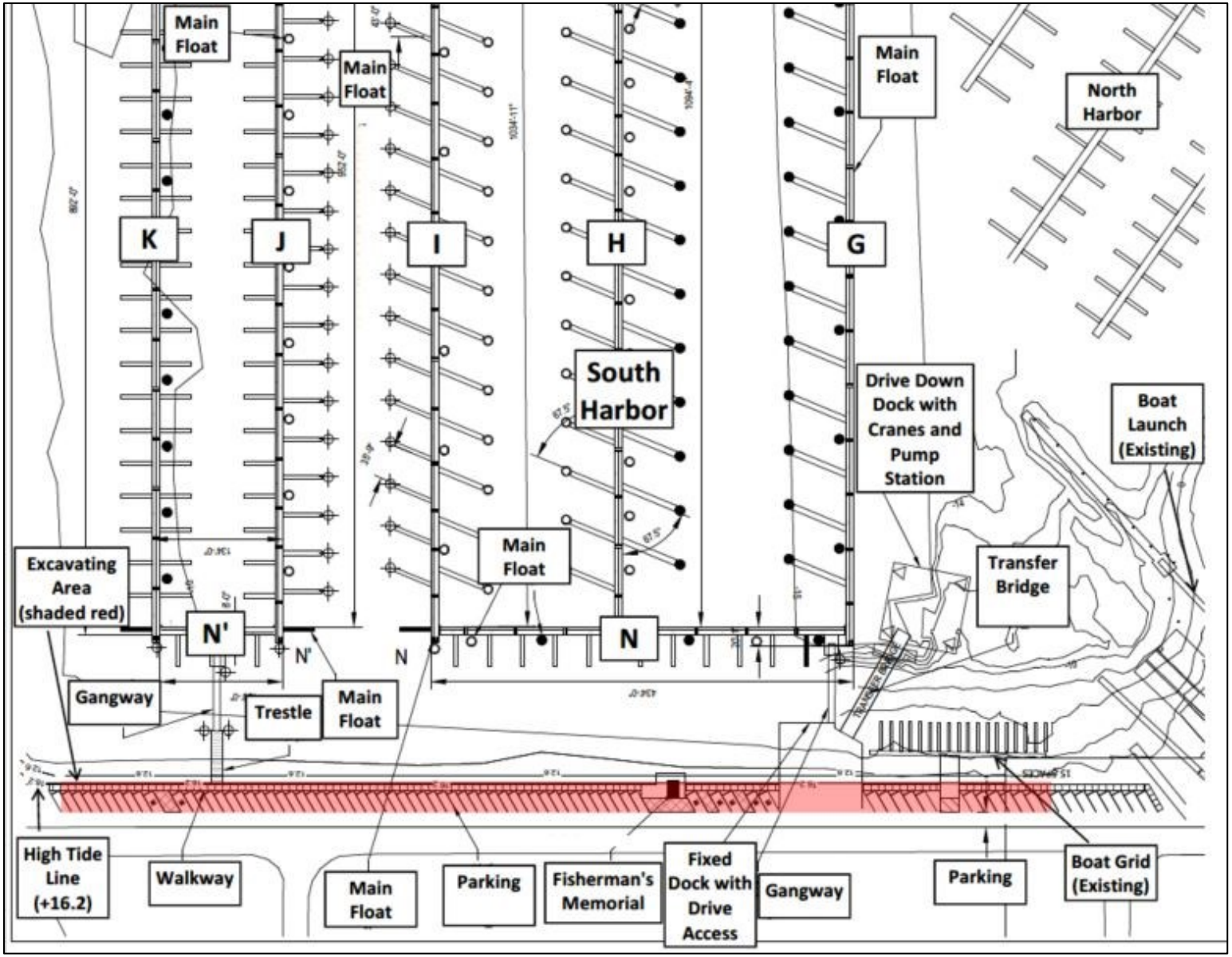


Figure 4. Cordova Harbor Rebuild Project South Waterfront Site Plans – Phase I



1.2.4.2 Phase II

Phase II of the Cordova Harbor Rebuild Project would involve improvements and repairs to the North Harbor.

Under Phase II, the proposed project would remove the following existing components from the North Harbor and boat launch area:

- All (16) timber fender piles from the existing three-stage dock
- The western-most float (Science Center approach/Old Boat Grid) including the decking and creosote-treated timber piles (252)
- Approximately 22,000 cubic yards of material along the north side of the harbor

Phase II of the proposed project would add the following infrastructure within the harbor (Table 2, Figure 5; Figure 6):

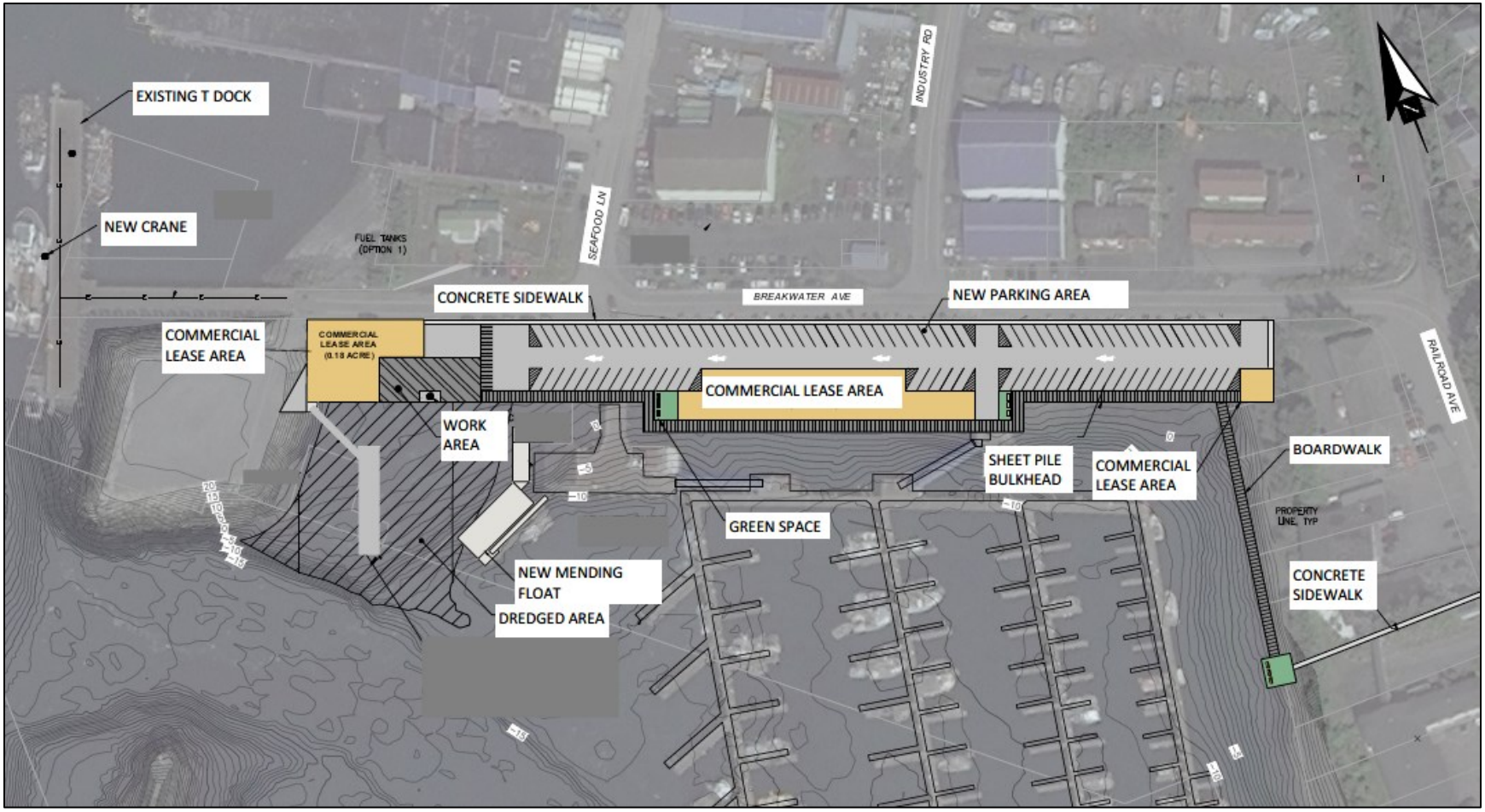
- A 30-feet by 80-feet net mending dock support by steel piles and accessed by a 6-foot by 80-foot pedestrian gangway
- Approximately 800 linear feet of sheet pile supported by H piles to create expanded uplands bulkhead
- A 20-foot by 160-foot boat launch ramp lane added to the existing launch to increase launch capacity
- Install fender piles (2) for the boat launch ramp (Table 2)
- Sixteen (16) steel fender piles on the three-stage dock and install a 5-ton mounted hydraulic crane
- Expanded uplands facilities with expanded parking areas, greenspaces, commercial lease areas, and appropriate stormwater processing capabilities to include an oil water grit separator (note: all upland components would be installed out of the water)
- A concrete sidewalk between the North and South Harbors

Table 2. Cordova Harbor Rebuild Project Pile Installation and Removal Summary-Phase II

	Piles									
	Permanent Pile Remove		**Temp. Pile Install**	**Temp. Pile Remove**	**Permanent Pile Install**					
Diameter of Piles (inches)	12	12	24	24	16	18	24	30	H	Sheet
Pile Type	Timber	Steel								
Science Center Approach	252	--	--	--	--	--	--	--	--	--
Net Mending Float	--	--	--	--	--	--	6	--	--	--
North Harbor Bulkhead	--	--	31	31	--	--	--	--	80	80
Three-Stage Dock	16	--	--	--	--	--	16	--	--	--
Boat Launch Lane	--	--	--	--	--	--	2	--	--	--
Phase II Total	**268**	**0**	**31**	**31**	**0**	**0**	**24**	**0**	**80**	**80**

Figure 5. Cordova Harbor Rebuild Project North Waterfront, Three-Stage Dock, and Boat Launch Ramp Site Plans – Phase II

Figure 6. Cordova Harbor Rebuild Project North Waterfront Site Plans – Phase II



1.2.5 Construction Methods

The Cordova Harbor Rebuild Project would involve removing components associated with the existing float system in the South Harbor and installing new floats, supports, gangways, drive-down floatplane and vessel service facility, and an access ramp. The new South Harbor components would include electrical, water, sewage, fire line, and wireless connections. Sheet pile bulkhead would be installed along the north and eastern edges of the harbor to create an expanded uplands area. Commercial lease areas and green space would be designated at the North Harbor uplands. The project would also replace degraded creosote treated piles at the existing three-stage dock with steel piles.

1.2.5.1 Pile Installation Methods

Table 3 and Table 4 identify timing associated with removal of existing piles during Phase I and II, respectively.

Removal of Existing Piles and Dock Components

All existing timber (130) and steel (61) piling supporting floats, slips, trestles, and gangways would be removed from the South Harbor using the deadpull method and if necessary, vibratory hammer. Additional timber piles from the Three-Stage Dock (16) in the South Harbor and the Science Center approach float (252) in the North Harbor would also be removed using the same methods.

Installation and Removal of Temporary (Template) Piles

A maximum of 131 and 31 template 24-inch-diameter piles would be installed and removed using a vibratory hammer in constructing the float system and bulkheads during Phase I and Phase II, respectively.

Installation of Permanent Piles

All permanent piles would be initially installed with a vibratory hammer. After vibratory driving, if needed, piles would be impacted into the bedrock with an impact hammer. For some piles, a down-the-hole (DTH) drill would be needed to drive piles the final few inches of embedment.

During impact pile driving, pile caps (pile softening material) would be used. The contractor would also use high-density polyethylene or ultra-high-molecular-weight polyethylene softening material on all templates to eliminate steel on steel noise generation.

Table 3. Cordova Harbor Rebuild Project Pile Size, Quantity, and Installation Method – Phase I

	In-Water (Below High Tide Line)[1]							In-Air (Above High Tide Line)[2]			
	Perm Pile Removal	Perm Pile Removal	Temp Pile Installation	Temp Pile Removal	Perm Pile Installation	Perm Pile Installation	Perm Pile Installation	Temp Pile Installation	Temp Pile Removal	Perm Pile Installation	Perm Pile Installation
Diameter of Piles (inches)	12	12	24	24	16	18	30	24	24	18	16 x 89
Pile Type	Timber Pipe	Steel Pipe	Steel Pipe	Steel Pipe	Steel Pipe	Steel Pipe	Steel Pipe	Steel Pipe	Steel Pipe	Steel Pipe	Steel H
Total # of Piles	130	61	61	61	155	70	30	70	70	70	140
Vibratory Pile Driving											
Total Quantity	130	61	61	61	155	70	30	70	70	70	140
Max # Piles Vibrated Per Day	25	25	6	10	10	10	6	6	10	6	10
Vibratory Time Per Pile (minutes)	10	10	10	10	15	20	30	10	10	10	15
Vibratory Time Per Day (hours)	4.2	4.2	1.0	1.7	2.5	3.3	3.0	1.0	1.7	1.0	2.5
Number of Days	5.2	2.4	10.2	6.1	15.5	7.0	5.0	11.7	7.0	11.7	14.0
Vibratory Time Total (hours)	21.7	10.2	10.2	10.2	38.8	23.3	15.0	11.7	11.7	11.7	35
Impact Pile Driving											
Total Quantity	--	--	--	--	73	35	20	--	--	35	70
Max # Piles Impacted Per Day	--	--	--	--	6	6	6	--	--	4	6
# of Strikes Per Pile	--	--	--	--	240	240	360	--	--	180	150
Impact Time Per Pile (minutes)	--	--	--	--	20	20	20	--	--	20	20
Impact Time Per Day (hours)	--	--	--	--	2.0	2.0	2.0	--	--	1.3	2.0
Number of Days	--	--	--	--	12.2	5.8	3.3	--	--	8.8	11.7
Impact Time Total (hours)	--	--	--	--	24.3	11.7	7	--	--	12	23
Down-The-Hole Pile Drilling											
Total Quantity	--	--	--	--	50	20	16	--	--	18	35
Max # of Piles Installed per Day	--	--	--	--	4	4	4	--	--	4	5
# of Strikes Per Pile	--	--	--	--	54,000	54,000	54,000	--	--	2,700	40,500
# of Strikes Per Second	--	--	--	--	10	10	10	--	--	10	10
Total Drilling Time Per Pile (minutes)	--	--	--	--	90	90	90	--	--	60	80
Actual Drilling Time Per Pile (minutes)	--	--	--	--	75	75	75	--	--	45	60
Time per Day (hours)	--	--	--	--	5	5	5	--	--	3	5
Number of Days	--	--	--	--	12.5	5.0	4.0	--	--	4.5	7.0
DTH Drilling Time Total (hours)	--	--	--	--	62.5	25.0	20	--	--	13.5	35

[1] For Phase I, in-water pile installation and removal activities include the following project components in the South Harbor: South Harbor demolition; G, H, I, J, K, N, and N' main walk floats; access trestle, fixed dock, and drive down dock and transfer bridge.

[2] In-air pile installation and removal activity includes the South Harbor bulkhead.

Table 4. Cordova Harbor Rebuild Project Pile Size, Quantity, and Installation Method – Phase II

	Permanent Pile Removal	Temporary Pile Installation		Perm Pile Installation		
Diameter of Piles (inches)	12	24	24	24	16 x 89	
Pile Type	Timber Pipe	Steel Pipe			Steel H	Steel Sheet
Total # of Piles	268	31	31	24	80	80
Vibratory Pile Driving						
Total Quantity	268	31	31	24	80	80
Max # Piles Vibrated Per Day	25	6	10	10	4	4
Vibratory Time Per Pile (minutes)	10	10	10	20	15	15
Vibratory Time Per Day (hours)	4.2	1.0	1.7	3.3	1.0	1.0
Number of Days	10.7	5.2	3.1	2.4	20.0	20.0
Vibratory Time Total (hours)	44.7	5.2	5.2	8.0	20.0	20.0
Impact Pile Driving						
Total Quantity	--	--	--	10	32	32
Max # Piles Impacted Per Day	--	--	--	4	4	4
# of Strikes Per Pile	--	--	--	20	20	20
Impact Time Per Pile (minutes)	--	--	--	20	20	20
Impact Time Per Day (hours)	--	--	--	1.3	1.3	1.3
Number of Days	--	--	--	2.4	8.0	8.0
Impact Time Total (hours)	--	--	--	3.0	11.0	11.0
Down-The-Hole Pile Drilling						
Total Quantity	--	--	--	5	16	--
Max # of Piles Installed per Day	--	--	--	2	3	--
# of Strikes Per Pile	--	--	--	54,000	54,000	--
# of Strikes Per Second	--	--	--	4	4	--
Total Drilling Time Per Pile (minutes)	--	--	--	150	150	--
Actual Drilling Time Per Pile (minutes)	--	--	--	60	60	--
Time per Day (hours)	--	--	--	2	3	--
Number of Days	--	--	--	2.4	5.3	--
DTH Drilling Time Total (hours)	--	--	--	4.8	16.0	--

1.2.5.2 Excavating, Dredging, and Filling Methods

Dredging Methods

To develop the South Harbor bulkhead, the project would require excavating 10,000 cubic yards above HTL (+16.2 feet relative to mean lower low water [MLLW; United States [U.S] Army Corps of Engineers 2017]; Figure 7) in Phase I. To develop the North Harbor bulkhead, the project would require dredging 22,000 cubic yards in Phase II. Dredge material would be alluvial fill, gravel, and riprap from silted-in sections of the harbor. Dredging would be expected to occur for 660 hours over 77 days in the North Harbor during Phase II. Approximately 1.5 acres in the North Harbor would be dredged between the +5 to -10 feet MLLW to remove sediment accumulation and allow development of bulkheads (Table 5). For context, current depths in areas that would be dredged range from a +40 to -14 feet MLLW.

Dredged and excavated soils will be stored at an upland location to dry before being used as fill within the proposed bulkheads. All unused removed material will be properly disposed of at a permitted offsite location.

Table 5. Cordova Harbor Rebuild Project Excavating, Dredging, and Filling Summary

Construction Activity	Description					
	Soil Type	Phase (Harbor)	Area (acres)	Total Quantity (cubic yards)	Total Time (hours)	# of Days
Excavating (above HTL)	Alluvial, Gravel, and Riprap	I (South)	1.0	10,000	300	35
Dredging	Alluvial, Gravel, and Riprap	II (North)	1.5	22,000	660	77
Filling	Alluvial, Gravel, and Riprap	I (South) (above HTL)	1.0	15,000	300	35
		II (North and Boat Launch)	1.5	47,970	946	110

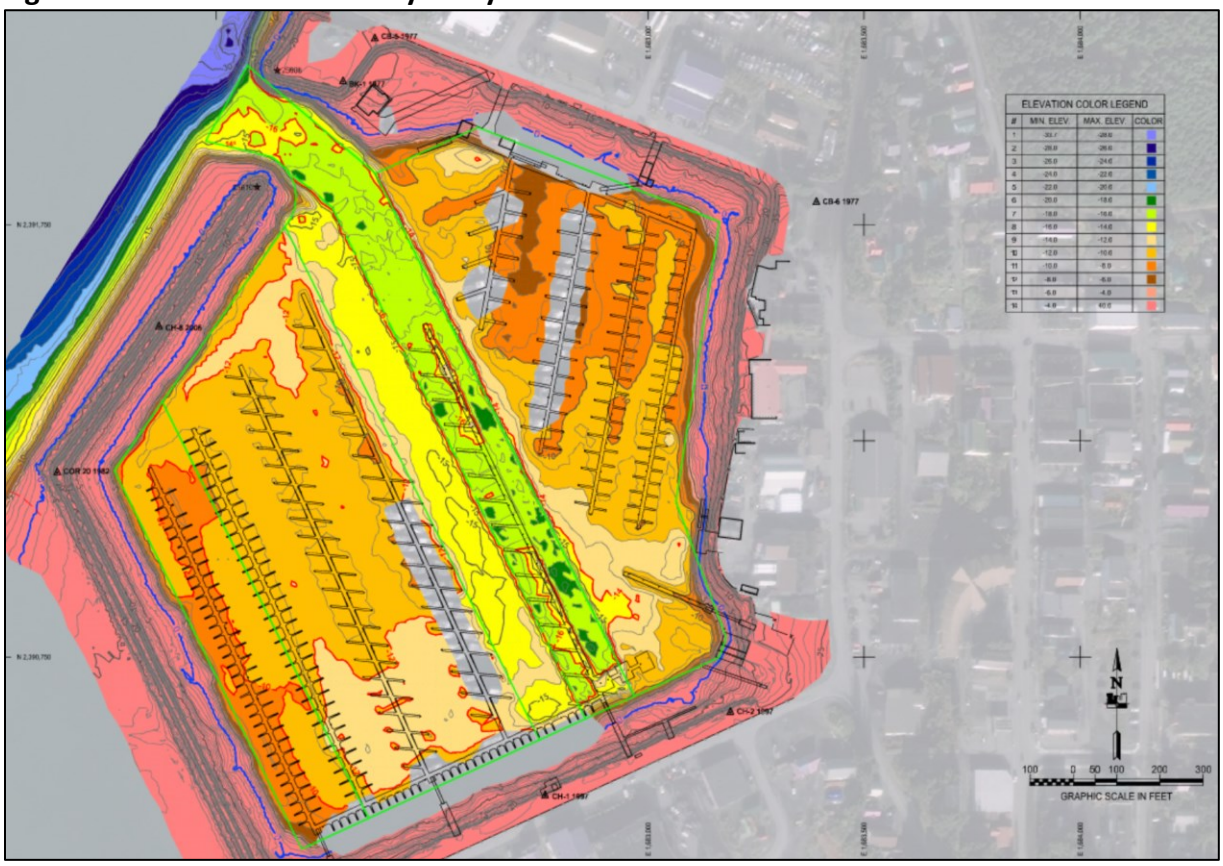
Filling Methods

Following dredging and installation of piling for bulkheads, dredge soil and imported gravel fill would be placed within the bulkhead to support the structure, totaling 15,000 cubic yards for the South Harbor during Phase I and 47,300 yards for the North Harbor during Phase II (Table 5). Placement of fill would be expected to occur over for 300 hours over 35 days for the South Harbor and 946 hours over 110 days for the North Harbor. The fill would be placed using an excavator and dozer and then compacted using a vibratory soil compactor.

There would be additional improvement of upland facilities adjacent to the harbor within existing developed areas. There would be no in-water noise impacts from placement of fill for the bulkheads and other upland construction to species since these activities would occur within the newly installed bulkhead structures.

Additionally, during Phase II, a small volume of in-water fill would be placed to develop the additional boat launch ramp lane in the South Harbor. Placement of 670 cubic yards of fill would be expected to occur over 5 hours and 1 day and may occur from land or water.

Figure 7. Cordova Harbor Bathymetry



1.2.5.3 Project Operation Activities

The continued use of the Cordova Harbor includes the operation of fishing and other vessels, including loading and unloading, general maintenance, power connections, and fueling. Harbor uplands would provide access to gangways and the drive down float, commercial lease areas along the north harbor, green space with benches, mixed use areas, parking, sidewalks, and boardwalks.

Cordova Harbor operation protocols would continue to incorporate best management practices to prevent or minimize contamination from vessels, general maintenance, fueling, and nonpoint source contaminants from upland facilities.

1.2.5.4 Construction Equipment

The following equipment or something similar are expected to be used for project construction (Table 6).

Table 6. Cordova Harbor Rebuild Project Proposed Project Equipment

Driving mechanism	Pile driver/Equipment Type	Properties
Impact pile driving	Diesel Delmag D46	Max Energy 107,280 feet-pounds Speed (blows per minute) 34-53
	Diesel Delmag D80	Max Energy 202,825 feet-pounds Speed (blows per minute) 34-53
Vibratory pile driving	ICE 44B/Static weight 12,250 pounds	202 tons centrifugal force 207 tons driving force
	APE 200-6/Static weight 19,000 pounds	255 tons driving force
DTH drilling	Drilling shaft drill: Holte top drive with DTH hammer and bit	100,000 feet-pounds
Fill Placement	CAT D4 and D6 dozer	130 hp/215 hp
	CAT 349 Excavator	295 kW/396 hp net power
Soil Compaction	CAT CS64B Vibratory Soil Compactor	29900 lb to 52600 lb Centrifugal force; 30.5 hertz (Hz) vibratory

Construction Vessels and Movements

The following vessels or something similar are expected to support construction and protected species monitoring:

- 1 material barge (approximately 250 feet by 76 feet by 15.5 feet) to transport materials from Washington to the project site and to be used onsite as a staging area during construction.
- 1 construction barge (crane barge, 280 feet by 76 feet by 16 feet) to transport materials from Washington to the project site and to be used onsite to support construction.
- 1 skiff (25-foot skiff with a 125–250 horsepower outboard motor) transported to the project site on the material barge or acquired locally in Cordova to support construction activities.
- 1 skiff (25-35-foot skiff powered with a 35-50 horsepower outboard motor) transported to the project site on the material barge or acquired locally in Cordova to support Protected Species Observer efforts.

Other In-water Construction and Heavy Machinery Activities

In addition to the activities described above, the proposed action would involve other in-water construction and heavy machinery activities. Examples of other types of activities include using standard barges, tug boats, or other equipment to place and position piles on the substrate via a crane (i.e., “stabbing the pile”).

1.2.5.5 Transport of Materials and Equipment

The material barge would transport materials from Washington state and the construction barge would be travelling from Juneau in Southeast Alaska, both at approximately 6 knots to the project site. These types of barges frequently travel the route to and from Alaska. Once at the project site, the construction barge would be secured in place by four mooring anchors. The anchors would be below the surface and would not be a hazard to navigation. The material barge would be tied to the existing harbor structure, and materials would be moved from the staging barge to the construction barge and project site by a crane on the construction barge. Barge movements between pile installation locations (in approximately 100-foot increments) would occur at a speed of less than 2 miles per hour.

1.2.5.6 Transport of Workers to and from Work Platform

Construction workers would be transported from shore to the barge work platform by 90 horsepower skiffs travelling at approximately 5 knots. The travel distance would be less than 300 feet. There could be multiple shore-to-barge trips during the day; however, the area of travel would be relatively small and close to shore. For larger monitoring areas in Phase II, Protected Species Observers (PSOs) may use a skiff to observe the action area.

1.2.5.7 Other In-water Construction and Heavy Machinery Activities

In addition to the activities described above, the proposed action will involve other in-water construction and heavy machinery activities. Examples of other types of activities include using standard barges, tug boats; and positioning piles on the substrate via a crane (i.e., “stabbing the pile”), and heavy machinery to place fill.

1.2.5.8 Construction Sequence

For Phase I, the harbor’s in-water construction would begin with demolition of the existing South Harbor structures as early as mid-August of 2023. Once demolition is complete, construction of the proposed harbor facilities would be expected to follow the following sequence:

- Excavate upland portions of the South Harbor (10,000 cubic yards) for development of a new bulkhead
- Install of H-piles (140) using template piles (70) for the South Harbor bulkhead
- Install piles (255) for the float system in the South Harbor (exact float sequence to be determined by contractor)

Phase I in-water work is expected to last into June 2024. After all piles are installed, construction would proceed with installation of the floats, mechanical systems, and other above-water components like the uplands construction, walkways, electricity connections, potable water service, fire waterlines, wireless connections, lighting, hand rails, and mast lights (listed in the *Proposed Action* section). Placement of fill would occur following in-water construction and is not expected to affect conditions within the harbor as this activity would occur within the newly installed bulkheads.

For Phase II, the harbor’s in-water construction would begin as early as mid-August of 2024. Once demolition is complete, construction of the proposed harbor facilities would be expected to follow the following sequence:

- Remove and install piles (16) to replace the Three Stage dock
- Remove piles slated for demolition in the North Harbor
- Dredge silted-in portions of the North Harbor (15,000 cubic yards) for development of a new bulkhead
- Install sheet piles (80) and H-piles (80) using template piles (31) for the North Harbor bulkhead

Phase II in-water work is expected to last into June 2025. As with Phase I, after all piles are installed, construction would proceed with installation of new floats, mechanical systems, and other above-water components like the uplands construction, walkways, electricity connections, potable water service, fire waterlines, wireless connections, lighting, hand rails, and mast lights (listed in the *Proposed Action* section). Placement of fill would occur inside the new bulkheads following in-water construction and is not expected to affect conditions within the harbor.

1.3 ACOUSTIC THRESHOLDS AND ENSONIFIED AREA

Vibratory pile driving and removal, impact pile driving, dredging, and filling would generate in-water and in-air noise that may result in take of marine mammals.

Using the best available science, National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) has developed acoustic thresholds that identify the received level of underwater sound above which exposed marine mammals would be reasonably expected to be behaviorally harassed (equated to Level B harassment) or to incur permanent threshold shift (PTS) of some degree (equated to Level A harassment).

1.3.1 Level A Harassment

NMFS' *Technical Guidance for Assessing the Effects of Anthropogenic Sounds on Marine Mammal Hearing* identifies dual criteria to assess auditory injury (Level A harassment) to five different marine mammal groups (based on hearing sensitivity) as a result of exposure to noise from two different types of sources (impulsive or non-impulsive) (NMFS 2018). The proposed project includes the use of both impulsive (impact pile driving) and non-impulsive (vibratory pile driving and removal) sources. The thresholds for auditory injury for Endangered Species Act (ESA)-listed and Marine Mammal Protection Act (MMPA) protected species are in Table 7.

Table 7. Thresholds Identifying the Onset of Permanent Threshold Shift

	PTS Onset Thresholds*(received level)	
Hearing Group	**Impulsive (Impact and DTH Pile Driving)**	**Non-impulsive (Vibratory Pile Driving)**
Low-Frequency (LF) Cetaceans	$L_{pk,flat}$: 219 dB $L_{E,LF,24h}$: 183 dB	$L_{E,LF,24h}$: 199 dB
Mid-Frequency (MF) Cetaceans	$L_{pk,flat}$: 230 dB $L_{E,MF,24h}$: 185 dB	$L_{E,MF,24h}$: 198 dB
High-Frequency (HF) Cetaceans	$L_{pk,flat}$: 202 dB $L_{E,HF,24h}$: 155 dB	$L_{E,HF,24h}$: 173 dB
Phocid Pinnipeds (PW) Underwater	$L_{pk,flat}$: 218 dB $L_{E,PW,24h}$: 185 dB	$L_{E,PW,24h}$: 201 dB
Otariid Pinnipeds (OW) Underwater	$L_{pk,flat}$: 232 dB $L_{E,OW,24h}$: 203 dB	$L_{E,OW,24h}$: 219 dB

Adapted from: NMFS 2018

* Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds should also be considered.
Note: Peak sound pressure has a reference value of 1 microPascal (µPa), and cumulative sound exposure level (L_E)has a reference value of 1µPa^{2}s. In this table, thresholds are abbreviated to reflect American National Standards Institute standards (ANSI; ANSI 2013). However, peak sound pressure is defined by ANSI as incorporating frequency weighting, which is not the intent for this Technical Guidance. Hence, the subscript "flat" is being included to indicate peak sound pressure (pk) should be flat weighted or unweighted within the generalized hearing range. The subscript associated with cumulative sound exposure level thresholds indicates the designated marine mammal auditory weighting function (LF, MF, and HF cetaceans, and phocid pinnipeds [PW] and otariid [OW] pinnipeds) and that the recommended accumulation period is 24 hours. The cumulative sound exposure level thresholds could be exceeded in a multitude of ways (i.e., varying exposure levels and durations, duty cycle).

1.3.2 Level B Harassment

NMFS predicts that all marine mammals are likely to be behaviorally harassed in a manner that they consider Level B harassment when exposed to underwater anthropogenic noise above received levels of 120 decibels (dB) re 1µPa root mean square (rms) for continuous and above 160 dB re 1µPa rms for non-explosive impulsive sources.

1.3.3 Calculated Distances to Level A and Level B Thresholds – Phase I and II

For this project, distances to the Level A and Level B thresholds were calculated based on various source levels, expressed in sound pressure level (SPL)[1] or sound exposure level (SEL)[2] for a given activity and pile type and, for Level A harassment, accounted for the maximum duration of that activity per day using the practical spreading model in the spreadsheet tool developed by NMFS (Appendix A). Calculated distances to thresholds are shown in Table 8 and Table 9, and range from approximately 1 meter to 15.8 kilometers.

[1] Sound pressure is the sound force per unit µPa, where 1 pascal is the pressure resulting from a force of one newton exerted over an area of one square meter. Sound pressure level is expressed as the ratio of a measured sound pressure and a reference level. The commonly used reference pressure level in acoustics is 1 µPa, and the units for underwater sound pressure levels are dB re 1 µPa (NMFS 2018).
[2] A measure of sound level that takes into account the duration of the signal (NMFS 2018).

Table 8. Cordova Harbor Rebuild Project Calculated Distances to NMFS Level A and B Acoustic Thresholds – Phase I

Activity	Received Level at 10 m	Distance (in meters) to Level A and Level B Thresholds[1]				
		Level A[2]				Level B
		Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid	Otariid	
Vibratory Pile Driving/Removal						
12-inch to 24-inch existing timber pile removal (130 piles; 4.2 hours per day on 5.2 days)	162 RMS [3]	1.8	30.5	12.5	0.9	6,309.6
12-inch to 24-inch existing steel pile removal (61 piles; 4.2 hours per day on 2.4 days)	161 RMS [4]	1.6	26.1	10.7	0.8	5,411.7
24-inch template pile installation and removal (61 piles; 1.7 hours per day on 16.3 days)	161 RMS [4]	0.9	14.2	5.8	0.4	5,411.7
16-inch permanent pile installation (155 piles; 2.5 hours per day on 15.5 days)	161 RMS [4]	1.1	18.6	7.6	0.5	5,411.7
18-inch permanent pile installation (70 piles; 3.3 hours per day on 7.0 days)	161 RMS [4]	1.4	22.5	9.3	0.7	5,411.7
30-inch permanent pile installation (30 piles; 3 hours per day on 5.0 days)	161.9 RMS [5]	1.4	24.1	9.9	0.7	6,213.5
In-air pile installation/removal (Bulkhead) (350 piles, up to 2.5 hour per day on 44 days)	103.2 RMS [6]	--	--	--	--	68.6 (PW)/ 22.8 (OW)
Impact Pile Driving						
16-inch permanent pile installation (73 piles; 2.0 hours per day on 12.5 days)	168.3 SEL/ 181.1 RMS	4.7	158.8	71.4	5.2	255.1
18-inch permanent pile installation (35 piles; 2.0 hours per day on 5.8 days)	168.3 SEL/ 181.1 RMS	4.7	158.8	71.4	5.2	255.1
30-inch permanent pile installation (20 piles; 2.0 hours per day on 3.3 days)	177 SEL/ 190 RMS [3]	23.6	791.3	355.5	25.9	1,000.0
In-air pile installation/removal (Bulkhead) (105 piles; 2.0 hours per day on 11.7 days)	101 RMS [8]	--	--	--	--	53.2 (PW)/ 16.8 (OW)

Activity	Received Level at 10 m	Distance (in meters) to Level A and Level B Thresholds[1]				
		Level A[2]				Level B
		Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid	Otariid	
Down the Hole (DTH) Drilling						
16-inch permanent pile installation (50 piles; 5.0 hours per day on 12.5 days)	159 SEL/ 167 RMS [9]	32.1	1,075.7	483.3	35.2	13,593.6
18-inch permanent pile installation (20 piles; 5.0 hours per day on 5.0 days)	159 SEL/ 167 RMS [9]	32.1	1,075.7	483.3	35.2	13,593.6
30-inch permanent pile installation (16 piles; 5.0 hours on 4.0 day)	164 SEL/ 174 RMS	61.3	2,052.2	922.0	67.1	39,810.7

Table 9. Cordova Harbor Rebuild Project Calculated Distances to NMFS Level A and B Acoustic Thresholds – Phase II

Activity	Received Level at 10m	Distance (in meters) to Level A and Level B Thresholds[1]				
		Level A[2]				Level B
		Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid	Otariid	
In-Water Activities						
Vibratory Pile Driving/Removal						
12-inch to 24-inch existing timber pile removal (268 piles; 4.2 hours per day on 10.7 days)	162 RMS [3]	1.8	30.5	12.5	0.9	6,309.6
24-inch template pile installation and removal (31 piles; 1.7 hours per day on 8.3 days)	161 RMS [4]	0.9	14.2	5.8	0.4	5,411.7
24-inch permanent pile installation (24 piles; 3.3 hours per day on 2.4 days)	161 RMS [4]	1.4	22.5	9.3	0.7	5,411.7
H-pile steel permanent pile installation (80 piles; 1 hour per day on 20 days)	165 RMS [3]	1.1	18.7	7.7	0.5	10,000.0
Sheet steel permanent pile installation (80 piles; 1 hour per day on 20 days)	162 RMS [11]	0.7	11.8	4.8	0.3	6,310.0
Impact Pile Driving						
24-inch permanent pile installation (10 piles; 1.3 hours per day on 2.4 days)	168.3 SEL/ 181.1 RMS [7]	4.7	158.8	71.4	5.2	255.0
H-pile steel permanent pile installation (32 piles; 1.3 hours per day on 8 days)	170 SEL/ 177 RMS [3]	12.1	405.3	182.1	13.3	341.5
Sheet steel permanent pile installation (32 piles; 1.3 hours per day on 8 days)	180 SEL/ 190 RMS [3]	56.2	1,881.2	845.2	61.5	1,000.0
Down the Hole (DTH) Drilling						
24-inch permanent pile installation (5 piles; 2.0 hours per day on 2.4 days)	159 SEL/ 167 RMS [9]	32.1	1,075.7	483.3	35.2	13,593.6
H-pile steel permanent pile installation (16 piles; 2.0 hours per day on 5.3 days)	164 SEL/ 174 RMS [10]	61.3	2,052.2	922.0	67.1	39,810.7

Notes for Table 8 and Table 9

[1] Distances, in meters, refer to the maximum radius of the zone.

[2] The values provided here represent the distance at which an animal may incur PTS if that animal remained at that distance for the entire duration of the activity within a 24-hour period. For example, a Steller sea lion would have to remain 19.6 meters from 16-inch piles being installed via impacting methods for 1.3 hours for PTS to occur.

[3] For 12-inch to 24-inch timber pile removal, vibratory source level is proxy from personal correspondence with NMFS (NMFS 2023).

[4] For 16-inch, 18-inch, and 24-inch pile, the vibratory source level is proxy from 24-inch steel piles driven at the Naval Base Kitsap in Bangor, Washington (Naval Facilities Engineering Systems Command [NAVFAC] 2013) and from acoustic modeling of nearshore marine pile driving at Navy installations in Puget Sound (NAVFAC 2015).

[5] For 30-inch pile installation, vibratory source level is proxy from median measured source levels from pile driving of 30-inch diameter piles to construct the Ketchikan Ferry Terminal (Denes et al. 2016, Table 72, Page 76).

[6] For in-air vibratory hammering, the sound source is proxy from the Washington State Department of Transportation has documented un-weighted rms levels for a vibratory hammer (30-inch pile) to an average 96.5 dB and a maximum of 103.2 dB at 15 meters (Laughlin 2010).

[7] For 16-inch, 18-inch, and 24-inch pile, impacting source level is proxy from median measured source levels from impacting 24-inch diameter piles to construct the Kodiak Ferry Terminal (Denes et al. 2016, Table 72).

[8] In-air sound levels for impact hammering are proxy from the Washington State Department of Transportation Coupeville Ferry Terminal Project, Ghebreghzabiher et al. (2017) source levels of 101 dB at 15 meters during impact installation of 24-inch-diameter steel piles.

[9] For 16-inch, 18-inch, and 24-inch pile, DTH source level is proxy from the sound source verification of 24-inch piles DTH drilled during the Tenakee Ferry Terminal Improvements Project (Heyvaert and Reyff 2021).

[10] For 30-inch and H-pile, the DTH source level is proxy from sound source verification of 42-inch piles from the Thimble Shoal in Chesapeake Bay Bridge Tunnel and White Pass and Yukon Railroad Mooring Dolphin Installation (Reyff and Heyvaert, 2019; Reyff 2020; and Denes et al. 2019).

[11] For sheet piles, vibratory source level is proxy from median measured source levels from vibratory pile driving of 24-inch sheets for Berth 30 at the Port of Oakland, CA (Buehler et al 2015; Table I.6-2).

1.3.4 Action Area

The vicinity of the project area that will be affected directly by the action, referred to as the action area in the document, has been determined by the area of water that will be ensonified above acoustic thresholds in a day. The action area for this project is centered at the Cordova Harbor within the City of Cordova on the eastern shore of Orca Inlet within eastern Prince William Sound, Alaska. In this case, the action area is as large as the area that received noise levels from vibratory hammer installation of H-piles (the farthest-reaching noise associated with the project) are expected to decline to 120 dB. The action area extends from the harbor to where noise levels from pile installation of various pile types surpass acoustic thresholds.

Separate action area perimeters are defined for work being conducted in the North Harbor and the South Harbor and the action area would be truncated where land masses obstruct underwater sound transmission. Propagation of noise from the proposed project is partially contained by the breakwaters at the entrance to Cordova Harbor, Spike Island, and other land boundaries in Orca Inlet.

As shown in Table 8, the project action area extends 4.5 kilometers from the South Harbor and 15.8 kilometers from the North Harbor (Figure 8 and Figure 9).[3] The transit routes to be taken by the material and construction barges are also considered a part of the action area due to the noise impacts of large vessels on the marine environment (Figure 10 and Figure 11).

In addition to in-water noise, marine species can be adversely affected by in-air noise. NMFS-established in-air noise disturbance threshold of 100 dB rms for marine species under their jurisdiction. Pile driving and removal associated with the project would generate in-air noise above ambient levels within Orca Inlet; however, the anticipated in-air noise that meets the Level B disturbance threshold for Steller sea lions would not extend more than 22 meters (72 feet) from the noise source during vibrating and 17 meters (55 feet) from the noise source during impacting.[4] Given that there are no documented Steller sea lion haulouts in the action area, no in-air disturbance to hauled-out individuals are anticipated as a result of in-water work associated with the proposed project. In Phase I, in-air zones will be used as the action area during installation of piles for the South Harbor bulkhead above the HTL.

To minimize impacts to protected species, shutdown and monitoring of harassment zones will be implemented to protect and document these species in the action area. Please see Table 8 and Table 9 for calculated distances to the Level A and B thresholds and Section 11 for mitigation information and shutdown and monitoring zones and figures. Observer protocols are

[3] Note, this document also refers to the project vicinity. This term refers to an area larger than the action area, which includes Orca Bay and adjacent waterbodies. This term is used because some of the information available about species with ranges extending into Prince William Sound is based on sightings outside the action area.

[4] Predicted distances for in-air threshold distances. The Washington State Department of Transportation has documented un-weighted rms levels for a vibratory hammer (30-inch pile) to an average 96.5 dB and a maximum of 103.2 dB at 15 meters (Laughlin 2010). Maximum levels were used to extrapolate distances for the Project's largest (30-inch-diameter) piles. In-air sound levels for impact hammering of 30-inch-diameter piles were not available; Ghebreghzabiher.et al. (2017) found source levels of 101 dB at 15 meters during impact installation of 24-inch-diameter steel piles which is applicable to the 24-inch piles being installed for in-air, on-land construction.

developed in consultation with NMFS and described in the attached Marine Mammal Monitoring and Mitigation Plan (4MP; Attachment B).

Figure 8. Cordova Harbor Rebuild Project South Harbor Action Area

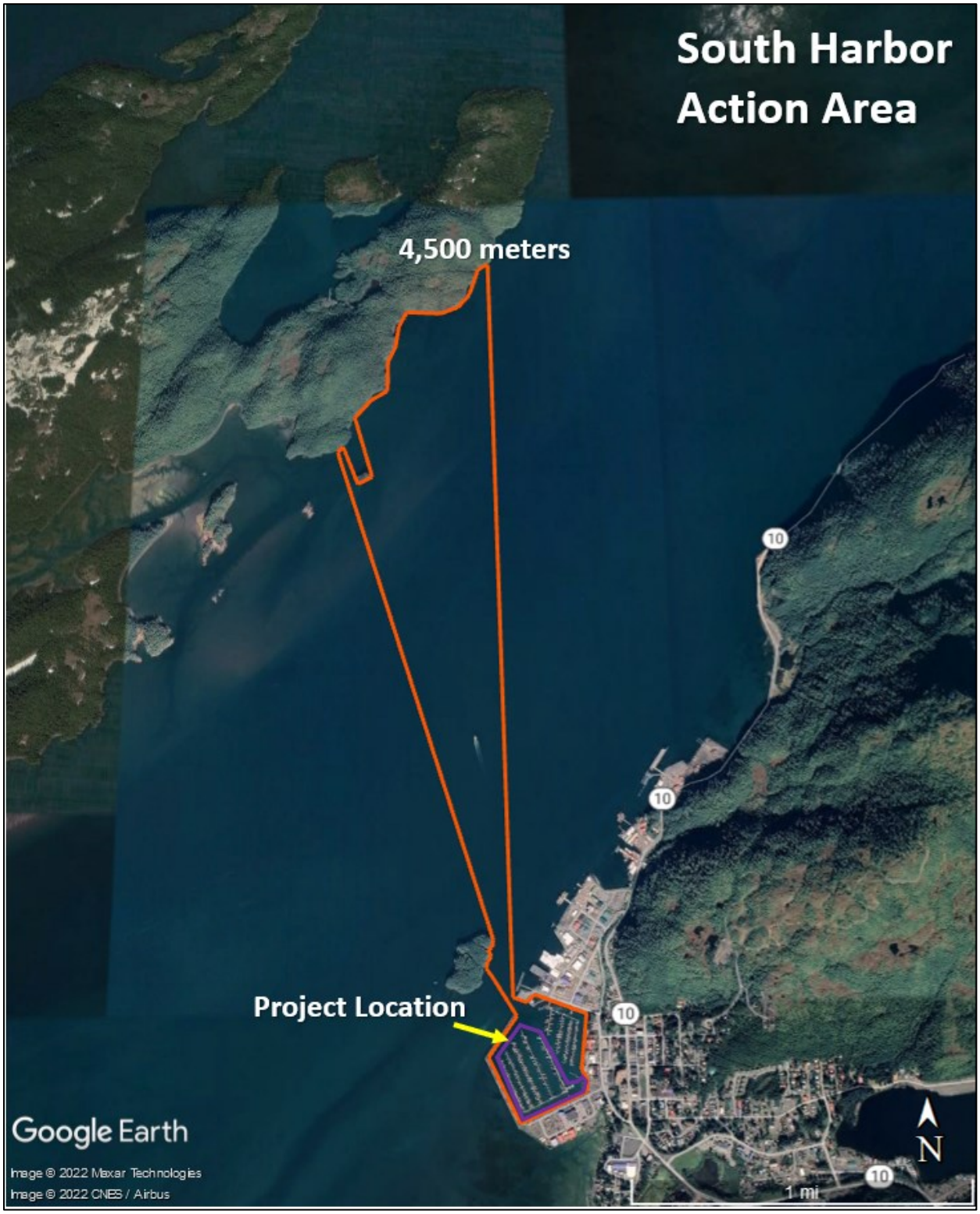


Figure 9. Cordova Harbor Rebuild Project North Harbor Action Area

Figure 10. Cordova Harbor Rebuild Project Expected Material Barge Route

Figure 11. Cordova Harbor Rebuild Project Expected Construction Barge Route

2 DATES, DURATION, AND REGION OF ACTIVITY

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

2.1 DATES AND DURATION

2.1.1 Phase I

Construction of Phase I would begin in mid-August 2023 and continue through June 2024. Pile driving is expected to occur for a total of approximately 433 hours over 170 days (not necessarily consecutive). Most of the in-water work time would be spent vibratory pile driving (96 days). Please see Table 3 and Table 4 for the specific amount of time required to remove existing piles, dredge, and install piles. Placement of fill would occur within the newly established bulkheads and since it would not be considered in-water work, this activity could occur outside of the in-water construction period. Excavating and placement of fill would both be expected to occur over for 300 hours over 35 days, respectively.

The total in-water construction duration accounts for potential delays in material deliveries, equipment maintenance, inclement weather, and shutdowns that may occur to prevent impacts to marine mammals. The total construction duration could be longer, to account for the time required to mobilize materials and resources, and construct the project.

2.1.2 Phase II

Construction of Phase II would begin in mid-August 2024 and continue through April 2025. In-water construction activities (pile driving and dredging) are expected to occur for a total of approximately 148 hours over 88 days and 660 hours over 77 days (not necessarily consecutive). Most of the in-water work time would be spent vibratory pile driving (162 days). Please see Table 3 and Table 4 for the specific amount of time required to remove existing piles, dredge, and install piles. Placement of fill would occur within the newly established bulkheads and since it would not be considered in-water work, this activity could occur outside of the in-water construction period. Placement of fill would be expected to occur over for 946 hours over 110 days.

The total in-water construction duration accounts for potential delays in material deliveries, equipment maintenance, inclement weather, and shutdowns that may occur to prevent impacts to marine mammals. The total construction duration could be longer, to account for the time required to mobilize materials and resources, and construct the project.

2.2 SPECIFIC GEOGRAPHIC REGION

The action area is located within the City of Cordova on Orca Inlet in Orca Bay within Prince William Sound, Alaska. The proposed harbor improvements and repairs is within the footprint of the existing harbor waters and uplands in downtown Cordova, Alaska. For more detailed location information, see Section 1.

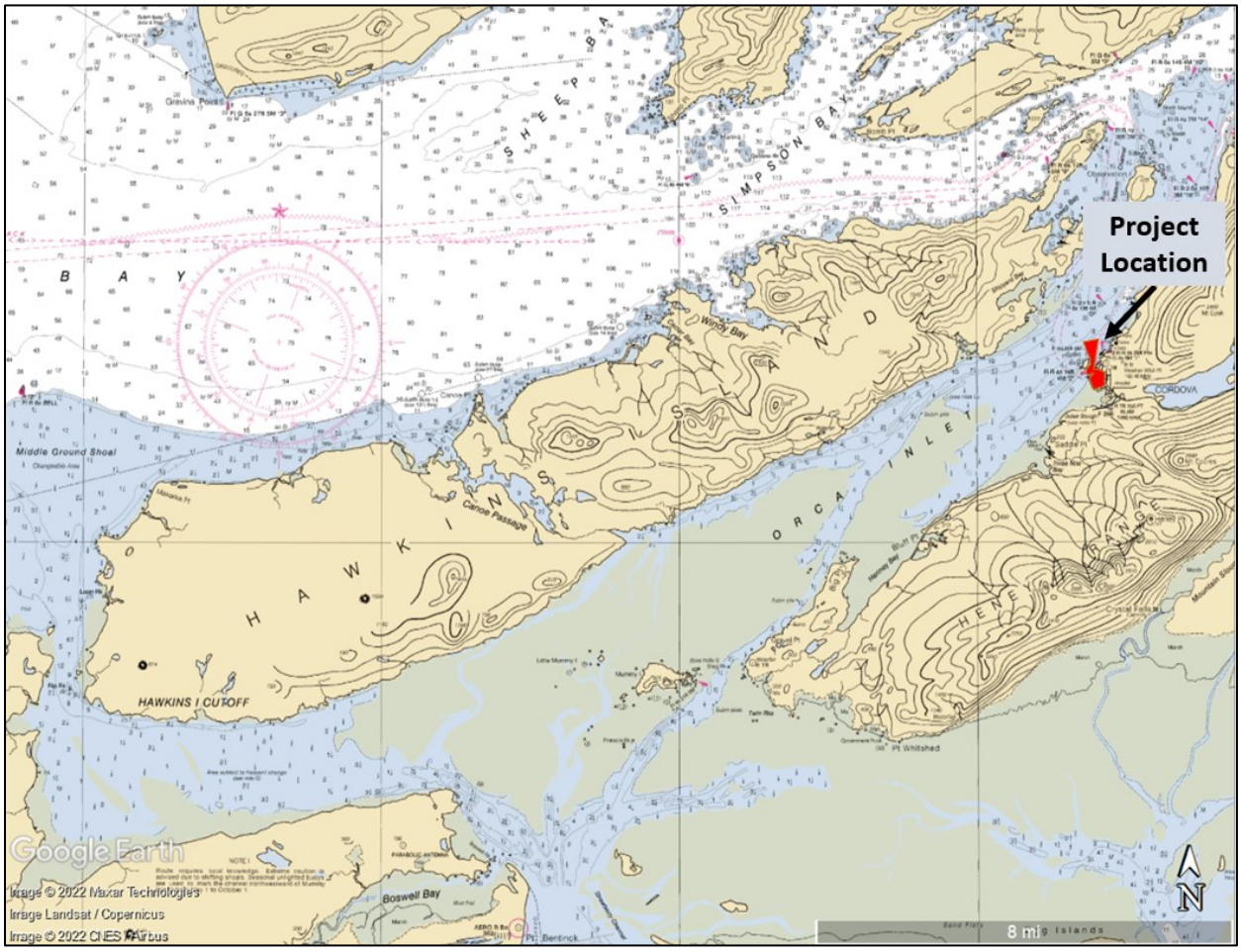
2.2.1 Physical Environment

Orca Inlet is an approximately 48-kilometer-long (30 miles) elongated estuary that adjoins the southern end of Orca Bay (Figure 12). The bay varies between 2.5 and 5.6 kilometers (1.5 to 3.5 miles) wide. South of Cordova Harbor, Orca Inlet is relatively shallow with exposed mudflats at

a zero tide. North of Cordova Harbor, Orca Inlet is deeper which provides the only access to the harbor for deeper drafting boats. Orca Inlet experiences an average semidiurnal tide from 0.5 meters (1.61 feet) to 3.5 meters (11.52 feet) above MLLW (NOAA 2022).

Cordova Harbor has been characterized on the NMFS ShoreZone Mapper and has a protected/anthropogenic permeable habitat class and man-made permeable riprap environmental sensitivity index (NMFS 2022).

Figure 12. NOAA Nautical Chart #16709 Cordova Area Bathymetry



Source: NOAA 2018

2.3 SEASONAL ISSUES

Marine mammal species can occur year-round in the action area; however, concentrated numbers are most likely to occur during seasonal prey aggregations. Herring, walleye pollock, salmon, and eulachon are among the species that congregate ephemerally, and marine mammals tend to be more common in the action area in late spring/early summer when these prey species tend to be more abundant (Straley et al. 2017). As construction would occur in fall, winter, and spring, seasonal variation has been factored into take estimates.

3 SPECIES AND NUMBER OF MARINE MAMMALS

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

Orca Inlet supports eleven marine mammal species under NMFS jurisdiction that may occur in the vicinity of the proposed project based on the NMFS Alaska Species Distribution Mapper (NMFS 2022a). Table 10 lists these species and summarizes key information regarding their stock status, distinct population segments (DPS), abundance, potential biological removal (PBR), annual mortality/serious injury rate (M/SI), and potential to occur in the action area.

Marine mammals' specific density data in Orca Inlet is readily available due to Prince William Sound Science Center's location in Cordova and anecdotal research conducted in the Gulf of Alaska. To more accurately determine species that may occur in the action area in Passage Canal, staff at the Prince William Sound Science Center and the Cordova Harbor were consulted (Prince William Sound Science Center 2022; Schinella 2022).

Information from local sources, a review of scientific literature, and consideration of conditions within the project area indicate that Steller sea lions, harbor seals, killer whales, and Dall's Porpoise could occur in the action area during construction. This Incidental Harassment Authorization (IHA) application requests take for these species and assesses the potential impacts that may occur to them as a result of this project.

Although listed in the area by the NMFS Distribution mapper, northern fur seal, Pacific white-sided dolphin, harbor porpoise, humpback whale, fin whale, minke whale, and gray whale are extremely rare in Orca Bay, and it would be unusual for these species to come into the shallow waters of the action area in Orca Inlet. As a result, take for these species is not requested. In the unusual event that one of these species entered the action area, shutdowns will be implemented if these or any other marine mammal species not listed above appears likely to approach the Level B shutdown zone during in-water work (see Section 11.4).

Table 10. Prince William Sound Marine Mammal Species Abundance Estimates

Species [a]	Stock and Abundance Estimate [b]	DPS and ESA Status	MMPA Status	PBR	Annual M/SI	Timing and Occurrence in Action Area [c]
Steller Sea Lion (*Eumetopias jubatus*)	Western U.S.: 52,932	Western DPS: Endangered	Strategic, depleted	318	254	Year-round/Common
	Eastern U.S.: 43,201	Eastern DPS: Not listed	Not strategic, non-depleted	2,592	112	Year-round/Common
Northern Fur Seal (*Callorhinus ursinus*)	Eastern Pacific: 626,618	Not listed	Strategic, depleted	11,403	373	Very rare
Harbor Seal (*Phoca vitulina*)	Prince William Sound: 44,756	Not listed	Not strategic, non-depleted	1,253	413	Year-round/Common
Killer Whale (*Orcinus orca*)	Alaska Resident: 2,347	Not listed	Not strategic, non-depleted	24	1	Year-round; more likely in summer and early fall/Infrequent
	Gulf of Alaska/Aleutian Islands/Bering Sea Transient: 587	Not listed	Not strategic, non-depleted	5.9	0.8	
	AT1 Transient: 7 [e]	Not listed	Strategic, depleted	0.1	0	
Pacific White-Sided Dolphin (*Lagenorhynchus obliquidens*)	North Pacific: 26,880	Not listed	Not strategic, non-depleted	Unknown	0	Very rare
Harbor Porpoise (*Phocoena phocoena*)	Gulf of Alaska: 31,046	Not listed	Not strategic, non-depleted	Unknown	72	Year-round/Very rare
Dall's Porpoise (*Phocoenoides dalli*)	Alaska: 13,110 [d]	Not listed		131	37	Year-round/Infrequent

Species [a]	Stock and Abundance Estimate [b]	DPS and ESA Status	MMPA Status	PBR	Annual M/SI	Timing and Occurrence in Action Area [c]
Humpback Whale (*Megaptera novaeangliae*)	Western North Pacific: 1,107	Western North Pacific DPS: Endangered	Strategic, depleted	3	2.8	Year-round; peak presence in summer (May to September)/Rare
	California/Oregon/Washington: 4,973	Mexico DPS: Threatened		28.7	48.3	
	Central North Pacific: 10,103	Hawaii DPS: Not listed		83	26	
Fin Whale (*Balaenoptera physalus*)	Northeast Pacific: 3,168	Endangered	Strategic, depleted	5.1	0.6	Spring – summer/Very rare
Minke Whale (*Balaenoptera acutorostrata*)	Alaska: Unknown	Not listed	Not strategic, non-depleted	Unknown	0	Very rare
Gray Whale (*Eschrichtius robustus*)	Eastern North Pacific: 26,960	Not listed	Not strategic, non-depleted	801	131	April – May, October – January (coastal migration route)/Very rare

[a] Species listed with ranges extending into the project area derived from the NMFS Species Distribution Mapper (NMFS 2022a) and review of scientific literature. Estimates are presented for either an entire stock or DPS known to be present in the action area.

[b] Abundance estimates are from the most recent stock assessment reports [Carretta et al. 2022 (gray whale, humpback whale CA/OR/WA stock); Muto et al. 2022 (all others)].

[c] Occurrence estimates based on consultation with staff at the Prince William Sound Science Center in Cordova, Alaska and the Cordova Harbor were consulted (Prince William Sound Science Center 2022; Schinella 2022). Common=multiple sightings every month, could occur each day; Frequent=multiple sightings every year, could occur each month; Infrequent=few sightings each year, could occur each month; Rare=no sightings in recent years; Very rare = no local knowledge of sightings in the project vicinity.

[d] Population estimate based on surveys from western Prince William Sound only, as abundance estimates for the Alaska stock are more than eight years old and no longer considered reliable (Muto et al. 2022).

[e] As the AT1 Transient killer whale stock population size is very small, PBR and M/SI numbers are not as useful since any human-caused mortality or serious injury is likely to have a serious population-level impact. This stock is not likely to recover since no births have been recorded in the past 30 years (Muto et al. 2022).

4 AFFECTED SPECIES STATUS AND DISTRIBUTION

A description of the status and distribution of each species or stocks or marine mammals likely to be affected by the activity.

4.1 STELLER SEA LION

4.1.1 Description, Behavior, and Life History

Steller sea lions are pinnipeds and members of the otariidae or "eared seals" family. They are the largest of the eared seals, with males measuring up to 2,500 pounds and 11 feet long. Females of the species are slightly smaller, weighing up to 800 pounds. They are characterized by light blonde to reddish brown coats and long white whiskers on their muzzles used to sense prey and navigate within the water. They have long front flippers that are used to propel themselves in water and shorter back flippers that can be turned for walking on land (NMFS 2022b). As social animals, they gather in large groups on land at rookeries for resting, breeding, and raising young pups. They are known to haul out on land, docks, buoys, and navigational markers. Different from rookeries, haulouts are more informal gathering locations used for resting and molting. In their aquatic habitat they are generally more solitary hunters and are excellent divers but often gather in large rafts, or clusters, at the surface.

Steller sea lions do not follow traditional migration patterns, but will move from offshore rookeries in the summer to more protected haulouts closer to shore in the winter. They use rookeries and haulouts as resting spots as they follow prey movements and take foraging trips for days, usually within a few miles of their rookery or haulout. They are generalist marine predators and opportunistic feeders based on seasonal abundance and location of prey. Fish such as salmon, herring, cod, eulachon, and pollock or cephalopods like octopus and squid are diet staples. Steller sea lions forage in nearshore as well as offshore areas, following prey resources. They are highly social and are often observed in large groups while hauled out but alone or in small groups when at sea (NMFS 2022b).

4.1.2 Hearing Ability and Communication

Steller sea lions are classified by NMFS as otariid pinnipeds with a generalized in-water hearing range of 60 Hz to 39 kHz (kilohertz, NMFS 2018). The ability to detect sound and communicate underwater is important for a variety of Steller sea lion life functions, including reproduction and predator avoidance. Sea lions have a range of vocalizations used on land and in water in conjunction with territorial behaviors, breeding, and communication between mother/pup pairs (Charrier 2021). Studies of Steller sea lion auditory sensitivities have found that this species detects sounds underwater between 1 to 25 kHz (Kastelein et al. 2005) and in air between 250 Hz (hertz) and 30 kHz (Mulsow and Reichmuth 2010).

4.1.3 Status

The Steller sea lion was listed as a threatened species under the ESA on November 26, 1990 due to significant population decline (55 FR 49204). Speculated causes of the decline included competition with commercial fisheries, environmental change, disease, predation, incidental take, and shooting (NMFS 2008). In 1997, NMFS reclassified Steller sea lions as two DPSs based on genetic studies and other information (62 FR 24345; May 7, 1997). At that time, the eastern DPS (EDPS; which includes animals born east of Cape Suckling, Alaska) was listed as threatened,

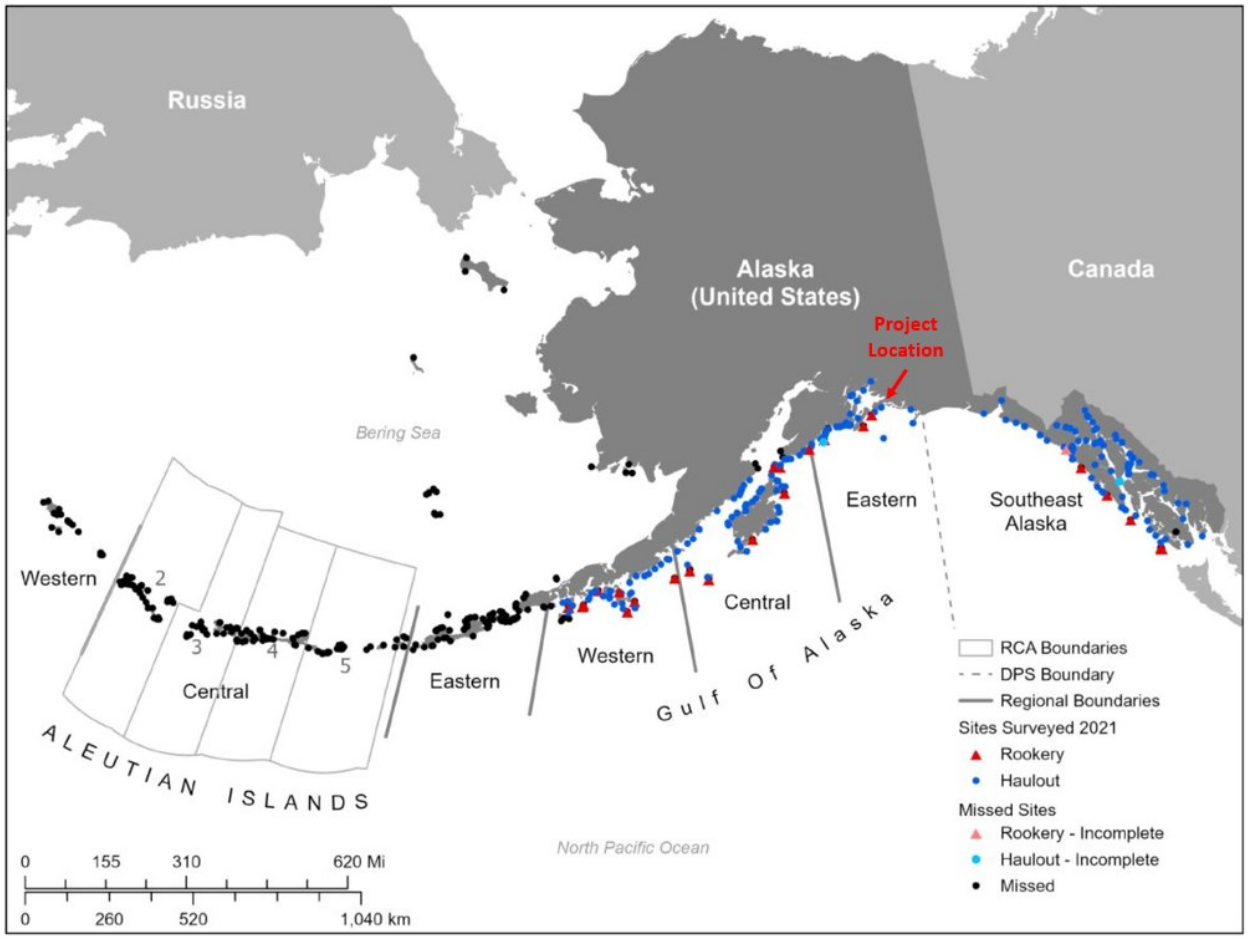
and the western DPS (WDPS; which includes animals breeding west of Cape Suckling, both in Alaska and Russia) was listed as endangered. The EDPS was removed from the endangered species list on November 4, 2013 (78 FR 66140). The WDPS remains on the ESA's endangered list. There have been no unexplained mortality events (UMEs) declared for this species in recent years (NMFS 2022c).

4.1.4 Distribution

Steller sea lions are distributed along the North Pacific Rim from northern Japan to California, with centers of abundance in the Gulf of Alaska and the Aleutian Islands (NMFS 2008). The EDPS includes sea lions born on rookeries from as far south as California through Southeast Alaska, and the WDPS includes those born on rookeries from Prince William Sound westward, with an eastern boundary at 144 degrees (°) west (W; NMFS 2022b; Hastings et al. 2020). Both WDPS and EDPS Steller sea lions may be found within the project area but most Steller sea lions observed in Orca Inlet are likely to be from the WDPS (NMFS 2022b). Steller sea lions are not known to migrate annually, but individuals may disperse widely outside of the breeding season (Jemison et al. 2013; Allen and Angliss 2015).

Steller sea lions are distributed throughout Prince William Sound, with patterns loosely correlated to aggregations of spawning and migrating prey species, particularly fish and cephalopod species (Womble 2005; Sinclair and Zeppelin 2002; Sinclair et al. 2013). Haulout and rookery sites in Southcentral Alaska are documented through biennial aerial surveys and are shown in Figure 13 (Sweeney et al. 2022). Of the two Steller sealion populations in Alaska, the WDPS includes sea lions born on rookeries at or west of Cape Suckling, and the EDPS includes sea lions born on rookeries from California north through Southeast Alaska. A dividing line, based on genetic studies, was established at 144°W as shown in Figure 16 (NMFS 2022b). Cordova, Alaska is at 166°W, west of the dividing line and firmly within the range of the ESA-list WDPS.

Figure 13. Separation of WDPS and EDPS Steller Sea Lion Rookeries at 144°W



Source: Sweeney et al. 2022

4.1.5 Presence in Project Area

Steller sea lions are distributed throughout Southcentral Alaska, with patterns loosely correlated to aggregations of spawning and migrating prey species (Womble et al. 2005; Sinclair and Zeppelin 2002; Sinclair et al. 2013). Haulout sites in Southcentral Alaska, at and west of Cape Suckling, were documented through aerial surveys and are shown in Figure 13.

Steller sea lions may be found in and around Orca Inlet throughout the year. Additionally, communication with the Cordova Harbormaster and Prince William Sound Science Center scientists indicate that Steller sea lions are frequently observed inside Cordova Harbor (Schinella 2022; Prince William Sound Science Center 2022). They are drawn to fish processing plants and high forage value areas such as anadromous streams. The Cordova area has several anadromous streams that support salmon species (Alaska Department of Fish and Game [ADF&G] 2022) and six Alaska Department of Environmental Conservation permitted seafood processing plant outfalls that also attracts Steller sea lions (ADEC 2022).

4.1.6 Critical Habitat

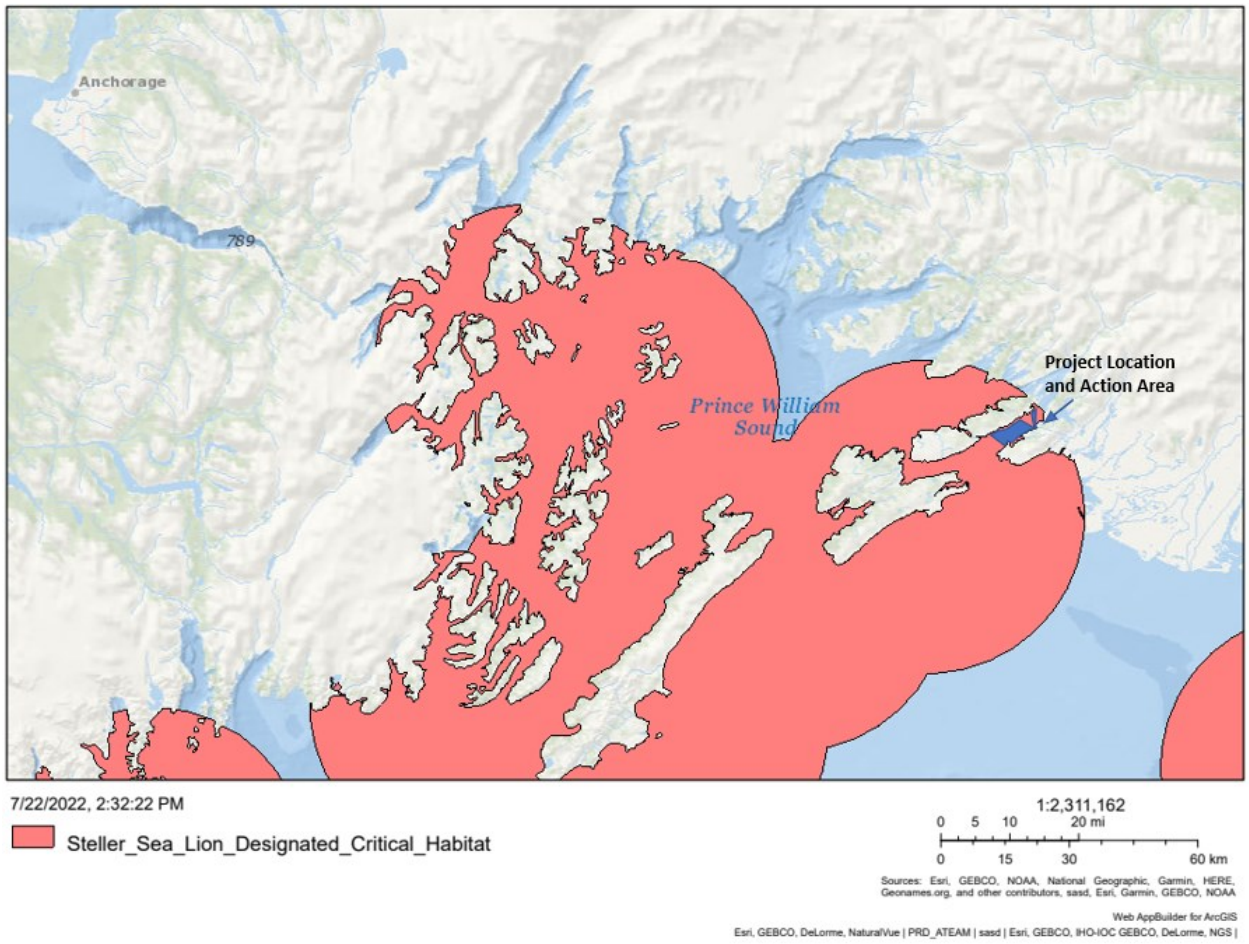
Critical habitat for Steller sea lions was designated by NMFS in 1993 based on the following essential physical and biological habitat features: terrestrial habitat (including rookeries and haulouts important for rest, reproduction, growth, social interactions) and aquatic habitat

(including nearshore waters around rookeries and haulouts, free passage for migration, prey resources, and foraging habitats; 58 FR 45269). Specifically, designated critical habitat consists of a terrestrial buffer zone that extends 914 meters (3,000 feet) landward from each major sea lion rookery and haulout. The aquatic buffer zone extends 914 meters (3,000 feet) from major rookeries and haulouts east of 144° W longitude (the dividing line for EDPS and WDPS Steller sea lions) and 37 km (20 nautical miles) from major rookeries and haulouts west of 144° W longitude.

While the project action area is within designated WDPS Steller sea lion critical habitat, there are few essential physical and biological habitat features of critical habitat within in the action area. The nearest rookery to the proposed project is Seal Rocks (approximately 73 kilometers northeast of project [45 miles]) off the coast of Hinchinbrook Island and the nearest major haulouts are Hook Point (36 kilometers northeast of project [22 miles]) and Cape Hinchinbrook (59 kilometers northwest of project [37 miles]; Figure 13; NMFS 2016). However, given the small footprint and shallow depth of water in the project's action area, prey resources and foraging habitats in the action area are expected to be minimal.

Within the action area, all of the important aquatic features exist for Steller sea lions, although prey availability has been declining in the area in recent years. Pacific cod in the Gulf of Alaska and herring stocks in Prince William Sound (primary prey species for Steller sea lions) have been in decline since the 1990s (NMFS 2020). Terrestrial habitat exists within the action area, but as it has not been previously used by Steller sea lions (i.e., no existing rookery or haulout sites in the area) does not meet the functions needed for critical habitat such as social interactions, warmth (provided by huddling with a group), reproduction, and growth (NMFS 2020).

Figure 14. Steller Sea Lion Critical Habitat Near the Cordova Harbor Project Area



Source: NMFS 2022a

4.2 HARBOR SEAL

4.2.1 Description, Behavior, and Life History

Harbor seals are one of the most common marine mammals in Alaska. They haul out on rocks, reefs, beaches, and drifting glacial ice sometimes in groups for protection against larger predators such as transient killer whales and feed in marine, estuarine, and occasionally fresh waters. Harbor seals are generally non-migratory with local movements associated with such factors as tide, weather, season, food availability and reproduction. Harbor seals are able to dive to depths up to 500 meters (1,640 feet) and forage on fish, clams, mussels, and crustaceans. Harbor seals deviate from other pinniped species in that pupping may occur on a wide variety of haul-out sites rather than particular major rookeries (ADF&G 2022a).

4.2.2 Hearing Ability and Communication

Harbor seals are classified by NMFS as phocid pinnipeds with a generalized in-water hearing range of 50 Hz to 86 kHz (NMFS 2018). They respond to underwater sounds from approximately 1 Hz to 180 kHz, with the functional high-frequency limit around 60 kHz and peak sensitivity at about 32 kHz. Their hearing ability in the air is greatly reduced (by 25 to 30 dB); they respond to sounds from 1 to 22.5 kHz, with a peak sensitivity of 12 kHz (Kastak and Schusterman 1995).

Most harbor seal vocalizations are exhibited during breeding season by adult males in order to establish territory and attract females (Casey et al. 2016; Matthews et al. 2020). Vocalizations between mother/pup pairs are also important as female seals forage during the nursing period and use attraction calls to maintain contact with pups (Perry and Renouf 1988; Sauvé et al. 2015).

4.2.3 Status

Harbor seals are not listed as depleted under the MMPA or as threatened or endangered under the ESA. In 2010, harbor seals in Alaska were partitioned into 12 separate stocks based largely on genetic structure (Muto et al. 2022). The status of the 12 stocks relative to their optimum sustainable population size is unknown. The Prince William Sound stock of harbor seals, the stock that would be expected in the project vicinity, is not classified as strategic.

The current statewide abundance estimate for Alaskan harbor seals is 243,938 based on aerial survey data collected between 1996 and 2018 (Boveng et al. 2019). The abundance estimate for the Prince William Sound stock is 44,756 (Muto et al. 2022). The current Prince William Sound population trend shows a decrease of 200 seals per year, with a 0.648 probability that the stock is decreasing (Muto et al. 2022).

4.2.4 Distribution

Harbor seals range from Baja California north along the west coasts of Washington, Oregon, California, British Columbia, and Southeast Alaska; west through the Gulf of Alaska, Prince William Sound, and the Aleutian Islands; and north in the Bering Sea to Cape Newenham and the Pribilof Islands.

Distribution of the Prince William Sound stock, the only stock considered in this application, range from Elizabeth Island off the southwest tip of the Kenai Peninsula to Cape Fairweather, including Prince William Sound, the Copper River Delta, Icy Bay, and Yakutat Bay (Muto et al. 2022).

4.2.5 Presence in Project Area

The Prince William Sound stock of harbor seals are commonly sighted residents and can occur on any given day in the action area, although they tend to be more abundant during the fall months (Womble and Gende 2013).

Harbor seals may be found in and around Orca Inlet throughout the year. Additionally, communication with the Cordova Harbormaster and scientists at the Prince William Sound Science Center indicated that harbor seals are often observed inside Cordova Harbor (Schinella 2022; Prince William Sound Science Center 2022).

4.3 KILLER WHALE

4.3.1 Description, Behavior, and Life History

Killer whales, members of the *Delphinidae* family, or dolphins, are one of the most recognizable marine mammals, with their distinctive black and white bodies. They are highly social animals and apex predators, often traveling in social groups (pods) made up of 20 or more animals, and use coordinated feeding efforts to capture and also share prey with others in the pod. Killer whales have diverged evolutionarily into three distinct genetic ecotypes (offshore, resident, and

transient) that overlap in distribution somewhat but exhibit different vocalization patterns and prey preferences. They are opportunistic feeders and generally their diet is shaped by where they live, although favored prey are marine mammals, fish, squid, and even sharks (NMFS 2022d).

4.3.2 Hearing Ability and Communication

Killer whales are classified by NMFS as mid-frequency cetaceans with a generalized hearing range of 150Hz to 160 kHz (NMFS 2018). The hearing of killer whales is well developed. Szymanski et al. (1999) found that they responded to tones between 1 and 120 kHz, with the most sensitive range between 18 and 42 kHz. Their greatest sensitivity is at 20 kHz, which is lower than many other odontocetes, but it matches peak spectral energy reported for killer whale echolocation clicks. Killer whales use vocalizations in a variety of ways. Each pod employs a unique set of sounds including clicks, whistles, and calls for echolocation during foraging, to communicate with other pod members, and for navigation (Myers et al. 2021).

4.3.3 Status

Based on data regarding association patterns, acoustics, movements, and genetic differences, eight killer whale stocks are now recognized within the Pacific U.S. Exclusive Economic Zone, seven of which occur in Alaska. The three stocks that are most likely to occur in Prince William Sound are the southern Alaska Resident stock, Gulf of Alaska/Aleutian Islands/Bering Sea Transient stock, and the AT1 Transient stock (Muto et al. 2022).

With the exception of the strategically depleted AT1 Transient stock, the populations that are known to occur in Prince William Sound are not strategic or depleted under the MMPA. The southern Alaska resident stock size is 2,347 (675 individuals documented in Prince William Sound), Gulf of Alaska/Aleutian Islands/Bering Sea transient stock population size is 587 (136 individuals documented in the Gulf of Alaska); and the AT1 transient stock population size is 7 (Muto et al. 2022). Long-term studies of pods belonging to the southern Alaska resident stock in the Gulf of Alaska indicate these populations are increasing at an estimated growth rate of approximately 3.4-percent (Matkin et al. 2014). However, the AB resident pod and AT1 transient stock both experienced a large mortality event following the 1989 Exxon Valdez Oil spill. Prior to the spill the AB pod consisted of 36 members and from 1989 to 1990, 14 whales disappeared from the pod. AB pod is considered recovering; however, due to slow reproduction rates only 28 individuals were observed in 2005 (Exxon Valdez Oil Spill Trustee Council 2022). The AT1 transient population is not considered recovering because its population has remained at seven individuals with no recorded birth or deaths since 2010 (Exxon Valdez Oil Spill Trustee Council 2022).

4.3.4 Distribution

Killer whales have been observed in all oceans and seas of the world, but the highest densities occur in colder and more productive waters found at high latitudes. Killer whales are found throughout the North Pacific and occur along the entire Alaska coast, in British Columbia and Washington inland waterways, and along the outer coasts of Washington, Oregon, and California (NMFS 2022d).

In the Gulf of Alaska, the offshore killer whale ecotype is found in pelagic waters off the Aleutian Islands to California and mainly prey on sharks. The resident ecotype (southern Alaska

residents) ranges from Kodiak Island to Southeast Alaska and prefer to eat fish. The two different transient populations (Gulf of Alaska transients and AT1 transients) prefer marine mammals and are most often found near the Hinchinbrook Entrance and Montague Strait (Myers et al. 2021). A tagging study focused on killer whale movements in Prince William Sound found that killer whales' favored use areas were highly-seasonal and pod specific, likely timed with seasonal salmon returns to spawning streams (Olsen et al. 2018).

4.3.5 Presence in Project Area

Results from the Olsen et al. (2018) satellite tagging surveys in Prince William Sound from 2006 to 2014 revealed several core use areas for resident killer whales based on pod and season. Most resident pods primarily concentrated at the southern end of Prince William Sound in Hinchinbrook Entrance during the summer and Montague Strait in the late summer and fall. A few of the pods were observed making trips to deeper glacial fjords, but these areas did not appear to be an important focus area for the pods. The AD16 pod (estimated 9 animals) and AK pod (estimated 19 animals) were the most frequently observed in the northern glacial fjords of the Sound (Muto et al. 2022; Olsen et al. 2018).

Killer whales may be found in and around Orca Bay throughout the year. Communication with the Cordova Harbormaster and Prince William Sound Science Center scientists indicate that killer whales are occasionally observed in the deeper waters of Orca Inlet north of Cordova Harbor (Schinella 2022; Prince William Sound Science Center 2022).

4.4 DALL'S PORPOISE

4.4.1 Description, Behavior, and Life History

Dall's porpoise are small black and white odontocetes (toothed whales) that are very fast swimmers and generally travel in small groups, but have been observed in larger groups of hundreds of animals. Playful and social, these animals sometimes group and swim alongside larger whales or the bow of transiting vessels. Dall's porpoises are known to feed on small fish, cephalopods, and crustaceans, with a tendency towards high-value prey such as herring and sardines. The life span of the Dall's porpoise is approximately 15 to 20 years. Calving generally occurs between June and September (NMFS 2022e).

4.4.2 Hearing Ability and Communication

Dall's porpoises are classified by NMFS as high-frequency cetaceans with a generalized hearing range of 275 Hz to 160 kHz (NMFS 2018). They emit a variety of intense, high-frequency clicks and whistles which are particularly important for echolocating prey and communication (Kyhn et al. 2013).

4.4.3 Status

Dall's porpoises are not listed as threatened or endangered under the ESA or as strategic or depleted under the MMPA. NMFS currently recognizes a single stock of Dall's porpoise in Alaskan waters and an estimate of 83,400 Dall's porpoises has been used by NMFS for the entire stock; however, surveys that determined this number are more than 8 years old and not considered reliable. The minimum population estimate for this stock has been adjusted to 13,110 animals, although this number is likely low since the survey study area represents only a

small fraction of the species' range (Muto et al. 2022). There have been no UMEs declared for this species in recent years (NMFS 2022c).

4.4.4 Distribution

Dall's porpoises are widely distributed across the North Pacific Ocean and are one of the most common cetaceans in the Gulf of Alaska (Rone et al. 2017). They show some migration patterns, inshore and offshore and north and south, based on morphology and type, geography, and seasonality. Surveys conducted in the Gulf of Alaska from 2009 to 2015 indicate that Dall's porpoises inhabit all strata on the continental shelf, slope, and pelagic waters with the greatest densities occurring in deeper inshore and slope habitats (Rone et al. 2017).

4.4.5 Presence in Project Area

From data collected during surveys conducted from 2007 to 2015, Dall's porpoise presence in Prince William Sound varied based on season. They were most dispersed throughout Prince William Sound in the summer months but tended towards deeper waters in the middle of the Sound, away from shorelines. In the fall and winter, they were more often observed in the periphery of Prince William Sound with concentrations in bay areas, likely following herring shoals towards their overwintering areas. Their distribution was most concentrated in the spring, with one major activity center in eastern Prince William Sound. These porpoises were not typically found in shallow habitats or confined fjords like that of Passage Canal, preferring open water escape routes where they are able to use quick swimming techniques to evade predators such as killer whales (Moran et al. 2018). On occasion, Dall's porpoise may be present in and around Orca Bay and venturing into the deeper water in northern Orca Inlet.

5 TYPE OF INCIDENTAL TAKE AUTHORIZATION REQUESTED

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

For Phase I, the City of Cordova requests the issuance of an IHA pursuant to Section 101(a)(5) of the MMPA for incidental take by Level B harassment of four species (Steller sea lion, harbor seal, killer whale, and Dall's porpoise) and Level A take of Steller sea lion and harbor seal that may occur in the Cordova Harbor Rebuild Project harassment zones during construction.

For Phase II, the City of Cordova requests the issuance of an IHA pursuant to Section 101(a)(5) of the MMPA for incidental take by Level B harassment and Level A take of Steller sea lion and harbor seal that may occur in the Cordova Harbor Rebuild Project harassment zones during construction.

The activities outlined in Section 1 have the potential to take marine mammals by exposure to in-water sound. Level B take of four species and Level A take of two species as listed above during Phase I and the two species listed above during Phase II will potentially result from noise associated with pile installation and removal, dredging, and placement of in-water fill using the methods mentioned above (vibrating, impacting, and DTH drilling).

During Phase I and Phase II, Steller sea lions and harbor seals could be present throughout the duration of the project, likely as groups of individuals who frequently occupy the harbor area. The consistent presence of these species results in higher numbers of take requested; however, it is expected that far fewer individuals would be affected by construction noise. It is expected that the same individuals could experience repeated takes over the course of the project.

During Phase I, construction activities will be shut down before a species without Level A take designated (most likely killer whale and Dall's porpoise) appear likely to enter the Level A shutdown zones for applicable construction activities (varies by species and activity, see Section 11), thereby decreasing potential Level A take of marine mammals. During Phase II, killer whale and Dall's porpoise are not expected to occur within any harassment zones due to the relatively shallow water. During both phases, construction activities will be shut down if species without take by Level B harassment designated enter or appear likely to enter within Level B shutdown zones for applicable construction activities (varies by species and activity, see Section 11).

The City of Cordova requests two IHAs for incidental take of marine mammals described within this application. For Phase I, the City of Cordova requests an IHA for 1 year, beginning on September 15, 2023 (or the issuance date, whichever is earlier). For Phase I, the applicant requests an additional IHA for 1 year, beginning September 15, 2024 (or 1 year from the first HA issuance date, whichever is earlier). The City of Cordova is not requesting a Letter of Authorization (LOA) at this time because the activities described herein for each phase are expected to be completed within 1 year from the date of their respective authorizations and are not expected to rise to the level of serious injury or mortality, which would require an LOA.

6 TAKE ESTIMATES FOR MARINE MAMMALS

The number of marine mammals (by species) that may be taken by each type of taking identified in Section 5, and the number of times such takings by each type of taking are likely to occur.

6.1 ESTIMATED TAKE

Incidental take is estimated for each species considering the following:

1) Acoustic thresholds above which NMFS believes marine mammals will be behaviorally harassed or incur some degree of permanent hearing impairment;
2) the size of the action area (the area of water that will be ensonified above acoustic thresholds in a day);
3) the density or occurrence of marine mammals in the action area;
4) the number of days of pile driving and removal activity.

Consultation with the Cordova Harbor Harbormaster, staff at the Prince William Sound Science Center, and available scientific literature are used to estimate the density or occurrence of marine mammals in the action area. Incidental take is being requested for each species whose occurrence in the action area is described as 'common', or 'infrequent'. Take of species whose occurrence in the action area is described as 'rare' or 'very rare' is not requested (Table 10).

Daily occurrence probability of each marine mammal species in the action area is based on consultation with local researchers and marine professionals. Occurrence probability estimates are based on conservative density approximations for each species and factor in historic data of occurrence, seasonality, and group size in Orca Bay, Orca Inlet, and/or Prince William Sound (Table 11 and Table 12). For total take estimate, the daily occurrence probability for a species, was multiplied by the estimated group size and by the number of days of each type of pile driving activity. Group size is based on the best available published research for these species and their presence in this area.

Level A take is requested for Steller sea lions and harbor seals given that these species are observed to spend extended periods of time within Cordova Harbor and most Level A isopleths are contained within Cordova Harbor. The Level A take calculations are based on smaller daily occurrence estimates for each species than Level B take calculations based on input from marine professionals in the community about their presence in within the smaller ensonified zone of the harbor (Greenwood 2022).

Estimated take =
Group size (weighted average) x Groups per day x Days of pile driving activity

6.1.1 Phase I

For construction of Phase I, the City of Cordova is requesting Level B take for Steller sea lions, harbor seals, killer whales, and Dall's porpoise and Level A harassment of Steller sea lions and harbor seals. Table 11 shows species occurrence information used to estimate take and take calculations for Phase I.

Table 11. Cordova Harbor Rebuild Project Species Occurrence Information and Take Calculation – Phase I

Species	Frequency	Seasonality	Group Size (Weighted Average)	Groups per Day	Pile Driving Method	Max Duration per Day (Hours)	Total Days	Total Hours	Distance (range, m)	Take Calculation	Total Take
Level A											
Steller sea lion	Common	Year-round	1-7 (4.1) [1]	1 group per day	Impact	2.0	3.3	6.7	35	4.1 per group X 1 group per day X 6.7 days = 14	102
					DTH	5.0	21.5	107.5	40 - 70	4.1 per group X 1 group per day X 21.5 days = 88	
Harbor seal	Frequent	Year-round	1-7 (3.5) [2]	1 group per day	Vibratory	4.2	7.6	31.9	25	3.5 per group X 1 group per day X 7.6 days = 26	114
					Impact	2.0	3.3	66.6	75 - 360	3.5 per group X 1 group per day X 3.3 days = 12	
					DTH	5.0	21.5	107.5	500 - 925	3.5 per group X 1 group per day X 21.5 days = 75	
Level B											
Steller sea lion	Common	Year-round	1-7 (4.1) [1]	2 groups per day	Vibratory	4.2	95.8	224.5	70 - 4,500	4.1 per group X 2 groups per day X 95.8 days = 782	1,305
					Impact	5.0	41.8	66.6	55 - 1,000	4.1 per group X 2 groups per day X 41.8 days = 343	
					DTH	5.0	21.5	107.5	4,500	4.1 per group X 2 groups per day X 21.5 days = 176	
Harbor seal	Common	Year-round	1-7 (3.5) [2]	2 groups per day	Vibratory	4.2	95.8	224.0	70 - 4,500	3.5 per group X 2 groups per day X 95.8 days = 671	1,114
					Impact	5.0	41.8	66.6	55 - 1,000	3.5 per group X 2 groups per day X 41.8 days = 293	
					DTH	5.0	21.5	107.5	4,500	3.5 per group X 2 groups per day X 21.5 days = 151	

Species	Frequency	Seasonality	Group Size (Weighted Average)	Groups per Day	Pile Driving Method	Max Duration per Day (Hours)	Total Days	Total Hours	Distance (range, m)	Take Calculation	Total Take
Killer whale	Infrequent	Year-round	9-16 (14) [3]	1 group every 10 days	Vibratory	4.2	51.4	136.5	4,500	14 per group x 1 group every 10 days X (51.4 days/10) = 72	107
					Impact	2.0	3.3	6.6	1,000	14 per group x 1 group every 10 days X (3.3 days/10) = 5	
					DTH	5.0	21.5	107.5	4,500	14 per group x 1 group every 10 days X (21.5 days/10) = 30	
Dall's Porpoise	Infrequent	Year-round	1-18 (4.3) [4]	1 group every 10 days	Vibratory	4.2	51.4	136.5	4,500	4.3 per group x 1 group every 10 days X (51.4 days/10) = 22	33
					Impact	2.0	3.3	6.6	1,000	4.3 per group x 1 group every 10 days X (3.3 days/10) = 1	
					DTH	5.0	21.5	107.5	4,500	4.3 per group x 1 group every 10 days X (21.5 days/10) = 9	

[1] Using a weighted average group size (7 per group May – September; 2 per group October – April) = 4 animals per group (Leonard and Wisdom 2020; Sigler et al. 2017)

[2] Using a weighted average group size (7 per group May – September; 1 per group October – April) = 3.5 animals per group (ADF&G 2022a)

[3] Using the average between the two pods in the region (AK pod: 19; AD16 pod: 9) = 14 animals per group (Muto et al. 2022)

[4] Using the weighted average of groups observed in Prince William Sound (1 to 18) = 4.3 animals per group (Moran et al. 2018)

6.1.2 Phase II

For construction of Phase II, the City of Cordova is requesting Level B and Level A take for Steller sea lions and harbor seals. As discussed above (see Section 5), Level B take is not requested for killer whales or Dall's porpoise or any other marine mammal during Phase II because the action area extends south of Spike Island into tidal mudflats. However, Level B take is requested for Steller sea lions and harbor seals have been observed to use this area at mid-to-high tides. Table 12 shows species occurrence information used to estimate take and take calculations for Phase II.

Table 12. Cordova Harbor Rebuild Project Species Occurrence Information and Take Calculation – Phase II

Species	Frequency	Seasonality	Group Size	Groups per Day	Pile Driving Method	Max Duration per Day (Hours)	Total Days	Total Hours	Distance (range, m)	Take Calculation	Total Take
Level A											
Steller sea lion	Common	Year-round	1-7 (4.1) [1]	1 group per day	Impact	1.3	16.0	22.0	25 - 75	4.1 per group X 1 group per day X 16.0 days = 66	97
					DTH	2.0	7.7	3.1	40 - 75	4.1 per group X 1 group per day X 7.7 days = 32	
Harbor seal	Frequent	Year-round	1-7 (3.5) [2]	1 group per day	Vibratory	1.0	30.7	49.9	25	3.5 per group X 1 group per day X 30.7 days = 107	199
					Impact	1.3	18.4	23.9	75 - 850	3.5 per group X 1 group per day X 18.4 days = 64	
					DTH	2.0	7.7	15.4	500 - 925	3.5 per group X 1 group per day X 15.4 days = 27	

Species	Frequency	Seasonality	Group Size	Groups per Day	Pile Driving Method	Max Duration per Day (Hours)	Total Days	Total Hours	Distance (range, m)	Take Calculation	Total Take
Level B											
Steller sea lion	Common	Year-round	1-7 (4.1) [1]	2 groups per day	Vibratory	4.2	61.4	89.0	1,000 – 10,000	4.1 per group X 2 groups per day X 61.4 days = 503	718
					Impact	1.3	18.4	23.9	275-1,000	4.1 per group X 2 groups per day X 18.4 days = 151	
					DTH	2.0	7.7	15.4	36,400	4.1 per group X 2 groups per day X 7.7 days = 63	
Harbor seal	Common	Year-round	1-7 (3.5) [2]	2 groups per day	Vibratory	4.2	61.4	89.0	1,000 – 10,000	3.5 per group x 2 groups per day X 61.4 days = 430	613
					Impact	1.3	18.4	23.9	275-1,000	3.5 per group x 2 groups per day X 18.4 days = 129	
					DTH	2.0	7.7	15.4	36,400	3.5 per group x 2 groups per day X 7.7 days = 54	

[1] Using a weighted average group size (7 per group May – September; 2 per group October – April) = 4 animals per group (Leonard and Wisdom 2020; Sigler et al. 2017)

[2] Using a weighted average group size (7 per group May – September; 1 per group October – April) = 3.5 animals per group (ADF&G 2022a)

6.2 ALL MARINE MAMMAL TAKE REQUESTED

For Phase I, this analysis for the Cordova Harbor Rebuild Project predicts 102 potential Level A takes of ESA-listed Steller sea lions and 114 potential Level A takes of harbor seals. This analysis also predicts the following potential takes by Level B harassment: 1,305 takes of ESA-listed Steller sea lions, 1,114 takes of harbor seals, 107 takes of killer whales, and 33 takes of Dall's porpoise.

For Phase II, this analysis for the Cordova Harbor Rebuild Project predicts 97 potential Level A takes of ESA-listed Steller sea lions and 199 potential Level A takes of harbor seals. This analysis also predicts 718 potential takes by Level B harassment of ESA-listed Steller sea lions and 613 potential takes by Level B harassment of harbor seals.

For the construction of the entire Cordova Harbor Rebuild Project, the City of Cordova requests 199 Level A take of Steller sea lions and 313 Level A take of harbor seals and the following takes by Level B harassment: 2,023 takes of ESA-listed Steller sea lions, 1,727 takes of harbor seals, 107 takes of killer whales, and 33 takes of Dall's porpoise.

Table 13 presents Level A and B take requests and percent of marine mammal stocks by Phase I, Phase II, and the entire project.

Table 13. Cordova Harbor Rebuild Project Take Requests for Marine Mammals and Percent of Stock – Phase I and II

Species	Stock/DPS (NEST) [a]	Phase I			Phase II			Project Total
		Level A	Level B [b]	Percent of Stock [c]	Level A	Level B [b]	Percent of Stock [c]	Percent of Stock [c]
Steller Sea Lion	Western U.S. (52,932)	102	1,305	2.7	76	570	1.2	3.7
Harbor Seal	Prince William Sound (44,756)	114	1,114	2.7	97	718	1.5	4.2
Killer Whale	Alaska Resident (2,347)	--	85	3.6	199	613	1.8	4.6
	Gulf of Alaska/Aleutian Islands/Bering Sea Transient (587)	--	21	3.6	--	--	--	3.6
	AT1 Transient (7)	--	0.3	3.6	--	--	--	3.6
Dall's Porpoise	Alaska (13,110) [d]	--	33	0.3	--	--	--	3.6

[a] Stock estimate from Muto et al. 2022

[b] Take estimates are weighted based on calculated percentages of population for each distinct stock, assuming animals present would follow same probability of presence in project area

[c] Percent of stock refers to combined Level B and Level A take (if requested)

[d] Population estimate based on surveys from western Prince William Sound only, as abundance estimates for the Alaska stock are more than eight years old and no longer considered reliable (Muto et al. 2022)

7 ANTICIPATED IMPACT OF THE ACTIVITY

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

The City of Cordova is requesting authorization for Level A and Level B take of marine mammals as listed in Table 13 which shows take requests in relation to the overall stock size of each species. Incidental takes of marine mammals will likely be multiple takes of individuals, rather than single takes of unique individuals. Since the stock take calculations in Table 13 assume takes of individual animals instead of repeated takes of a smaller number of the same individuals, the stock take percentage calculations are conservative.

Incidental Level B take is expected to result primarily in short-term changes in behavior, such as avoidance of the project area, changes in swimming speed or direction, and changes in foraging behavior. During Phase I, Level B exposure could occur on 170 days when pile driving and removal occurs. During Phase II, Level B exposure could occur on 88 days when pile driving and removal occurs and 1 day during placement of in-water fill. Because of the limited time that marine mammals could be exposed to Level B harassment, the Cordova Harbor Rebuild Project would be unlikely to have any impact on stock recruitment or survival, and therefore, would have a negligible impact on the stocks of these species.

The City of Cordova is requesting Level A take that may occur for Steller sea lions and harbor seals when Level A monitoring zones are greater than 10 meters (see Table 16 and Table 19). Incidental Level A take can cause injury including permanent, partial, or full hearing loss if marine mammals are exposed to underwater sounds exceeding the injury threshold, which vary by species. Marine mammals exposed to high received sound levels may experience non-auditory physiological effect such as increased stress, neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage.

Because of the limited area over which Steller sea lions and harbor seals could experience Level A harassment (a maximum of 925 meters [3,035 feet]), it is not expected that there would be any impact on stock recruitment or survival, and therefore, there would be no impact on the stocks of these species.

8 ANTICIPATED IMPACTS ON SUBSISTENCE USES

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

Alaska Natives have used subsistence resources, including sea lions and harbor seals, in Prince William Sound for thousands of years. The Alutiiq and Eyak people of Prince William Sound traditionally harvested marine mammals, land mammals, birds, shellfish, and fish, mostly salmon and herring. Subsistence harvesting went into sharp decline after the Exxon Valdez Oil Spill of 1989 and full recovery has not yet been achieved (Keating et al. 2020). Today most subsistence species used in Prince William Sound are salmon, halibut, shellfish, and plant species such as wild berries.

In the decade since the Exxon Valdez Oil Spill, there have been declines in the number of households hunting and harvesting larger marine mammals in Prince William Sound. Surveys gathering subsistence data found that 10 percent or fewer households harvest or use harbor seals or sea lions (Poe et al. 2010). Subsistence hunters in Prince William Sound report having to travel farther from their home communities to be successful when harvesting marine mammals (Keating et al. 2020).

In 2008, Cordova households reported harvesting 64 harbor seals (ADF&G 2022a). The last recorded subsistence harvest in Cordova was in 2014 as part of a regional effort to update the status of subsistence uses in Exxon Valdez Oil Spill communities (Fall and Zimpelman 2016). This community survey found no marine mammals were harvested in Cordova; however, a number of households used marine mammals as a subsistence resource. During the same 2014 survey, harvest of harbor seals and Steller sea lions was reported in the nearby community of Tatitlek (Fall and Zimpelman 2016).

The proposed project is not likely to adversely impact the availability of any marine mammal species or stocks that are commonly used for subsistence purposes or to impact subsistence harvest of marine mammals in the region because:

- there is no recent recorded subsistence harvest of marine mammals in the area;
- construction activities are localized and temporary;
- mitigation measures will be implemented to minimize disturbance of marine mammals in the action area; and,
- the project will not result in significant changes to availability of subsistence resources.

9 ANTICIPATED IMPACTS ON HABITAT

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

9.1 LOSS OF MARINE MAMMAL HABITAT DUE TO PROJECT FOOTPRINT

The Cordova Harbor Rebuild Project would likely not impact any marine mammal habitat since its proposed location is within the current harbor footprint and is located in an area that is currently used by numerous commercial fishing and personal vessels. The general area is also an active marine, commercial, and tourist area.

9.2 LOSS OF MARINE MAMMAL HABITAT DUE TO TURBIDITY/SEDIMENT

Throughout the duration of pile driving and removal, dredging, and placement of in-water fill and localized increase in turbidity near the seafloor would occur in the immediate area surrounding the area where activity occurs. A temporary and localized increase in turbidity near the seafloor will occur in the harbor during the estimated 279 and 813 hours (660 hours of dredging) of in-water project construction during Phase I and Phase II, respectively. A portion of the in-water work will involve DTH drilling which would also release drill cuttings into the marine environment from the top of the piles and increase turbidity in the immediate area during pile driving. Sediments will be disturbed during in-water work; however, this will occur only one time, suspension will be brief and limited to a small area within the harbor footprint, and is unlikely to measurably affect marine mammals or their prey in the area.

9.3 LOSS OF MARINE MAMMAL HABITAT DUE TO NOISE

The project could cause a temporary loss of habitat because of elevated noise levels. Displacement of marine mammals by construction noise is not expected to be permanent nor is it anticipated to have long-term effects on the species. Project activities are not expected to have any habitat-related effects that could cause significant or long-term consequences for individual marine mammals or their populations, because pile driving and other construction-related noise sources will be temporary and intermittent and mostly contained within the harbor area. This project would not expand mooring capacity in Cordova Harbor, and no increases in vessel traffic in the area are expected as a result of this project.

9.4 EFFECTS TO CRITICAL HABITAT

Designated WDPS Steller sea lions critical exists in Orca Inlet (see Section 4.1.6). ESA-listed species could experience a temporary loss of suitable habitat in the action area for 1 to 5 hours per day over 170 days during Phase I and 1 to 8.5 hours per day over 166 days during Phase II of construction if elevated noise levels associated with in-water construction results in their displacement from the area. However, the project would only impact the essential physical and biological features that make the area critical habitat for WDPS Steller sea lions, such as good water quality, prey availability, or open space for transiting and foraging when the ensonified area extends beyond Cordova Harbor. The area already has elevated noise levels because of busy vessel traffic transiting through the area, and critical habitat impacts would not be permanent nor would it result long-term effects to the local population. No known rookeries or major haulouts would be impacted.

9.5 EFFECTS TO MARINE MAMMAL PREY SPECIES

Fish, including all five Pacific Salmon species and other fish with essential fish habitat (EFH) in the project area (NMFS 2022f; Table 14), serve as marine mammal prey. These fish could be affected by noise or turbidity generated from in-water pile-driving. It is expected that most fish will be able to move away from the proposed activity to avoid harm and will still be available to marine mammals as a food source. The quantity, quality, and availability of adequate food resources are therefore not likely to be reduced (due to the small area affected, mobility of fish, anticipated recolonization, and the temporary nature of the project).

Table 14. Orca Inlet EFH Species

Species	Life Stage(s) Found at Location
Chinook Salmon (*Oncorhynchus tshawytscha*)	Immature adult and mature adult (marine)
Coho Salmon (*O. kisutch*)	Juvenile and mature adult (marine)
Pink Salmon (*O. gorbuscha*)	Juvenile and mature adult (marine)
Chum Salmon (*O. keta*)	Juvenile, immature adult, and mature adult (marine)
Sockeye Salmon (*O. nerka*)	Juvenile, immature adult, and mature adult (marine)
Walleye Pollock (*Gadus chalcogrammus*)	Egg and larvae (summer)
Sablefish (*Anoplopoma fimbria*)	Larvae (summer)
Pacific Cod (*G. macrocephalus*)	Larvae (summer)
Yellowfin Sole (*Limanda aspera*)	Egg (summer)
Northern Rock Sole (*Lepidopsetta polyxystra*)	Larvae (summer)
Alaska Plaice (*Pleuronectes quadrituberculatus*)	Egg and larvae (summer)
Rex Sole (*Glyptocephalus zachirus*)	Egg and larvae (summer)
Dover Sole (*Microstomus pacificus*)	Egg and larvae (summer)
Flathead Sole (*Hippoglossoides elassodon*)	Egg and larvae (summer)
Arrowtooth Flounder (*Atheresthes stomias*)	Larvae (summer)
Pacific Ocean Perch (*Sebastes alutus*)	Larvae (summer)

Additionally, there are twelve documented anadromous fish streams in the project area (Table 15; ADFG 2022b). Each anadromous waterbody supports at least one species of Pacific salmon at various life stages.

Fish populations in the project area that serve as marine mammal prey could be affected by noise from in-water pile-driving, dredging, and placement of fill. High underwater sound pressure levels have been documented to alter behavior, cause hearing loss, and injure or kill individual fish by causing serious internal injury (Hastings and Popper 2005).

In general, impacts to marine mammal prey species are expected to be minor and temporary. The area impacted by the project is very small compared to the available habitat in Orca Inlet and Prince William Sound. The most likely impact to prey will be temporary behavioral avoidance of the immediate area. During pile driving it is expected that fish and marine

mammals would temporarily move to nearby locations and return to the area following cessation of in-water construction activities.

The proposed project has a small benthic footprint and is within a previously disturbed area with existing high levels of vessel traffic. Conditions inside the harbor are too industrial to be pristine fish habitat and much of the action area in Orca Inlet is exposed at a zero low tide. As a result of these conditions, the project is not likely to adversely affect prey habitat including EFH. Therefore, indirect effects on marine mammal prey during construction are not expected to be substantial.

Table 15. Orca Inlet Anadromous Water Catalog (AWC) Streams

Waterbody Name (AWC Code)	Species Present*	Distance from Project Site (kilometer [miles])
Fleming Creek (221-10-10080)	CHs, COrs, Ps	2.3 (1.5) northeast
Ocean Dock Creek (221-10-10070)	Ps	1.3 (0.8) northeast
Odiak Slough (221-10-10060)	COp, Pp	1.1 (0.7) southeast
Eccles Creek (221-10-10050)	CHp, COr, Ps, CTp	1.9 (1.2) southwest
Heney Creek (221-10-10040)	COpr, Ps	2.9 (1.8) southwest
Nicolet Creek (221-10-10030)	COr, Ps	3.4 (2.1) southwest
Hartney Creek (221-10-10020)	CHpr, COp, Ppr, Sp, CTp, DVp	7.2 (4.5) southwest
Unnamed Creek (221-10-10017)	COpr, Ps	9.0 (5.6) southwest
Unnamed Creek (221-10-10010)	COp, Pp	10.0 (6.2) southwest
Unnamed Creek (221-10-10094)	COsr, Ps, CTp	12.3 (7.6) southwest
Hidden Creek (228-10-18480)	Ps	13.6 (8.5) southwest
Hyde Creek (228-10-18660)	Pp	4.1 (2.6) southwest

Source: ADF&G 2022

*Key: Chum Salmon (CH); Coho Salmon (CO); Cutthroat Trout (CT); Dolly Varden (DV); Pink Salmon (P); Sockeye Salmon (S); spawning (s); present (p); rearing(r)

9.6 INDIRECT HABITAT IMPACTS

This project does not increase moorage capacity in Cordova Harbor, and as discussed, improved harbor amenities and conditions would not increase vessel traffic to the area. As a result, there are no indirect habitat impacts anticipated as a result of this project. In addition, because the purpose of the project is to replace existing deteriorating infrastructure and help lessen congestion throughout the harbor area, project is not expected to induce any indirect development.

10 ANTICIPATED EFFECT OF HABITAT IMPACTS ON MARINE MAMMALS

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

Prey resources in the project area are likely limited in this area as compared to other areas within Prince William Sound due to the shallow conditions and existing development in and around Cordova Harbor. Therefore, the likelihood of attracting high numbers of marine mammals to habitat within Orca Inlet and Cordova Harbor is decreased, and the probability that the proposed project would impact a substantial amount of habitat for those species is diminished.

The most likely effects on marine mammal habitat from the project would be: temporary, short duration in-water noise; temporary prey (fish) disturbance; and localized, temporary water quality effects from increased turbidity. The direct loss of marine mammal habitat during construction due to noise, water quality impacts, and general construction activity is expected to be short-term and minimal.

All of these species discussed in this application could experience a temporary loss of suitable habitat within the action area, depending on the degree that they use the area, if elevated noise levels associated with in-water construction result in their displacement from the area. However, displacement of species by noise is expected to be temporary and will not result in long-term effects to the local populations.

The most likely effects on marine mammal habitat from the proposed project would be 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 construction due to noise, water quality impacts, and other construction activity is expected to be short-term and minimal.

As stated in Section 9, fish populations in the project area that serve as marine mammal prey could be affected by noise or turbidity generated from in-water construction activities. Although existing fish presence in the action area at any given time is anticipated to be low, it is expected that most fish will be able to move away from the proposed activity to avoid harm and will still be available to marine mammals as a food source. The quantity, quality, and availability of adequate food resources are therefore not likely to be reduced (due to the small area affected, mobility of fish, anticipated recolonization, and the temporary nature of the project). These temporary impacts on habitat were discussed in more detail in Section 9.

11 MITIGATION MEASURES

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

Mitigation measures and construction techniques will be employed to minimize effects to marine mammal species and habitat. These measures are described below and presented in detail in the Cordova Harbor Rebuild Project 4MP (Appendix B).

11.1 MITIGATION MEASURES DESIGNED TO REDUCE PROJECT IMPACTS

The project uses the most compact design possible, while meeting the demands of the vessels that would use the facility.

- The project uses a design that will dredge within the regularly dredged basin.
- The project uses a design that will not use blasting.
- The project uses a design that incorporates the smallest-diameter piles and footprint practicable while still minimizing the overall number of piles and area.

11.2 OIL AND SPILL PREVENTION

- The contractor will provide and maintain a spill cleanup kit on-site at all times, to be implemented as part of the Shipboard Oil Pollution Emergency Plan for oil spill prevention and response.
- Fuel hoses, oil drums, oil or fuel transfer valves and fittings, and similar equipment will be checked regularly for drips or leaks, and would be maintained and stored properly to prevent spills.
- Oil booms will be readily available for oil or other fuel spill containment should any release occur.
- All chemicals and petroleum products will be properly stored to prevent spills.
- No petroleum products, cement, chemicals, or other deleterious materials will be allowed to enter surface waters.

11.3 MITIGATION MEASURES DESIGNED TO REDUCE IMPACTS TO MARINE MAMMALS

- The City of Cordova is required to conduct briefings for construction supervisors and crews, the monitoring team, and city staff prior to the start of all pile driving activity, and when new personnel join the work, in order to explain responsibilities, communication procedures, the marine mammal monitoring protocol, and operational procedures.
- The City of Cordova is required to employ PSOs during all in-water construction activities per the Marine Mammal Monitoring Plan (Appendix B), dated September 2021, and Monitoring Measures described in section 13 of this IHA.
- Marine mammal monitoring must take place from 30 minutes prior to initiation of pile driving activity through 30 minutes post-completion of pile driving activity. Pile driving may commence when observers have declared the shutdown zone clear of marine mammals. In the event of a delay or shutdown of activity resulting from marine

mammals in the shutdown zone, their behavior must be monitored and documented until they leave of their own volition, at which point the activity may begin.

- If a marine mammal is entering or is observed within an established shutdown zone (Table 16 and Table 19), in-water construction must be halted or delayed. Pile driving may not commence or resume until either the animal has voluntarily left and been visually confirmed beyond the shutdown zone; 15 minutes have passed without subsequent detections of small cetaceans and pinnipeds; or 15/30 minutes have passed without subsequent detections of large cetaceans. NMFS may adjust the shutdown zones pending review and approval of an acoustic monitoring report.
- The City of Cordova must use soft start techniques when impact pile driving. Soft start requires contractors to provide an initial set of strikes at reduced energy, followed by a thirty-second waiting period, then two subsequent reduced energy strike sets. A soft start must be implemented at the start of each day's impact pile driving and at any time following cessation of impact pile driving for a period of thirty minutes or longer.
- If a species for which authorization has not been granted, or a species for which authorization has been granted but the authorized takes are met, is observed approaching or within the monitoring zone (Table 16 and Table 19), pile driving and other in-water activities must shut down immediately using delay and shut-down procedures. Activities must not resume until the animal has been confirmed to have left the area or the observation time period, as indicated in the conditions above, has elapsed.

11.4 SHUTDOWN AND MONITORING ZONES

The City of Cordova is requesting Level B take for Steller sea lions, harbor seals, killer whales, and Dall's porpoise. Due to their frequency near the project area, the City of Cordova is also requesting Level A take of Steller sea lions and harbor seals incidental to project construction. The City of Cordova is not requesting take for any other marine mammals. Shutdown and monitoring zones are described in the following sub-sections.

Additionally, the project site is delineated into six sound units based on construction activities and the capacity for sound to travel based on where land masses, such as the harbor breakwater and Spike Island obstruct underwater sound transmission; three units in the North Harbor and South Harbor, respectively (Figure 15). Monitoring and shutdown zones are outlined based on these units. Additionally, the project site is delineated into six different units (Figure 15).

11.4.1 Phase I

11.4.1.1 Level A Monitoring and Shutdown Zones

There will be a nominal 10-meter shutdown zone for construction-related activity where Level An acoustic injury is not an issue. This type of work could include (but is not limited to) the following activities:

- Movement of the barge to the pile location
- Positioning of the pile on the substrate via a crane (i.e., stabbing the pile)
- The placement of sound attenuation devices around the piles
- Installation of bulkhead pilings above HTL

For these activities, monitoring would take place from 15 minutes prior to initiation until the action is complete.

The City of Cordova will implement additional shutdowns to protect marine mammals from Level A harassment and prevent auditory injury to all hearing groups during pile installation and removal project activities as shown in Table 16, Table 17, and Figure 16. Due to the high likelihood of Steller sea lions and harbor seals within the project area and extent of shutdown distances, Level A take has been requested for these species (Figure 16). A 10-meter shutdown zone will be implemented in the event of authorized Level A harassment of these species.

Figure 15. Cordova Harbor Rebuild Project Action Area Units

Table 16. Cordova Harbor Rebuild Project Level A and Level B Monitoring and Shutdown Zones – Phase I

Activity	Received Level at 10 meters	Distance (in meters) to Level A and Level B Thresholds[1]				
		Level A[2]				Level B
		Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid	Otariid	
In-Water Activities						
Barge movements, pile positioning, etc. (throughout construction)[3]	171-176 dB[4]	10	10	10	10	10
Vibratory Pile Driving/Removal						
12-inch to 24-inch existing timber pile removal (130 piles; 4.2 hours per day on 5.2 days)	162 RMS[5]	10	35	25	10	6,310 (stopped at 4,500)
12-inch to 24-inch existing steel pile removal (61 piles; 4.2 hours per day on 2.4 days)	161 RMS[6]	10	35	25	10	5,425 (stopped at 4,500)
24-inch template pile installation and removal (61 piles; 1.7 hours per day on 16.3 days)	161 RMS[6]	10	25	10	10	5,425 (stopped at 4,500)
16-inch permanent pile installation (155 piles; 2.5 hours per day on 15.5 days)	161 RMS[6]	10	25	10	10	5,425 (stopped at 4,500)
18-inch permanent pile installation (70 piles; 3.3 hours per day on 7.0 days)	161 RMS[6]	10	25	10	10	5,425 (stopped at 4,500)
30-inch permanent pile installation (30 piles; 3 hours per day on 5.0 days)	161.9 RMS[7]	10	25	10	10	6,225 (stopped at 4,500)
In-air pile installation/removal (Bulkhead) (350 piles, up to 2.5 hour per day on 44 days)	103.2 RMS[8]	10	10	10	10	70 (PW)/ 25 (OW)
Impact Pile Driving						
16-inch permanent pile installation (73 piles; 2.0 hours per day on 12.5 days)	168.3 SEL/ 181.1 RMS[9]	10	185	75	10	275
18-inch permanent pile installation (35 piles; 2.0 hours per day on 5.8 days)	168.3 SEL/ 181.1 RMS[9]	10	185	75	10	275
30-inch permanent pile installation (20 piles; 2.0 hours per day on 3.3 days)	177 SEL/ 190 RMS[5]	25	800	360	35	1,000
In-air pile installation/removal (Bulkhead) (105 piles; 2.0 hours per day on 11.7 days)	101 RMS[10]	10	10	10	10	55 (PW)/ 25 (OW)

Activity	Received Level at 10 meters	Distance (in meters) to Level A and Level B Thresholds[1]				
		Level A[2]				Level B
		Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid	Otariid	
Down the Hole (DTH) Drilling						
16-inch permanent pile installation (50 piles; 5.0 hours per day on 12.5 days)	159 SEL/ 167 RMS [11]	35	1,080	500	40	13,600 (stopped at 4,500)
18-inch, 24-inch permanent pile installation (20 piles; 5.0 hours per day on 5.0 days)	159 SEL/ 167 RMS [11]	35	1,080	500	40	13,600 (stopped at 4,500)
30-inch permanent pile installation (16 piles; 5.0 hours on 4.0 day)	164 SEL/ 174 RMS [12]	75	2,050	925	75	39,815 (stopped at 4,500)

[1] Distances, in meters, refer to the maximum radius of the zone.

[2] The values provided here represent the distance at which an animal may incur PTS if that animal remained at that distance for the entire duration of the activity within a 24-hour period. For example, a Steller sea lion would have to remain 25 meters from 16-inch piles being installed via impacting methods for 1.3 hours for PTS to occur.

[3] Although acoustic injury is not the primary concern with these activities, shutdowns will be implemented to avoid impacts to species.

[4] For general in-water work other than pile driving and placing fill, proxy is from Richardson et al. 1995; Kipple and Gabriele 2004.

[5] For 12-inch to 24-inch timber pile removal, vibratory source level is proxy from personal correspondence with NMFS (NMFS 2023).

[6] For 16-inch, 18-inch, and 24-inch pile, the vibratory source level is proxy from 24-inch steel piles driven at the Naval Base Kitsap in Bangor, Washington (Naval Facilities Engineering Systems Command [NAVFAC] 2013) and from acoustic modeling of nearshore marine pile driving at Navy installations in Puget Sound (NAVFAC 2015).

[7] For 30-inch pile installation, vibratory source level is proxy from median measured source levels from pile driving of 30-inch diameter piles to construct the Ketchikan Ferry Terminal (Denes et al. 2016, Table 72, Page 76).

[8] For in-air vibratory hammering, the sound source is proxy from the Washington State Department of Transportation has documented un-weighted rms levels for a vibratory hammer (30-inch pile) to an average 96.5 dB and a maximum of 103.2 dB at 15 meters (Laughlin 2010).

[9] For 16-inch, 18-inch, and 24-inch pile, impacting source level is proxy from median measured source levels from impacting 24-inch diameter piles to construct the Kodiak Ferry Terminal (Denes et al. 2016, Table 72).

[10] In-air sound levels for impact hammering are proxy from the Washington State Department of Transportation Coupeville Ferry Terminal Project, Ghebreghzabiher et al. (2017) source levels of 101 dB at 15 meters during impact installation of 24-inch-diameter steel piles.

[11] For 16-inch, 18-inch, and 24-inch pile, DTH source level is proxy from the sound source verification of 24-inch piles DTH drilled during the Tenakee Ferry Terminal Improvements Project (Heyvaert and Reyff 2021).

[12] For 30-inch, the DTH source level is proxy from sound source verification of 42-inch piles from the Thimble Shoal in Chesapeake Bay Bridge Tunnel and White Pass and Yukon Railroad Mooring Dolphin Installation (Reyff and Heyvaert, 2019; Reyff 2020; and Denes et al. 2019).

Table 17. Cordova Harbor Rebuild Project Level A Monitoring and Shutdown Zones by Action Area Unit – Phase I (Figure 16 Legend)

Unit	Method	Pile Type	Distance (Meters)	Hearing Group
Unit A	**Barge movements, pile positioning**		10	MF OW PW HF
	Vibratory	24-inch steel removal, 24-inch timber removal	10	MF OW
			25	PW
			35	HF
		24-inch templates, 16-inch, 18-inch	10	MF OW PW
			25	HF
		30-inch	10	MF OW PW
			25	HF
	Impact	16-inch, 18-inch	10	MF OW
			75	PW
			185	HF
		30-inch	25	MF
			35	OW
			360	PW
			500	HF
	DTH	16-inch, 18-inch	35	MF
			40	OW
			500	PW HF
		30-inch	75	MF OW
			500	PW HF

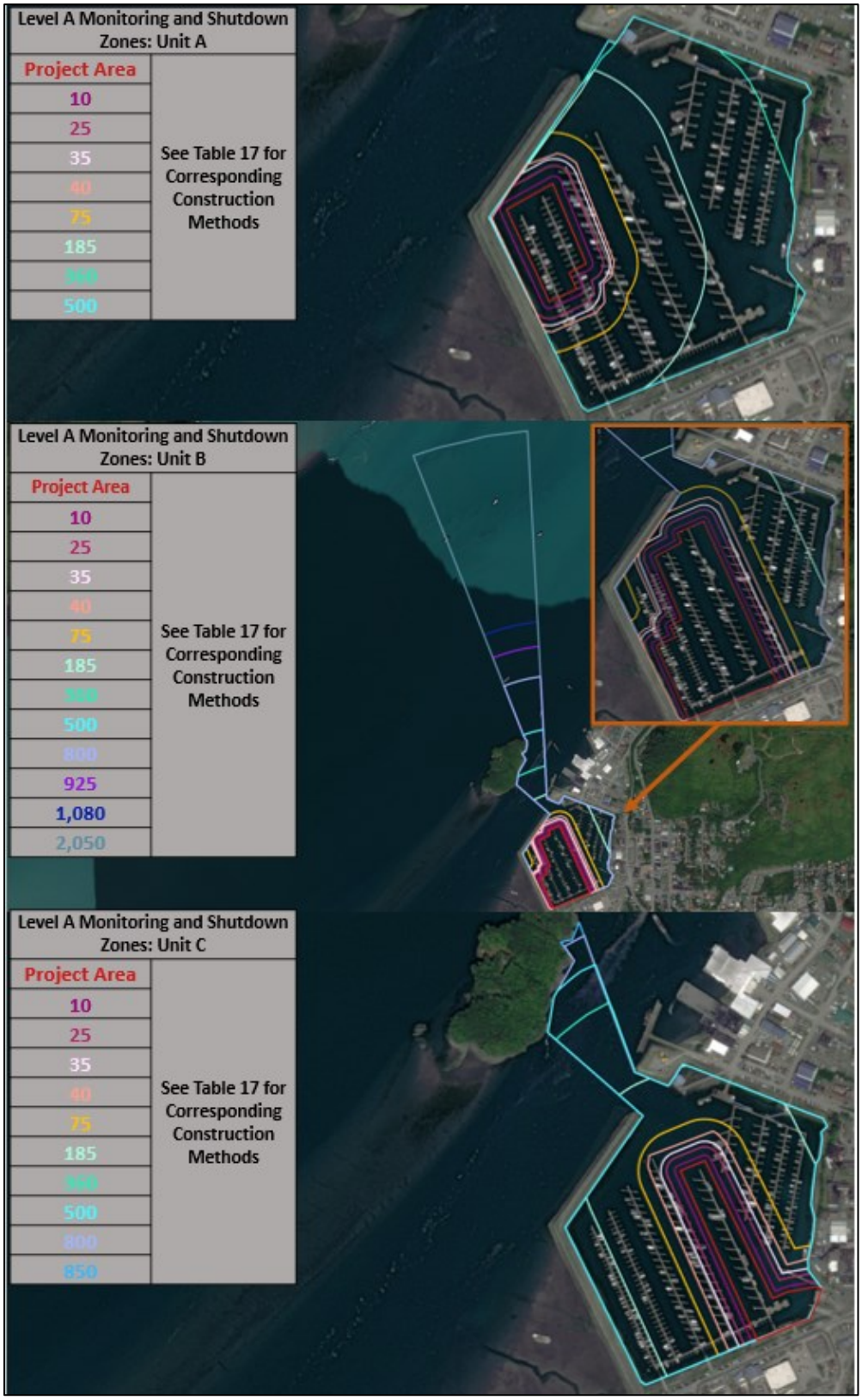
Table 17. Cordova Harbor Rebuild Project Level A Monitoring and Shutdown Zones by Action Area Unit – Phase I (Figure Legend 16 - Continued)

Unit	Method	Pile Type	Distance (Meters)	Hearing Group
Unit B	**Barge movements, pile positioning**		10	MF OW PW HF
	Vibratory	24-inch steel removal, 24-inch timber removal	10	OW MF
			25	PW
			35	HF
		24-inch templates, 16-inch, 18-inch	10	OW PW MF
			25	HF
		30-inch	10	MF OW PW
			25	HF
	Impact	16-inch, 18-inch	10	MF OW
			75	PW
			185	HF
		30-inch	25	MF
			35	OW
			360	PW
			800	HF
	DTH	16-inch, 18-inch	35	MF
			40	OW
			500	PW
			925	HF
		30-inch	75	MF OW
			1,080	PW
			2,050	HF

Table 17. Cordova Harbor Rebuild Project Level A Monitoring and Shutdown Zones by Action Area Unit – Phase I (Figure Legend 16 - Continued)

Unit	Method	Pile Type	Distance (Meters)	Hearing Group
Unit C	**Barge movements, pile positioning**		10	MF OW PW HF
	Vibratory	24-inch steel removal, 24-inch timber removal	10	MF OW
			25	PW
			35	HF
		24-inch templates, 16-inch, 18-inch	10	MF OW PW
			25	HF
		30-inch	10	MF OW PW
			25	HF
	Impact	16-inch, 18-inch	10	MF OW
			75	PW
			185	HF
		30-inch	25	MF
			35	OW
			360	PW
			800	HF
	DTH	16-inch, 18-inch	35	MF
			40	OW
			500	PW
			850	HF
		30-inch	75	MF OW
			850	PW HF

Figure 16. Cordova Harbor Rebuild Project Level A Monitoring and Shutdown Zones by Action Area Unit – Phase I



11.4.1.2 Level B Monitoring and Shutdown Zones

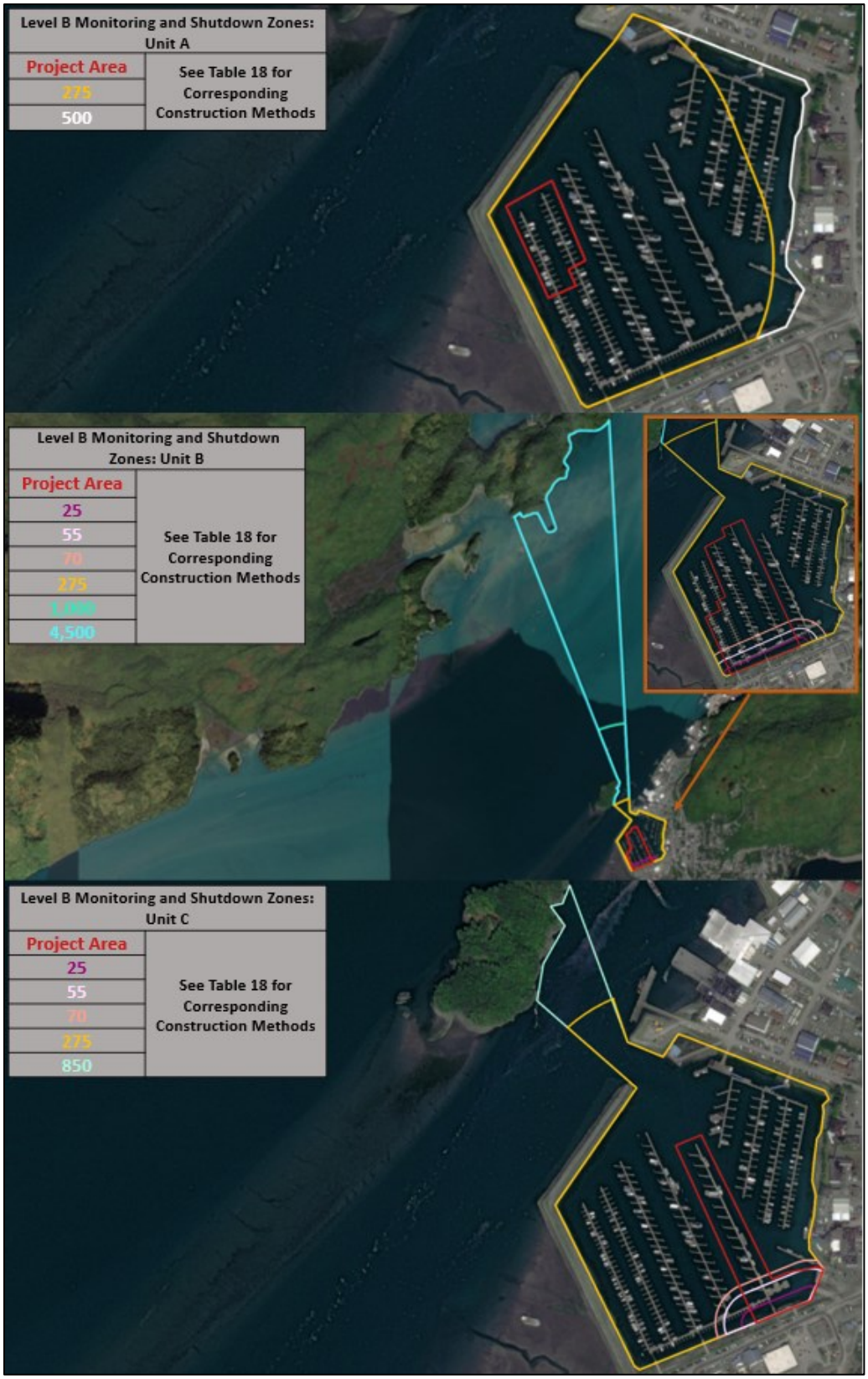
The City of Cordova is requesting Level B take of Steller sea lions, harbor seals, killer whales, and Dall's porpoise incidental to project construction and shutdown associated with Level B harassment of any additional species observed approaching the action area. Calculated distances to Level B thresholds will reach their full extent; however, where land masses block sound transmission distances will be truncated. The monitoring zones associated with Level B disturbance are outlined in Table 16, Table 18, and Figure 17. If species other than those listed above were approach or appear likely to enter the Level B area, in-water work would be shut down.

For pile installation of the South Harbor bulkhead, monitoring zones are applied for in-air exposure. Monitoring zones are provided accordingly.

Table 18. Cordova Harbor Rebuild Project Level B Monitoring and Shutdown Zones by Action Area Unit – Phase I (Figure Legend 17)

Unit	Method	Pile Type	Distance (Meters)
Unit A	**Vibratory**	24-inch timber removal, 24-inch steel removal, 24-inch templates, 16-inch, 18-inch, 30-inch	500
	Impact	16-inch, 18-inch	275
		30-inch	500
	DTH	16-inch, 18-inch, 30-inch	500
Unit B	**Vibratory**	In-air (Bulkhead)	25 (Steller Sea Lion)
			70 (Harbor Seal)
		24-inch steel removal, 24-inch timber removal, 24-inch templates, 16-inch, 18-inch, 30-inch	4,500
	Impact	In-air (Bulkhead)	25 (Steller Sea Lion)
			55 (Harbor Seal)
		16-inch, 18-inch	275
		30-inch	1,000
	DTH	16-inch, 18-inch, 30-inch	4,500
Unit C	**Vibratory**	In-air (Bulkhead)	25 (Steller Sea Lion)
			70 (Harbor Seal)
		24-inch timber and steel removal, 24-inch templates, 16-inch, 18-inch, 30-inch	850
	Impact	In-air (Bulkhead)	25 (Steller Sea Lion)
			55 (Harbor Seal)
		16-inch, 18-inch	275
		30-inch	850
	DTH	16-inch, 18-inch, 30-inch	850

Figure 17. Cordova Harbor Rebuild Project Level B Monitoring and Shutdown Zones by Action Area Unit – Phase I



11.4.2 Phase II

11.4.2.1 Level A Monitoring and Shutdown Zones

There will be a nominal 10-meter shutdown zone for construction-related activity where acoustic injury is not an issue. This type of work could include (but is not limited to) the following activities:

- movement of the barge to the pile location;
- positioning of the pile on the substrate via a crane (i.e., stabbing the pile); or
- the placement of sound attenuation devices around the piles.

For these activities, monitoring would take place from 15 minutes prior to initiation until the action is complete.

The City of Cordova will implement additional shutdowns to protect marine mammals from Level A harassment and prevent auditory injury to all hearing groups during pile installation and removal project activities as shown in Table 19, Table 20, and Figure 18**.** Due to the high likelihood of Steller sea lions and harbor seals within the project area and extent of shutdown distances, Level A take has been requested for these species (Figure 18). A 10-meter shutdown zone will be implemented in the event of authorized Level A harassment of these species.

Table 19. Cordova Harbor Rebuild Project Level A and Level B Monitoring and Shutdown Zones by Action Area Unit– Phase II

Activity	Received Level at 10 m	Distance (in meters) to Level A and Level B Thresholds[1]				
		Level A[2]				Level B
		Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid	Otariid	
In-Water Activities						
Barge movements, pile positioning, etc. (throughout construction) [3]	171-176 dB [4]	10	10	10	10	10
In-water fill (5 hours on 1 days)	125-185 RMS [5]	100	100	100	100	300
Vibratory Pile Driving/Removal						
12-inch to 24-inch existing timber pile removal (268 piles; 4.2 hours per day on 10.7 days)	162 RMS [6]	10	35	25	10	6,310
24-inch template pile installation and removal (31 piles; 1.7 hours per day on 8.3 days)	161 RMS [7]	10	25	10	10	5,425
24-inch permanent pile installation (24 piles; 3.3 hours per day on 2.4 days)	161 RMS [7]	10	25	10	10	5,425
H-pile steel permanent pile installation (80 piles; 1 hour per day on 20 days)	165 RMS [6]	10	35	25	10	10,000
Sheet steel permanent pile installation (80 piles; 1 hour per day on 20 days)	162 RMS [8]	10	25	10	10	6,310
Impact Pile Driving						
24-inch permanent pile installation (10 piles; 1.3 hours per day on 2.4 days)	168.3 SEL/ 181.1 RMS [9]	10	185	75	10	275
H-pile steel permanent pile installation (32 piles; 1.3 hours per day on 8 days)	170 SEL/ 183 RMS [6]	25	410	185	25	350
Sheet steel permanent pile installation (32 piles; 1.3 hours per day on 8 days)	180 SEL/ 190 RMS [6]	75	1,885	850	75	1,000

Activity	Received Level at 10 m	Distance (in meters) to Level A and Level B Thresholds[1]				
		Level A[2]				Level B
		Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid	Otariid	
Down the Hole (DTH) Drilling						
24-inch permanent pile installation (5 piles; 2.0 hours per day on 2.4 days)	159 SEL/ 167 RMS [10]	35	1,080	500	40	13,600
H-pile steel permanent pile installation (16 piles; 2.0 hours per day on 5.3 days)	164 SEL/ 174 RMS [11]	75	2,050	925	75	39,815 (stopped at 36,400)

[1] Distances, in meters, refer to the maximum radius of the zone.

[2] The values provided here represent the distance at which an animal may incur PTS if that animal remained at that distance for the entire duration of the activity within a 24-hour period.

[3] Although acoustic injury is not the primary concern with these activities, shutdowns will be implemented to avoid impacts to species.

[4] For general in-water work other than pile driving and placing fill, proxy is from Richardson et al. 1995; Kipple and Gabriele 2004.[5] For in-water placement of fill, sound sources is from USFWS 2012.

[6] For 12-inch to 24-inch timber pile removal, vibratory source level is proxy from personal correspondence with NMFS (NMFS 2023).

[7] For 24-inch pile, the vibratory source level is proxy from 24-inch steel piles driven at the Naval Base Kitsap in Bangor, Washington (Naval Facilities Engineering Systems Command [NAVFAC] 2013) and from acoustic modeling of nearshore marine pile driving at Navy installations in Puget Sound (NAVFAC 2015).

[8] For sheet piles, vibratory source level is proxy from median measured source levels from vibratory pile driving of 24-inch sheets for Berth 30 at the Port of Oakland, CA (Buehler et al 2015; Table I.6-2).

[9] For 24-inch pile, impacting source level is proxy from median measured source levels from impacting 24-inch diameter piles to construct the Kodiak Ferry Terminal (Denes et al. 2016, Table 72).

[10] For 24-inch pile (Level A and B) and H-pile (Level B), DTH source level is proxy from the sound source verification of 24-inch piles DTH drilled during the Tenakee Ferry Terminal Improvements Project (Heyvaert and Reyff 2021).

[11] For H-pile (Level A), the Level A DTH source level is proxy from sound source verification of 42-inch piles from the Thimble Shoal in Chesapeake Bay Bridge Tunnel and White Pass and Yukon Railroad Mooring Dolphin Installation (Reyff and Heyvaert, 2019; Reyff 2020; and Denes et al. 2019).

Table 20. Cordova Harbor Rebuild Project Level A Monitoring and Shutdown Zones by Action Area Unit – Phase II (Figure Legend 18)

Unit	Method	Pile Type	Distance (Meters)	Hearing Group
Unit C	**Barge movements, pile positioning**		10	MF OW PW HF
	In-water fill		100	MF OW PW HF
	Vibratory	24-inch timber removal	10	MF OW
			25	PW
			35	HF
		24-inch	10	MF OW PW
			25	HF
	Impact	24-inch	10	MF OW
			75	PW
			185	HF
	DTH	24-inch	35	MF
			40	OW
			500	PW
			850	HF
Unit D	**Barge movements, pile positioning**		10	MF OW PW HF
	Vibratory	24-inch templates, sheet piles, H-piles	10	MF OW PW
			25	HF
	Impact	H-piles	25	OW PW
			185	MF
			410	HF
		Sheet piles	75	OW PW
			850	MF
			1,885	HF
	DTH	H-piles	75	MF OW
			925	PW
			2,050	HF

Table 20. Cordova Harbor Rebuild Project Level A Monitoring and Shutdown Zones by Action Area Unit – Phase II (Figure Legend 18 - Continued)

Unit	Method	Pile Type	Distance (Meters)	Hearing Group
Unit E	**Barge movements, pile positioning**		10	OW PW HF MF
	Vibratory	24-inch templates, sheet piles, H-piles	10	OW PW MF
			25	HF
	Impact	H-piles	25	OW MF
			185	PW
			410	HF
		Sheet piles	75	OW MF
			850	PW
			1,885	HF
	DTH	H-piles	75	OW MF
			925	PW
			2,050	HF
Unit F	**Barge movements, pile positioning, dredging**		10	MF OW PW HF
	Vibratory	24-inch templates, 24-inch, H, and sheet piles	10	MF OW PW
			25	HF
		24-inch timber removal	10	OW MF
			25	PW
			35	HF
	Impact	24-inch	10	OW MF
			75	PW
			185	HF
		H-piles	25	OW MF
			185	PW
			410	HF
		Sheet piles	75	OW MF
			850	PW
			1,885	HF
	DTH	24-inch	35	MF
			40	OW
			500	PW
			1,080	HF
		H-piles	75	MF OW
			925	PW
			2,050	HF

Figure 18. Cordova Harbor Rebuild Project Level A Monitoring and Shutdown Zones by Action Area Unit – Phase II

Figure 18. Cordova Harbor Rebuild Project Level A Monitoring and Shutdown Zones by Action Area Unit – Phase II (Continued)

11.4.2.2 Level B Monitoring and Shutdown Zones

The City of Cordova is requesting Level B take Steller sea lions and harbor seals incidental to project construction, and shutdown associated with Level B harassment of these species are not proposed. Calculated distances to Level B thresholds will reach their full extent from some construction locations; however, where land masses block sound transmission, distances will be truncated. The monitoring zones associated with Level B disturbance are outlined in Table 19, Table 21, and Figure 19.

If species other than those listed above were approach or appear likely to enter the Level B area, in-water work would be shut down.

Table 21. Cordova Harbor Rebuild Project Level B Monitoring and Shutdown Zones by Action Area Unit– Phase II (Figure Legend 19)

Unit	Method	Pile Type	Distance (Meters) *
Unit C	**In-water fill**	N/A	300
	Vibratory	24-inch	850
	Impact	24-inch	275
	DTH	24-inch	850
Unit D	**Vibratory**	18-inch templates	5,425
		Sheet piles	6,310
		H piles	7,150
	Impact	H-piles	350
			410 (HF only) *
		Sheet piles	1,000
			1,580 (LF only) *
			1,885 (HF only) *
	DTH	H piles	7,150
Unit E	**Vibratory**	18-inch templates	5,425
		Sheet	6,310
		H piles	10,000
	Impact	H-piles	350
			410 (HF only) *
		Sheet piles	1,000
			1,580 (LF only) *
			1,885 (HF only) *
	DTH	H piles	15,850
Unit F	**Vibratory**	18-inch templates, 24-inch	5,425
		24-inch timber removal and sheet piles	6,310
		H piles	10,000
	Impact	24-inch	275
		H-piles	350
			410 (HF only) *
		Sheet piles	1,000
			1,580 (LF only) *
			1,885 (HF only) *
	DTH	24-inch	13,600
		H piles	36,400

* Indicates Level A zone. Where Level A zone radii are larger than the corresponding Level B radii, the Level A zone is shown.

Figure 19. Cordova Harbor Rebuild Project Level B Monitoring and Shutdown Zones by Action Area Unit– Phase II

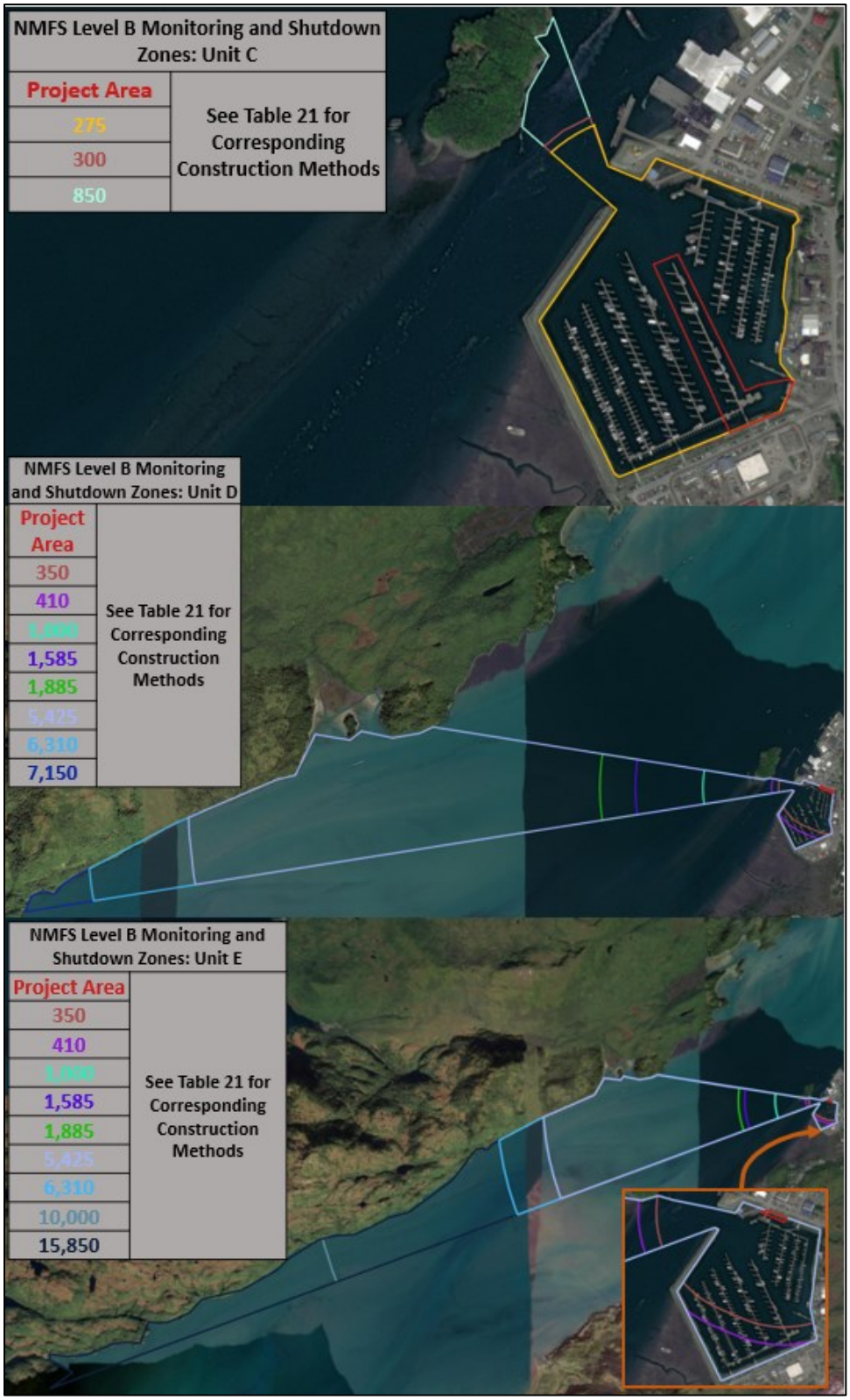
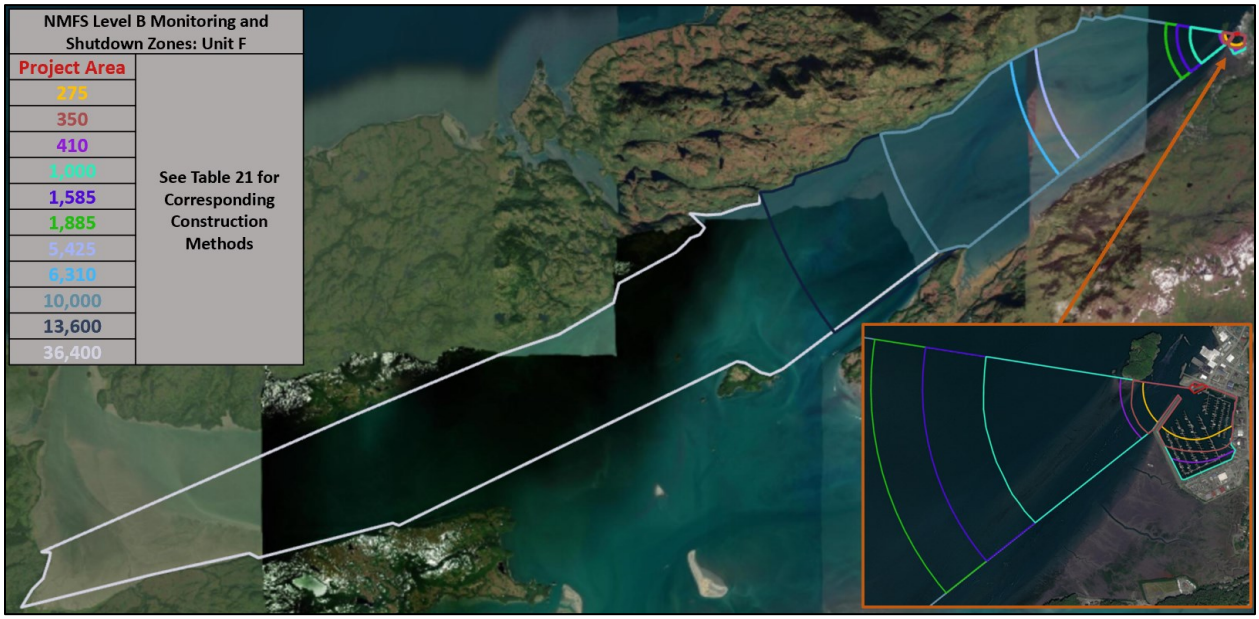


Figure 19. Cordova Harbor Rebuild Project Level B Monitoring and Shutdown Zones by Action Area Unit– Phase II (Continued)



12 ARCTIC PLAN OF COORDINATION

Where the proposed activity would take place in or near a traditional Arctic subsistence hunting area and/or may affect the availability of a species or stock of marine mammal for Arctic subsistence uses, submit either a plan of cooperation or information that identifies what measures have been taken and/or will be taken to minimize any adverse effects on the availability of marine mammals for subsistence uses. (This requirement is applicable only for activities that occur in Alaskan waters north of 60° North latitude.)

Although the action area is located south of 60° north, the latitude NMFS regulations consider Arctic waters, and no activities will take place in or near traditional Arctic subsistence hunting areas, there are subsistence uses of marine mammals in Southcentral Alaska that include the community of Cordova. Alaska Natives have traditionally harvested subsistence resources, including sea lions and harbor seals, in Southcentral Alaska for hundreds of years.

Section 11 describes mitigation measures designed to reduce project impacts and Section 8 details subsistence information and consultations with subsistence users in the project vicinity.

13 MONITORING AND REPORTING

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

13.1 MONITORING PROTOCOLS

To minimize impacts of project activities on marine mammals, a detailed 4MP has been developed for the project and is included as Appendix B. Project shutdown and monitoring zones as outlined in Appendix B and Section 11.4 would be implemented during any in-water pile driving, dredging, and placement of fill activities associated with the project. If the number of animals of a species exposed to Level A or B harassment approaches the number of takes allowed by the IHA, the City of Cordova will notify NMFS and seek further consultation.

13.2 MONITORING REPORT

13.2.1 Monthly Report

During construction, the City of Cordova will submit brief, monthly reports to the NMFS Alaska Region Protected Resources Division that summarize PSO observations and recorded takes. Monthly reporting will allow NMFS to track the amount of take, to allow reinitiation of consultation in a timely manner, if necessary. The monthly reports will be submitted by email to akr.section7@noaa.gov.

The reporting period for each monthly PSO report will be the entire calendar month, and reports will be submitted by close of business on the tenth day of the month following the end of the reporting period (e.g., the monthly report covering September 1–31, 2023, would be submitted to the NMFS by close of business on October 10, 2023).

13.2.2 Final Report

The City of Cordova will submit a draft report to NMFS not later than 90 days following the end of construction activities or 60 days prior to the issuance of any subsequent IHA for the project. The City of Cordova will provide a final report within 30 days following resolution of NMFS' comments on the draft report. Reports will contain, at minimum, the following:

- Date and time that monitored activity begins and ends for each day conducted (monitoring period)
- Construction activities occurring during each daily observation period, including how many and what type of piles driven
- Deviation from initial proposal in pile numbers, pile types, average driving times, etc.
- Weather parameters in each monitoring period (e.g., wind speed, percent cloud cover, visibility)
- Water conditions in each monitoring period (e.g., sea state, tide state);
- For each marine mammal sighting:
  - Species, numbers, and, if possible, sex and age class of marine mammals

  - Description of any observable marine mammal behavior patterns, including bearing and direction of travel and distance from pile driving activity
  - Type of construction activity that was taking place at the time of sighting;
  - Location and distance from pile driving activities to marine mammals and distance from the marine mammals to the observation point
  - Reason why shutdown was implemented (if needed)
  - If shutdown was implemented, behavioral reactions noted and if they occurred before or after shutdown
  - Estimated amount of time that the animals remained in the Level A or B zone
- Description of implementation of mitigation measures within each monitoring period (e.g., shutdown or delay)
- Other human activity in the area within each monitoring period
- A summary of the following:
  - Total number of individuals of each species detected within the Level B Zone and estimated as taken if correction factor appropriate
  - Total number of individuals of each species detected within the Level A Zone and estimated as takes
  - Daily average number of individuals of each species detected within the Level B Zone, and estimated as taken, if appropriate

The City of Cordova will also immediately report injured or dead marine mammals to NMFS, and, if the specified activity clearly causes the take of marine mammals in a manner prohibited by the IHA (e.g., serious injury or mortality), the City of Cordova will immediately cease pile activities and report the incident to NMFS by calling the NOAA Fisheries statewide 24-hour Stranding Hotline (877) 925-7773.

14 SUGGESTED MEANS OF COORDINATION

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

In-water and in-air noise generated by vibratory pile driving, impact hammer pile driving, DTH pile driving, dredging, and placement of in-water fill at the Cordova Harbor Rebuild Project is the primary issue of concern to local marine mammals during this project. Potential impacts on marine mammals have been studied, with the results used to establish the noise criteria for evaluating take.

The data recorded during marine mammal monitoring for the proposed project will be provided to NMFS in the monitoring report (Section 13.2). The report will provide information on marine mammals' use of Cordova Harbor and Orca Inlet, including numbers before, during, and after pile driving activities. The monitoring data may also inform NMFS and future permit applicants generally about the behavior of marine mammals during pile installation and removal for future projects of a similar nature.

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Appendix A: Threshold Calculation Spreadsheets

Cordova Harbor Rebuild Project

Project Pile Size	Installation method	Proxy Pile Size	RMS/SPL	PK	SEL	Weighting Factor	# of piles in 24-hour	Duration (min)	Duration (strikes per pile)	TLC	Distance of Measurement	Reference
24	Vibratory Removal Steel Pile	24	161	-		2.5	25	10	-	15	10	For 24" steel pile removal, vibratory source level is proxy from 24" steel piles driven at the Naval Base Kitsap in Bangor, Washington (NAVFAC 2013) and from acoustic modeling of nearshore marine pile driving at Navy installations in Puget Sound (NAVFAC 2015).
24	Vib Removal Wood Pile	24	162	-		2.5	25	10	-	15	10	The 12" to 24" timber pile removal, vibratory source level is proxy from personal correspondance with NMFS (NMFS 2023).
24 (temp)	Vibratory	24	161	-		2.5	10	10	-	15	10	For 16", 18" and 24" pile, the vibratory source level is proxy from 24" steel piles driven at the Naval Base Kitsap in Bangor, Washington (Naval Facilities Engineering Systems Command [NAVFAC] 2013) and from acoustic modeling of nearshore marine pile driving at Navy installations in Puget Sound (NAVFAC 2015).
16	Vibratory	24	161	-		2.5	10	15	-	15	10	For 16", 18" and 24" pile, the vibratory source level is proxy from 24" steel piles driven at the Naval Base Kitsap in Bangor, Washington (Naval Facilities Engineering Systems Command [NAVFAC] 2013) and from acoustic modeling of nearshore marine pile driving at Navy installations in Puget Sound (NAVFAC 2015).
18	Vibratory	24	161	-		2.5	10	20	-	15	10	For 16", 18" and 24" pile, the vibratory source level is proxy from 24" steel piles driven at the Naval Base Kitsap in Bangor, Washington (Naval Facilities Engineering Systems Command [NAVFAC] 2013) and from acoustic modeling of nearshore marine pile driving at Navy installations in Puget Sound (NAVFAC 2015).
30	Vibratory	30	161.9	-		2.5	6	30	-	15	10	For 30" pile installation, vibratory source level is proxy from median measured source levels from pile driving of 30" diameter piles to construct the Ketchikan Ferry Terminal (Denes et al. 2016, Table 72, Page 76)
H	Vibratory	H	165	-		2.5	4	15	-	15	10	For H-pile, vibratory source levels are proxy from personal correspondance with NMFS (NMFS 2023).
Sheet	Vibratory	24-inch Sheet	162	-		2.5	4	15	-	15	10	For sheet pile, vibratory source levels are proxy from median measured source levels from vibratory pile driving of 24-inch sheets for Berth 30 at the Port of Oakland, CA (Buehler et al 2015; Table I.6-2).
16, 18, 24	Impact	24	181.1	192.8	168.3	2	6	20	240	15	10	For 16", 18", and 24" pile, impacting source levels are proxy from median measured source levels from impacting 24-inch diameter piles to construct the Kodiak Ferry Terminal (Denes et al. 2016, Table 72).
30	Impact	36	190	210	177	2	6	20	360	15	10	For 30-inch pile, the impact source level is proxy from personal correspondance with NMFS (NMFS 2023).
Sheet	Impact	Sheet	190	205	180	2	6	20	360	15	10	For sheet pile, the impact source level is proxy from personal correspondance with NMFS (NMFS 2023).
H	Impact	H	183	200	170	2	6	20	360	15		For H-pile, the impact source level is proxy from personal correspondance with NMFS (NMFS 2023).
16, 18, 24	DTH	24	167	184	159	2	4	90	54000	15	10	Level A: For 16", 18", and 24" pile, DTH source level is proxy from the sound source verification of 24" piles DTH drilled during the Tenakee Ferry Terminal Improvements Project (Heyvaert and Reyff 2021). Level B: For 16", 18", 24", 36", and H-pile, DTH source level is proxy from the sound source verification of 24" piles DTH drilled during the Tenakee Ferry Terminal Improvements Project (Heyvaert and Reyff 2021).
30, H	DTH	42	174	194	164	2	4	90	54000	15	10	For 30" and H-pile, DTH source level is proxy from sound source verification of 42" piles from the Thimble Shoal in Chesapeake Bay Bridge Tunnel and White Pass and Yukon Railroad Mooring Dolphin Installation (Reyff & Heyvaert 2019; Reyff 2020; and Denes et al., 2019).
All Piles	In-air Vibratory	30	103.2	-	-	-	10	15	-	20	10	In-air vibrating sound source is proxy from the Washington State Department of Transportation has documented un-weighted rms levels for a vibratory hammer (30-inch pile) to an average 96.5 dB and a maximum of 103.2 dB at 15 meters (Laughlin 2010). Maximum levels were used to extrapolate distances for the projects.
All Piles	In-air Impact	48	101	-	-	-	10	15	-	20	10	In-air impacting sound source is proxy from the Port of Anchorage, AK, Austin et al. (2016) found source levels of 101 dB at 15 meters during impact installation of 48-inch-diameter steel piles.

USER SPREADSHEET INTRODUCTION

VERSION: 2.2 (2020)

Companion* User Spreadsheet to:

National Marine Fisheries Service (NMFS): 2018 Revision to: Technical Guidance For Assessing the Effects of Anthropogenic Noise on Marine Mammal Hearing: Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts (Version 2.0)

2018 Revised Technical Guidance web page

*For more information on the optional methodology provided within this User Spreadsheet, see Appendix D of Technical Guidance (2018)

DISCLAIMER: NMFS has provided this spreadsheet as an optional tool to provide estimated effect distances (i.e., isopleths) where PTS onset thresholds may be exceeded. Results provided by this spreadsheet do not represent the entirety of the comprehensive effects analysis, but rather serve as one tool to help evaluate the effects of a proposed action on marine mammal hearing and make findings required by NOAA's various statutes. Input values are the responsibility of the individual user.

NOTE: The User Spreadsheet tool provides a means to estimate distances associated with the Technical Guidance's PTS onset thresholds. Mitigation and monitoring requirements associated with a Marine Mammal Protection Act (MMPA) authorization or an Endangered Species Act (ESA) consultation or permit are independent management decisions made in the context of the proposed activity and comprehensive effects analysis, and are beyond the scope of the Technical Guidance.

INSTRUCTIONS

STEP 1: Determine what spreadsheet is appropriate for activity

HOW TO DETERMINE WHICH TAB TO USE

1) Is the sound source NON-IMPULSIVE or IMPULSIVE? (If it is unclear which category describes your source, consult NOAA)
- (a) NON-IMPULSIVE (e.g., drilling, vibratory pile driving, tactical sonar): Go to Question 2
- (b) IMPULSIVE (e.g., explosives, impact pile driving, DTH pile driving, seismic): Go to Question 5

2) Is the NON-IMPULSIVE sound source STATIONARY or MOBILE?
- (a) STATIONARY: Go to Question 3
- (b) MOBILE: Go to Question 4

3) Is the NON-IMPULSIVE, STATIONARY source CONTINUOUS or INTERMITTENT?
- (a) CONTINUOUS: Use Tab A*
  - *If source is vibratory pile driving: Use Tab A.1
- (b) INTERMITTENT: Use Tab B

RED / BRICK / YELLOW

- ^ A key distinction between continuous and intermittent sound sources is that intermittent sounds have a more regular (predictable) pattern of bursts of sounds and silent periods (i.e., duty cycle), which continuous sounds do not.

4) Is the NON-IMPULSIVE, MOBILE source CONTINUOUS or INTERMITTENT?
- (a) CONTINUOUS: Use Tab C ("safe distance" methodology from Sivle et al. 2014)
- (b) INTERMITTENT: Use Tab D ("safe distance" methodology from Sivle et al. 2014)

BLUE / ORANGE

5) Is the IMPULSIVE sound source STATIONARY or MOBILE?
- (a) STATIONARY: Use Tab E*
  - *If source is impact pile driving: Use Tab E.1
  - *If source is DTH pile driving/installation: Use Tab E.2
- (b) MOBILE: Use Tab F ("safe distance" methodology from Sivle et al. 2014)

GREEN / EVRGRN / TEAL / PURPLE

STEP 2: Within the appropriate tab, fill-in: SAGE CELLS specific to the activity
- (a) Please provide information used to support values in provided in sage boxes (e.g., surrogate data, direct measurements, etc.)
- (b) If information is unavailable to fill-out one or more of the sage boxes, please consult NMFS

STEP 3: Estimated PTS isopleths (meter) will be provided in: SKY BLUE CELLS by marine mammal hearing group

STEP 4: When using this spreadsheet to estimate marine mammal takes, please provide a copy of completed tab used to estimate isopleths

ASSUMPTIONS & ADDITIONAL INFORMATION

1) Marine mammals remain stationary during activity
2) Currently, recovery between intermittent sounds is not considered regardless of time between sounds (i.e., all sounds within the accumulation period are counted)

Suggested (Default*) Weighting Factor Adjustments (WFA) for Broadband Sources:

Source	WFA	Example Supporting Sources
Seismic airguns	1 kHz	Breitzke et al. 2008; Tashmukhambetov et al. 2008; Tolstoy et al. 2009
Impact pile driving hammers	2 kHz	Blackwell 2005; Reinhall and Dahl 2011
Vibratory pile driving hammers	2.5 kHz	Blackwell 2005; Dahl et al. 2015
DTH pile driving/installation	2 kHz	Denes et al. 2016; Denes et al. 2019; Reyff and Heyaert 2019
Drill vessels/platforms	2 kHz	Greene 1987; Blackwell et al. 2004; Blackwell and Greene 2006

* NMFS acknowledges default WFAs are likely conservative

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW): true seals
Otariid pinnipeds (OW): sea lions and fur seals

Based on NMFS 2018 Revised Technical Guidance

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Technical questions or suggestion on User Spreadsheet: Please contact Amy Scholik-Schlomer (amy.scholik@noaa.gov)

UPDATES (will be posted when change results in the need to recalculate an isopleth; other non-substantive changes may be made periodically but will not result in a version number change)

Original Version	Updated Version	Change	Date posted
1.0	1.1	Sheet A, error with formula for phocid pinniped	Aug. 27, 2018
1.1	2.0	Corresponds to 2.0 version of Revised Technical Guidance (2018). Added sheet specific to vibratory pile driving and explosives and added capabilities to calculate peak sound pressure level isopleths for impulsive sources	July 2019
2.0	2.1	Updated version based on comments from 2018 public comment period. Added Tab for DTH	July 2020
2.0	2.2	Updated version based on comments from 2018 public comment period (late) on seismic surveys from IAGC	December 2020
2.2		Additional clarification on 1/repetition rate term. No changes to tool functionality	November 2021

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

VERSION 2.2: 2020

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Technical Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATION	For 16",18", and 24" pile, impacting source level is proxy from median measured source levels from impacting 24-inch diameter piles to construct the Kodiak Ferry Terminal (Denes et al. 2016, Table 72).

Please include any assumptions

PROJECT CONTACT	Natalie Kiley-Bergen, natalie@solsticeak.com

STEP 2: WEIGHTING FACTOR ADJUSTMENT

Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)¥	2	

¥ Broadband: 95% frequency contour percentile (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 73), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

STEP 3: SOURCE-SPECIFIC INFORMATION

NOTE: METHOD E.1-1 is PREFERRED method when SEL-based source levels are available (because pulse duration is not required). Only use method E.1-2 if SEL-based source levels are not available.

E.1-1: METHOD TO CALCULATE PK AND SEL_{cum} (SINGLE STRIKE EQUIVALENT)	**PREFERRED METHOD (pulse duration not needed)**
Unweighted $SEL_{cum\ (at\ measured\ distance)}$ = SEL_{ss} + 10 Log (# strikes)	**199.9**

SEL_{cum}

Single Strike SEL_{ss} ($L_{E,p,\ single\ strike}$) specified at "x" meters (Cell B32)	168.3
Number of strikes per pile	240
Number of piles per day	6
Transmission loss coefficient	15
Distance of single strike SEL_{ss} ($L_{E,p,\ single\ strike}$) measurement (meters)	10

PK

$L_{p,0\text{-}pk}$ specified at "x" meters (Cell G29)	192.8
Distance of $L_{p,0\text{-}pk}$ measurement (meters)*	10
$L_{p,0\text{-}pk}$ Source level	207.8

RESULTANT ISOPLETHS*

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

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS Isopleth to threshold (meters)	**133.3**	**4.7**	**158.8**	**71.4**	**5.2**
PK Threshold	219	230	202	218	232
PTS PK Isopleth to threshold (meters)	**NA**	**NA**	**2.4**	**NA**	**NA**

"NA": PK source level is ≤ to the threshold for that marine mammal hearing group.

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

VERSION 2.2: 2020

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Technical Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATION	For 30" pile, impacting source level is proxy from personal correspondance with NMFS (NMFS 2023).

Please include any assumptions

PROJECT CONTACT	Natalie Kiley-Bergen, natalie@solsticeak.com

STEP 2: WEIGHTING FACTOR ADJUSTMENT

Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)¥	2	

¥ Broadband: 95% frequency contour percentile (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 73), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

STEP 3: SOURCE-SPECIFIC INFORMATION

NOTE: METHOD E.1-1 is PREFERRED method when SEL-based source levels are available (because pulse duration is not required). Only use method E.1-2 if SEL-based source levels are not availa

E.1-1: METHOD TO CALCULATE PK AND SEL_{cum} (SINGLE STRIKE EQUIVALENT) PREFERRED METHOD (pulse duration not needed)

Unweighted $SEL_{cum\ (at\ measured\ distance)}$ = SEL_{ss} + 10 Log (# strikes)	**210.3**

SEL_{cum}

Single Strike SEL_{ss} ($L_{E,p,single\ strike}$) specified at "x" meters (Cell B32)	177
Number of strikes per pile	360
Number of piles per day	6
Transmission loss coefficient	15
Distance of single strike SEL_{ss} ($L_{E,p,single\ strike}$) measurement (meters)	10

PK

$L_{p,0\text{-}pk}$ specified at "x" meters (Cell G29)	210
Distance of $L_{p,0\text{-}pk}$ measurement (meters)*	10
$L_{p,0\text{-}pk}$ Source level	225.0

RESULTANT ISOPLETHS*

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

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS isopleth to threshold (meters)	**664.3**	**23.6**	**791.3**	**355.5**	**25.9**
PK Threshold	219	230	202	218	232
PTS PK isopleth to threshold (meters)	**2.5**	**NA**	**34.1**	**2.9**	**NA**

"NA": PK source level is ≤ to the threshold for that marine mammal hearing group.

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

VERSION 2.2: 2020

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Technical Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATION	For H-pile, impaciting source level is proxy from proxy from personal correspondance with NMFS (NMFS 2023).

Please include any assumptions

PROJECT CONTACT	Natalie Kiley-Bergen, natalie@solsticeak.com

STEP 2: WEIGHTING FACTOR ADJUSTMENT

Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)¥	2	

¥ Broadband: 95% frequency contour percentile (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 73), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

STEP 3: SOURCE-SPECIFIC INFORMATION

NOTE: METHOD E.1-1 is PREFERRED method when SEL-based source levels are available (because pulse duration is not required). Only use method E.1-2 if SEL-based source levels are not avail

E.1-1: METHOD TO CALCULATE PK AND SEL_{cum} (SINGLE STRIKE EQUIVALENT) **PREFERRED METHOD (pulse duration not needed)**

Unweighted $SEL_{cum\ (at\ measured\ distance)}$ = SEL_{ss} + 10 Log (# strikes)	**203.3**

SEL_{cum}

Single Strike SEL_{ss} ($L_{E,p,single\ strike}$) specified at "x" meters (Cell B32)	170
Number of strikes per pile	360
Number of piles per day	6
Transmission loss coefficient	15
Distance of single strike SEL_{ss} ($L_{E,p,single\ strike}$) measurement (meters)	15

PK

$L_{p,0\text{-}pk}$ specified at "x" meters (Cell G29)	200
Distance of $L_{p,0\text{-}pk}$ measurement (meters)*	15
$L_{p,0\text{-}pk}$ Source level	217.6

RESULTANT ISOPLETHS*

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

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS Isopleth to threshold (meters)	**340.3**	**12.1**	**405.3**	**182.1**	**13.3**
PK Threshold	219	230	202	218	232
PTS PK Isopleth to threshold (meters)	**NA**	**NA**	**11.0**	**NA**	**NA**

"NA": PK source level is ≤ to the threshold for that marine mammal hearing group.

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

VERSION 2.2: 2020

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Technical Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATION	For sheet pile, impacting source level is proxy from personal correspondance with NMFS (NMFS 2023).

Please include any assumptions

PROJECT CONTACT	Natalie Kiley-Bergen, natalie@solsticeak.com

STEP 2: WEIGHTING FACTOR ADJUSTMENT

Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)¥	2	

¥ Broadband: 95% frequency contour percentile (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 73), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

STEP 3: SOURCE-SPECIFIC INFORMATION

NOTE: METHOD E.1-1 is PREFERRED method when SEL-based source levels are available (because pulse duration is not required). Only use method E.1-2 if SEL-based source levels are not availa

E.1-1: METHOD TO CALCULATE PK AND SEL_{cum} (SINGLE STRIKE EQUIVALENT) PREFERRED METHOD (pulse duration not needed)

Unweighted $SEL_{cum\ (at\ measured\ distance)}$ = SEL_{ss} + 10 Log (# strikes)	**213.3**

SEL_{cum}

Single Strike SEL_{ss} ($L_{E,p,single\ strike}$) specified at "x" meters (Cell B32)	180
Number of strikes per pile	360
Number of piles per day	6
Transmission loss coefficient	15
Distance of single strike SEL_{ss} ($L_{E,p,single\ strike}$) measurement (meters)	15

PK

$L_{p,0\text{-}pk}$ specified at "x" meters (Cell G29)	205
Distance of $L_{p,0\text{-}pk}$ measurement (meters)*	15
$L_{p,0\text{-}pk}$ Source level	222.6

RESULTANT ISOPLETHS*

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

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS isopleth to threshold (meters)	**1,579.3**	**56.2**	**1,881.2**	**845.2**	**61.5**
PK Threshold	219	230	202	218	232
PTS PK isopleth to threshold (meters)	**1.7**	**NA**	**23.8**	**2.0**	**NA**

"NA": PK source level is ≤ to the threshold for that marine mammal hearing group.

E.2: DTH PILE DRIVING/INSTALLATION (STATIONARY SOURCE: Impulsive, Intermittent)

VERSION 2.2: 2020

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Technical Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATION	For 16", 18", and 24" pile, DTH source level is proxy from the sound source verification of 24" piles DTH drilled during the Tenakee Ferry Terminal Improvements Project (Heyvaert and Reyff 2021).

Please include any assumptions

PROJECT CONTACT	Natalie Kiley-Bergen, natalie@solsticeak.com

STEP 2: WEIGHTING FACTOR ADJUSTMENT

Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)¥	2	

¥ Broadband: 95% frequency contour percentile (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 50), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

STEP 3: SOURCE-SPECIFIC INFORMATION

Unweighted $SEL_{cum\ (at\ measured\ distance)}$ = SEL_{ss} + 10 Log (# strikes)	**212.3**

SEL_{cum}

Single Strike SEL_{ss} ($L_{E,p,single\ strike}$) specified at "x" meters (Cell B30)	159
Strike rate (average strikes per second)	12
Duration to drive pile (minutes)	75
Number of piles per day	4
Transmission loss coefficient	15
Distance of single strike SEL_{ss} ($L_{E,p,single\ strike}$) measurement (meters)	10
Total number of strikes in a 24-h period	216000

PK

$L_{p,0\text{-}pk}$ specified at "x" meters (Cell G26)	184
Distance of $L_{p,0\text{-}pk}$ measurement (meters)♦	10
$L_{p,0\text{-}pk}$ Source level	199.0

RESULTANT ISOPLETHS*

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

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS Isopleth to threshold (meters)	**903.0**	**32.1**	**1,075.7**	**483.3**	**35.2**
PK Threshold	219	230	202	218	232
PTS PK Isopleth to threshold (meters)	**NA**	**NA**	**NA**	**NA**	**NA**

"NA": PK source level is < to the threshold for that marine mammal hearing group.

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**

NOTE: If user decided to override these Adjustment values, they need to make sure to download another copy to ensure the built-in calculations function properly.

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a\,[1+(f/f_2)^2]^b}\right\}$$

E.2: DTH PILE DRIVING/INSTALLATION (STATIONARY SOURCE: Impulsive, Intermittent)

VERSION 2.2: 2020

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Technical Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATION	For 30" and H-pile, DTH source level is proxy from sound source verification of 42" piles from Thimble Shoal in Chesapeake Bay Bridge Tunnel and White Pass and Yukon Railroad Mooring Dolphin Installation (Reyff & Heyvaert 2019; Reyff 2020; and Denes et al. 2019).

Please include any assumptions

PROJECT CONTACT	Natalie Kiley-Bergen, natalie@solsticeak.com

STEP 2: WEIGHTING FACTOR ADJUSTMENT

Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)¥	2	

¥ Broadband: 95% frequency contour percentile (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 50), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

STEP 3: SOURCE-SPECIFIC INFORMATION

Unweighted $SEL_{cum\ (at\ measured\ distance)}$ = SEL_{ss} + 10 Log (# strikes)	**216.6**

SEL_{cum}

Single Strike SEL_{ss} ($L_{E,p,single\ strike}$) specified at "x" meters (Cell B30)	164
Strike rate (average strikes per second)	12.5
Duration to drive pile (minutes)	80
Number of piles per day	3
Transmission loss coefficient	15
Distance of single strike SEL_{ss} ($L_{E,p,single\ strike}$) measurement (meters)	10
Total number of strikes in a 24-h period	180000

PK

$L_{p,0\text{-}pk}$ specified at "x" meters (Cell G26)	194
Distance of $L_{p,0\text{-}pk}$ measurement (meters)*	10
$L_{p,0\text{-}pk}$ Source level	209.0

RESULTANT ISOPLETHS*

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

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS Isopleth to threshold (meters)	**1,722.9**	**61.3**	**2,052.2**	**922.0**	**67.1**
PK Threshold	219	230	202	218	232
PTS PK Isopleth to threshold (meters)	**NA**	**NA**	**2.9**	**NA**	**NA**

"NA": PK source level is ≤ to the threshold for that marine mammal hearing group.

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**

NOTE: If user decided to override these Adjustment value they need to make sure to download another copy to ensure the built-in calculations function properly.

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

A.1: Vibratory Pile Driving (STATIONARY SOURCE: Non-Impulsive, Continuous)

VERSION 2.2: 2020

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Technical Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATION	For 12" steel pile removal, vibratory source level is proxy from 24" steel piles driven at the Naval Base Kitsap in Bangor, Washington (NAVFAC 2013)and from acoustic modeling of nearshore marine pile driving at Navy installations in Puget Sound (NAVFAC 2015).
Please include any assumptions	
PROJECT CONTACT	Natalie Kiley-Bergen, natalie@solsticeak.com

STEP 2: WEIGHTING FACTOR ADJUSTMENT

		Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value
Weighting Factor Adjustment (kHz)¥	2.5	

¥ 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 48), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

STEP 3: SOURCE-SPECIFIC INFORMATION

Sound Pressure Level (L_{rms}), specified at "x" meters (Cell B30)	161
Number of piles within 24-h period	25
Duration to drive a single pile (minutes)	10
Duration of Sound Production within 24-h period (seconds)	15000
10 Log (duration of sound production)	41.76
Transmission loss coefficient	15
Distance of sound pressure level (L_{rms}) measurement (meters)	10

NOTE: The User Spreadsheet tool provides a means to estimates distances associated with the Technical Guidance's PTS onset thresholds. Mitigation and monitoring requirements associated with a Marine Mammal Protection Act (MMPA) authorization or an Endangered Species Act (ESA) consultation or permit are independent management decisions made in the context of the proposed activity and comprehensive effects analysis, and are beyond the scope of the Technical Guidance and the User Spreadsheet tool.

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)	**17.7**	**1.6**	**26.1**	**10.7**	**0.8**

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**

NOTE: If user decided to override these Adjustment values, they need to make sure to download another copy to ensure the built-in calculations function properly.

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

A.1: Vibratory Pile Driving (STATIONARY SOURCE: Non-Impulsive, Continuous)

VERSION 2.2: 2020

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Technical Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATION	The 12" to 24" timber pile removal, vibratory source level is proxy from personal correspondance with NMFS (NMFS 2023).
Please include any assumptions	
PROJECT CONTACT	Natalie Kiley-Bergen, natalie@solsticeak.com

STEP 2: WEIGHTING FACTOR ADJUSTMENT

Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)¥	2.5

¥ 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 48), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

STEP 3: SOURCE-SPECIFIC INFORMATION

Sound Pressure Level (L_{rms}), specified at "x" meters (Cell B30)	162
Number of piles within 24-h period	25
Duration to drive a single pile (minutes)	10
Duration of Sound Production within 24-h period (seconds)	15000
10 Log (duration of sound production)	41.76
Transmission loss coefficient	15
Distance of sound pressure level (L_{rms}) measurement (meters)	10

NOTE: The User Spreadsheet tool provides a means to estimates distances associated with the Technical Guidance's PTS onset thresholds. Mitigation and monitoring requirements associated with a Marine Mammal Protection Act (MMPA) authorization or an Endangered Species Act (ESA) consultation or permit are independent management decisions made in the context of the proposed activity and comprehensive effects analysis, and are beyond the scope of the Technical Guidance and the User Spreadsheet tool.

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)	**20.6**	**1.8**	**30.5**	**12.5**	**0.9**

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**

NOTE: If user decided to override these Adjustment values, they need to make sure to download another copy to ensure the built-in calculations function properly.

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a\,[1+(f/f_2)^2]^b}\right\}$$

A.1: Vibratory Pile Driving (STATIONARY SOURCE: Non-Impulsive, Continuous)

VERSION 2.2: 2020

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Technical Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATION	For 24" pile template pile installation and removal, vibratory source level is proxy from 24" steel piles driven at the Naval Base Kitsap in Bangor, Washington (Naval Facilities Engineering Systems Command [NAVFAC] 2013) and from acoustic modeling of nearshore marine pile driving at Navy installations in Puget Sound
Please include any assumptions	
PROJECT CONTACT	Natalie Kiley-Bergen, natalie@solsticeak.com

STEP 2: WEIGHTING FACTOR ADJUSTMENT

Weighting Factor Adjustment (kHz)¥	2.5	Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

¥ 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 48), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

STEP 3: SOURCE-SPECIFIC INFORMATION

Sound Pressure Level (L_{rms}), specified at "x" meters (Cell B30)	161
Number of piles within 24-h period	10
Duration to drive a single pile (minutes)	10
Duration of Sound Production within 24-h period (seconds)	6000
10 Log (duration of sound production)	37.78
Transmission loss coefficient	15
Distance of sound pressure level (L_{rms}) measurement (meters)	10

NOTE: The User Spreadsheet tool provides a means to estimates distances associated with the Technical Guidance's PTS onset thresholds. Mitigation and monitoring requirements associated with a Marine Mammal Protection Act (MMPA) authorization or an Endangered Species Act (ESA) consultation or permit are independent management decisions made in the context of the proposed activity and comprehensive effects analysis, and are beyond the scope of the Technical Guidance and the User Spreadsheet tool.

RESULTANT ISOPLETHS

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

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**

NOTE: If user decided to override these Adjustment value they need to make sure to download another copy to ensure the built-in calculations function properly.

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

A.1: Vibratory Pile Driving (STATIONARY SOURCE: Non-Impulsive, Continuous)

VERSION 2.2: 2020

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Technical Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATION	For 16", 18" and 24" pile, vibratory source level is proxy from 24" steel piles driven at the Naval Base Kitsap in Bangor, Washington (Naval Facilities Engineering Systems Command [NAVFAC] 2013) and from acoustic modeling of nearshore marine pile driving at Navy installations in Puget Sound (NAVFAC 2015).
Please include any assumptions	
PROJECT CONTACT	Natalie Kiley-Bergen, natalie@solsticeak.com

STEP 2: WEIGHTING FACTOR ADJUSTMENT

Weighting Factor Adjustment (kHz)¥	2.5	Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

¥ 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 48), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

STEP 3: SOURCE-SPECIFIC INFORMATION

Sound Pressure Level (L_{rms}), specified at "x" meters (Cell B30)	161
Number of piles within 24-h period	10
Duration to drive a single pile (minutes)	15
Duration of Sound Production within 24-h period (seconds)	9000
10 Log (duration of sound production)	39.54
Transmission loss coefficient	15
Distance of sound pressure level (L_{rms}) measurement (meters)	10

NOTE: The User Spreadsheet tool provides a means to estimates distances associated with the Technical Guidance's PTS onset thresholds. Mitigation and monitoring requirements associated with a Marine Mammal Protection Act (MMPA) authorization or an Endangered Species Act (ESA) consultation or permit are independent management decisions made in the context of the proposed activity and comprehensive effects analysis, and are beyond the scope of the Technical Guidance and the User Spreadsheet tool.

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)	**12.6**	**1.1**	**18.6**	**7.6**	**0.5**

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**

NOTE: If user decided to override these Adjustment value they need to make sure to download another copy to ensure the built-in calculations function properly.

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a\,[1+(f/f_2)^2]^b}\right\}$$

A.1: Vibratory Pile Driving (STATIONARY SOURCE: Non-Impulsive, Continuous)

VERSION 2.2: 2020

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Technical Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATION	For 16", 18" and 24" pile, vibratory source level is proxy from 24" steel piles driven at the Naval Base Kitsap in Bangor, Washington (Naval Facilities Engineering Systems Command [NAVFAC] 2013) and from acoustic modeling of nearshore marine pile driving at Navy installations in Puget Sound (NAVFAC 2015).
Please include any assumptions	
PROJECT CONTACT	Natalie Kiley-Bergen, natalie@solsticeak.com

STEP 2: WEIGHTING FACTOR ADJUSTMENT

Weighting Factor Adjustment (kHz)¥	2.5	Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

¥ 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 48), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

STEP 3: SOURCE-SPECIFIC INFORMATION

Sound Pressure Level (L_{rms}), specified at "x" meters (Cell B30)	161
Number of piles within 24-h period	10
Duration to drive a single pile (minutes)	20
Duration of Sound Production within 24-h period (seconds)	12000
10 Log (duration of sound production)	40.79
Transmission loss coefficient	15
Distance of sound pressure level (L_{rms}) measurement (meters)	10

NOTE: The User Spreadsheet tool provides a means to estimates distances associated with the Technical Guidance's PTS onset thresholds. Mitigation and monitoring requirements associated with a Marine Mammal Protection Act (MMPA) authorization or an Endangered Species Act (ESA) consultation or permit are independent management decisions made in the context of the proposed activity and comprehensive effects analysis, and are beyond the scope of the Technical Guidance and the User Spreadsheet tool.

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)	**15.2**	**1.4**	**22.5**	**9.3**	**0.7**

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**

NOTE: If user decided to override these Adjustment value they need to make sure to download another copy to ensure the built-in calculations function properly.

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a\,[1+(f/f_2)^2]^b}\right\}$$

A.1: Vibratory Pile Driving (STATIONARY SOURCE: Non-Impulsive, Continuous)

VERSION 2.2: 2020

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Technical Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATION	For 30" pile installation, vibratory source level is proxy from median measured source levels from pile driving of 30" diameter piles to construct the Ketchikan Ferry Terminal (Denes et al. 2016, Table 72, Page 76).
Please include any assumptions	
PROJECT CONTACT	Natalie Kiley-Bergen, natalie@solsticeak.com

STEP 2: WEIGHTING FACTOR ADJUSTMENT

Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)¥	2.5	

¥ 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 48), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

STEP 3: SOURCE-SPECIFIC INFORMATION

Sound Pressure Level (L_{rms}), specified at "x" meters (Cell B30)	161.9
Number of piles within 24-h period	6
Duration to drive a single pile (minutes)	30
Duration of Sound Production within 24-h period (seconds)	10800
10 Log (duration of sound production)	40.33
Transmission loss coefficient	15
Distance of sound pressure level (L_{rms}) measurement (meters)	10

NOTE: The User Spreadsheet tool provides a means to estimates distances associated with the Technical Guidance's PTS onset thresholds. Mitigation and monitoring requirements associated with a Marine Mammal Protection Act (MMPA) authorization or an Endangered Species Act (ESA) consultation or permit are independent management decisions made in the context of the proposed activity and comprehensive effects analysis, and are beyond the scope of the Technical Guidance and the User Spreadsheet tool.

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)	**16.3**	**1.4**	**24.1**	**9.9**	**0.7**

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**

NOTE: If user decided to override these Adjustment values, they need to make sure to download another copy to ensure the built-in calculations function properly.

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a\,[1+(f/f_2)^2]^b}\right\}$$

A.1: Vibratory Pile Driving (STATIONARY SOURCE: Non-Impulsive, Continuous)

VERSION 2.2: 2020

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Technical Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATION	For H-pile, vibratory source level is proxy from personal correspondance with NMFS (NMFS 2023).
Please include any assumptions	
PROJECT CONTACT	Natalie Kiley-Bergen, natalie@solsticeak.com

STEP 2: WEIGHTING FACTOR ADJUSTMENT

		Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value
Weighting Factor Adjustment (kHz)¥	2.5	

¥ 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 48), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

STEP 3: SOURCE-SPECIFIC INFORMATION

Sound Pressure Level (L_{rms}), specified at "x" meters (Cell B30)	165
Number of piles within 24-h period	4
Duration to drive a single pile (minutes)	15
Duration of Sound Production within 24-h period (seconds)	3600
10 Log (duration of sound production)	35.56
Transmission loss coefficient	15
Distance of sound pressure level (L_{rms}) measurement (meters)	10

NOTE: The User Spreadsheet tool provides a means to estimates distances associated with the Technical Guidance's PTS onset thresholds. Mitigation and monitoring requirements associated with a Marine Mammal Protection Act (MMPA) authorization or an Endangered Species Act (ESA) consultation or permit are independent management decisions made in the context of the proposed activity and comprehensive effects analysis, and are beyond the scope of the Technical Guidance and the User Spreadsheet tool.

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)	**12.6**	**1.1**	**18.7**	**7.7**	**0.5**

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**

NOTE: If user decided to override these Adjustment values, they need to make sure to download another copy to ensure the built-in calculations function properly.

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a\,[1+(f/f_2)^2]^b}\right\}$$

A.1: Vibratory Pile Driving (STATIONARY SOURCE: Non-Impulsive, Continuous)

VERSION 2.2: 2020

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Technical Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATION	For sheet pile, vibratory source level is proxy from median measured source levels from vibratory pile driving of 24-inch sheets for Berth 30 at the Port of Oakland, CA (Buehler et al 2015; Table I.6-2).
Please include any assumptions	
PROJECT CONTACT	Natalie Kiley-Bergen, natalie@solsticeak.com

STEP 2: WEIGHTING FACTOR ADJUSTMENT

		Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value
Weighting Factor Adjustment (kHz)¥	2.5	

¥ 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 48), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

STEP 3: SOURCE-SPECIFIC INFORMATION

Sound Pressure Level (L_{rms}), specified at "x" meters (Cell B30)	162
Number of piles within 24-h period	4
Duration to drive a single pile (minutes)	15
Duration of Sound Production within 24-h period (seconds)	3600
10 Log (duration of sound production)	35.56
Transmission loss coefficient	15
Distance of sound pressure level (L_{rms}) measurement (meters)	10

NOTE: The User Spreadsheet tool provides a means to estimates distances associated with the Technical Guidance's PTS onset thresholds. Mitigation and monitoring requirements associated with a Marine Mammal Protection Act (MMPA) authorization or an Endangered Species Act (ESA) consultation or permit are independent management decisions made in the context of the proposed activity and comprehensive effects analysis, and are beyond the scope of the Technical Guidance and the User Spreadsheet tool.

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)	**8.0**	**0.7**	**11.8**	**4.8**	**0.3**

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**

NOTE: If user decided to override these Adjustment values, they need to make sure to download another copy to ensure the built-in calculations function properly.

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a\,[1+(f/f_2)^2]^b}\right\}$$

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATIONPlease include any assumptions	For 24" steel pile removal, vibratory source level is proxy from 24" steel piles driven at the Naval Base Kitsap in Bangor, Washington (NAVFAC 2013)and from acoustic modeling of nearshore marine pile driving at Navy installations in Puget Sound (NAVFAC 2015).
PROJECT CONTACT	Natalie Kiley-Bergen (natalie@solsticeak.com)

Fill in SPL and distances for peak and rms pressures, and read distance to threshold for appropriate model

Measured pressure	Peak	RMS
SPL =		161
Distance =		10

	Fish Meters to Threshold		Spreading Model	MarMam Meters to Threshold		
Spreading Model	Peak(180 dB)	RMS (150 dB)		RMS 180 dB	RMS 160 dB	RMS 120 dB
Spherical spreading	0	35	dB = 20*log(R1/R2)	1	11	1122
Cylindrical spreading	0	126	dB = 10*log(R1/R2)	0	13	125893
Practical spreading	0	54	dB = 15*log(R1/R2)	1	12	5412

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATIONPlease include any assumptions	The 12" to 24" timber pile removal, vibratory source level is proxy from personal correspondance with NMFS (NMFS 2023).
PROJECT CONTACT	Natalie Kiley-Bergen (natalie@solsticeak.com)

Fill in SPL and distances for peak and rms pressures, and read distance to threshold for appropriate model

Measured pressure	Peak	RMS
SPL =		162
Distance =		10

	Fish Meters to Threshold		Spreading Model	MarMam Meters to Threshold		
Spreading Model	Peak(180 dB)	RMS (150 dB)		RMS 180 dB	RMS 160 dB	RMS 120 dB
Spherical spreading	0	40	dB = 20*log(R1/R2)	1	13	1259
Cylindrical spreading	0	158	dB = 10*log(R1/R2)	0	16	158489
Practical spreading	0	63	dB = 15*log(R1/R2)	1	14	6309.6

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATIONPlease include any assumptions	For 16", 18" and 24" pile, vibratory source level is proxy from 24" steel piles driven at the Naval Base Kitsap in Bangor, Washington (Naval Facilities Engineering Systems Command [NAVFAC] 2013) and from acoustic modeling of nearshore marine pile driving at Navy installations in Puget Sound (NAVFAC 2015).
PROJECT CONTACT	Natalie Kiley-Bergen (natalie@solsticeak.com)

Fill in SPL and distances for peak and rms pressures, and read distance to threshold for appropriate model

Measured pressure	Peak	RMS
SPL =		161
Distance =		10

	Fish Meters to Threshold		Spreading Model	MarMam Meters to Threshold		
Spreading Model	Peak(180 dB)	RMS (150 dB)		RMS 180 dB	RMS 160 dB	RMS 120 dB
Spherical spreading	0	35	dB = 20*log(R1/R2)	1	11	1122
Cylindrical spreading	0	126	dB = 10*log(R1/R2)	0	13	125893
Practical spreading	0	54	dB = 15*log(R1/R2)	1	12	5411.7

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATIONPlease include any assumptions	For 30" pile installation, vibratory source level is proxy from median measured source levels from pile driving of 30" diameter piles to construct the Ketchikan Ferry Terminal (Denes et al. 2016, Table 72, Page 76)
PROJECT CONTACT	Natalie Kiley-Bergen (natalie@solsticeak.com)

Fill in SPL and distances for peak and rms pressures, and read distance to threshold for appropriate model

Measured pressure	Peak	RMS
SPL =		161.9
Distance =		10

	Fish Meters to Threshold		Spreading Model	MarMam Meters to Threshold		
Spreading Model	Peak(180 dB)	RMS (150 dB)		RMS 180 dB	RMS 160 dB	RMS 120 dB
Spherical spreading	0	39	dB = 20*log(R1/R2)	1	12	1245
Cylindrical spreading	0	155	dB = 10*log(R1/R2)	0	15	154882
Practical spreading	0	62	dB = 15*log(R1/R2)	1	13	6213.5

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATIONPlease include any assumptions	For H-pile, vibratory source level is proxy from median measured source levels from vibratory pile driving of H piles for the Port of Anchorage test pile project (Yurk et al. 2016 as cited in Denes et al. 2016; Appendix H/Table 2).
PROJECT CONTACT	Natalie Kiley-Bergen (natalie@solsticeak.com)

Fill in SPL and distances for peak and rms pressures, and read distance to threshold for appropriate model

Measured pressure	Peak	RMS
SPL =		165
Distance =		10

	Fish Meters to Threshold		Spreading Model	MarMam Meters to Threshold		
Spreading Model	Peak(180 dB)	RMS (150 dB)		RMS 180 dB	RMS 160 dB	RMS 120 dB
Spherical spreading	0	56	dB = 20*log(R1/R2)	2	18	1778
Cylindrical spreading	0	316	dB = 10*log(R1/R2)	0	32	316228
Practical spreading	0	100	dB = 15*log(R1/R2)	1	22	10000

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATIONPlease include any assumptions	For sheet pile, vibratory source level is proxy from median measured source levels from vibratory pile driving of 24-inch sheets for Berth 30 at the Port of Oakland, CA (Buehler et al 2015; Table I.6-2).
PROJECT CONTACT	Natalie Kiley-Bergen (natalie@solsticeak.com)

Fill in SPL and distances for peak and rms pressures, and read distance to threshold for appropriate model

Measured pressure	Peak	RMS
SPL =		162
Distance =		10

	Fish Meters to Threshold		Spreading Model	MarMam Meters to Threshold		
Spreading Model	Peak(180 dB)	RMS (150 dB)		RMS 180 dB	RMS 160 dB	RMS 120 dB
Spherical spreading	0	40	dB = 20*log(R1/R2)	1	13	1259
Cylindrical spreading	0	158	dB = 10*log(R1/R2)	0	16	158489
Practical spreading	0	63	dB = 15*log(R1/R2)	1	14	6310

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATIONPlease include any assumptions	For 16", 18", and 24" pile, impacting source level is proxy from median measured source levels from impacting 24-inch diameter piles to construct the Kodiak Ferry Terminal (Denes et al. 2016, Table 72).
PROJECT CONTACT	Natalie Kiley-Bergen (natalie@solsticeak.com)

Fill in SPL and distances for peak and rms pressures, and read distance to threshold for appropriate model

Measured pressure	Peak	RMS
SPL =	192.8	181.1
Distance =	10	10

	Fish Meters to Threshold		Spreading Model	MarMam Meters to Threshold		
Spreading Model	Peak(180 dB)	RMS (150 dB)		RMS 180 dB	RMS 160 dB	RMS 120 dB
Spherical spreading	44	359	dB = 20*log(R1/R2)	11	114	11350
Cylindrical spreading	191	12882	dB = 10*log(R1/R2)	13	1288	12882496
Practical spreading	71	1184	dB = 15*log(R1/R2)	12	255.1	118395

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATIONPlease include any assumptions	For 30" pile, impacting source level is proxy from personal correspondance with NMFS (NMFS 2023).
PROJECT CONTACT	Natalie Kiley-Bergen (natalie@solsticeak.com)

Fill in SPL and distances for peak and rms pressures, and read distance to threshold for appropriate model

Measured pressure	Peak	RMS
SPL =	210	190
Distance =	10	10

	Fish Meters to Threshold		Spreading Model	MarMam Meters to Threshold		
Spreading Model	Peak(180 dB)	RMS (150 dB)		RMS 180 dB	RMS 160 dB	RMS 120 dB
Spherical spreading	316	1000	dB = 20*log(R1/R2)	32	316	31623
Cylindrical spreading	10000	100000	dB = 10*log(R1/R2)	100	10000	100000000
Practical spreading	1000	4642	dB = 15*log(R1/R2)	46	1000.0	464159

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATIONPlease include any assumptions	For H-pile, impacting source level is proxy from personal correspondance with NMFS (NMFS 2023).
PROJECT CONTACT	Natalie Kiley-Bergen (natalie@solsticeak.com)

Fill in SPL and distances for peak and rms pressures, and read distance to threshold for appropriate model

Measured pressure	Peak	RMS
SPL =	200	183
Distance =	10	10

	Fish Meters to Threshold		Spreading Model	MarMam Meters to Threshold		
Spreading Model	Peak(180 dB)	RMS (150 dB)		RMS 180 dB	RMS 160 dB	RMS 120 dB
Spherical spreading	100	447	dB = 20*log(R1/R2)	14	141	14125
Cylindrical spreading	1000	19953	dB = 10*log(R1/R2)	20	1995	19952623
Practical spreading	215	1585	dB = 15*log(R1/R2)	16	341.5	158489

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATIONPlease include any assumptions	For sheet pile, impacting source level is proxy from personal correspondance with NMFS (NMFS 2023).
PROJECT CONTACT	Natalie Kiley-Bergen (natalie@solsticeak.com)

Fill in SPL and distances for peak and rms pressures, and read distance to threshold for appropriate model

Measured pressure	Peak	RMS
SPL =	205	190
Distance =	10	10

	Fish Meters to Threshold		Spreading Model	MarMam Meters to Threshold		
Spreading Model	Peak(180 dB)	RMS (150 dB)		RMS 180 dB	RMS 160 dB	RMS 120 dB
Spherical spreading	178	1000	dB = 20*log(R1/R2)	32	316	31623
Cylindrical spreading	3162	100000	dB = 10*log(R1/R2)	100	10000	100000000
Practical spreading	464	4642	dB = 15*log(R1/R2)	46	1000.0	464159

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATIONPlease include any assumptions	For 16", 18", and 24" pile, DTH source level is proxy from the sound source verification of 24" piles DTH drilled during the Tenakee Ferry Terminal Improvements Project (Heyvaert and Reyff 2021).
PROJECT CONTACT	Natalie Kiley-Bergen (natalie@solsticeak.com)

Fill in SPL and distances for peak and rms pressures, and read distance to threshold for appropriate model

Measured pressure	Peak	RMS
SPL =	184	167
Distance =	10	10

	Fish Meters to Threshold		Spreading Model	MarMam Meters to Threshold		
Spreading Model	Peak(180 dB)	RMS (150 dB)		RMS 180 dB	RMS 160 dB	RMS 120 dB
Spherical spreading	16	71	dB = 20*log(R1/R2)	2	22	2239
Cylindrical spreading	25	501	dB = 10*log(R1/R2)	1	50	501187
Practical spreading	18	136	dB = 15*log(R1/R2)	1	29	13594

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATIONPlease include any assumptions	For 30", and H-pile, DTH source level is proxy from the sound source verification of 24" piles DTH drilled during the Tenakee Ferry Terminal Improvements Project (Heyvaert and Reyff 2021).
PROJECT CONTACT	Natalie Kiley-Bergen (natalie@solsticeak.com)

Fill in SPL and distances for peak and rms pressures, and read distance to threshold for appropriate model

Measured pressure	Peak	RMS
SPL =	194	174
Distance =	10	10

	Fish Meters to Threshold		Spreading Model	MarMam Meters to Threshold		
Spreading Model	Peak(180 dB)	RMS (150 dB)		RMS 180 dB	RMS 160 dB	RMS 120 dB
Spherical spreading	50	158	dB = 20*log(R1/R2)	5	50	5012
Cylindrical spreading	251	2512	dB = 10*log(R1/R2)	3	251	2511886
Practical spreading	86	398	dB = 15*log(R1/R2)	4	86	39810.7

GENERAL PROJECT INFORMATION

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATIONPlease include any assumptions	In-air vibrating sound source is proxy from the Washington State Department of Transportation has documented un-weighted rms levels for a vibratory hammer (30-inch pile) to an average 96.5 dB and a maximum of 103.2 dB at 15 meters (Laughlin 2010). Maximum levels were used to extrapolate distances for the projects.
PROJECT CONTACT	Natalie Kiley-Bergen (natalie@solsticeak.com)

Fill in SPL and distances for peak and rms pressures, and read distance to threshold for appropriate model

Measured pressure	Peak	RMS
SPL =		103.2
Distance =		15

	Fish Meters to Threshold		Spreading Model	MarMam Meters to Threshold				
Spreading Model	Peak(180 dB)	RMS (150 dB)		RMS 180 dB	RMS 160 dB	RMS 120 dB	RMS 90dB- harbor seal in air	RMS 100dB - sea lion in air
Spherical spreading	0	0	dB = 20*log(R1/R2)	0	0	2	68.56323	21.6816
Cylindrical spreading	0	0	dB = 10*log(R1/R2)	0	0	0		
Practical spreading	0	0	dB = 15*log(R1/R2)	0	0	1		

Fill in SPL and distance at which SPL was measured

Conversion	meters	feet	miles
	1	3.733157477	7E-04

GENERAL PROJECT INFORMATION

PROJECT TITLE	City of Cordova Harbor Rebuild Project
PROJECT/SOURCE INFORMATIONPlease include any assumptions	In-air impacting sound source is proxy from the Port of Anchorage, AK, Austin et al. (2016) found source levels of 101 dB at 15 meters during impact installation of 48-inch-diameter steel piles.
PROJECT CONTACT	Natalie Kiley-Bergen (natalie@solsticeak.com)

Fill in SPL and distances for peak and rms pressures, and read distance to threshold for appropriate model

Measured pressure	Peak	RMS
SPL =		101
Distance =		15

	Fish Meters to Threshold		Spreading Model	MarMam Meters to Threshold				
Spreading Model	Peak(180 dB)	RMS (150 dB)		RMS 180 dB	RMS 160 dB	RMS 120 dB	RMS 90dB- harbor seal in air	RMS 100dB - sea lion in air
Spherical spreading	0	0	dB = 20*log(R1/R2)	0	0	2	53.22201	16.83028
Cylindrical spreading	0	0	dB = 10*log(R1/R2)	0	0	0		
Practical spreading	0	0	dB = 15*log(R1/R2)	0	0.0017	1		

Fill in SPL and distance at which SPL was measured

Conversion	meters	feet	miles
	1	2.663235944	5E-04

Appendix B: Marine Mammal Monitoring and Mitigation Plan

Marine Mammal Monitoring and Mitigation Plan

City of Cordova

Cordova Harbor Rebuild Project

Orca Inlet, Cordova, Alaska

April 2023

Prepared for:
City of Cordova
114 Nicholoff Way
Cordova, AK 99574

Prepared by:

2607 Fairbanks Street Suite B
Anchorage, Alaska 99503

Submitted to:
National Marine Fisheries Service

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ACRONYMS AND ABBREVIATIONS

3M	Marine Mammal Management
4MP	Marine Mammal Monitoring and Mitigation Plan
DPS	distinct population segment
DTH	down the hole
ESA	Endangered Species Act
HTL	high tide line
IHA	Incidental Harassment Authorization
LF	low-frequency
MF	high-frequency
MMPA	Marine Mammal Protection Act
NMFS	National Marine Fisheries Service
OW	otariid
Permits Division	Office of Protected Resources Permits and Conservation Division
PSO	protected species observer
PW	phocid
rms	root mean square
SPL	sound pressure level
USACE	U.S. Army Corp of Engineers
USFWS	U.S. Fish and Wildlife Service
WDPS	Western Distinct Population Segment

1 INTRODUCTION

The City of Cordova proposes the following Marine Mammal Monitoring and Mitigation Plan (4MP) for use during pile installation/removal and dredging during construction for the Cordova Harbor Rebuild Project in Cordova, Alaska (Figure 1). The project is in waters of the U.S., within the ranges of marine mammals listed in the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA), and has the potential to generate noise that could exceed Level A and B harassment thresholds established by the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). This 4MP supports the Biological Assessment, in accordance with the ESA, and the Incidental Harassment Authorization (IHA) applications, in accordance with the MMPA (Section 101(a)(5)(D) permitting).[1] Monitoring and shutdown zones will be implemented to minimize Level A and Level B harassment of marine mammals.

The goal of this 4MP is to ensure compliance with the ESA and the MMPA when implemented by the protected species observers (PSOs) at the project site. The project will comply with the terms and conditions outlined in the following requested permits and authorizations:

- U.S. Army Corp of Engineers (USACE), Orca Inlet for activities in Waters of the U.S. (forthcoming)
- NMFS Alaska Region, ESA Section 7(a)(2) Biological Opinion (requested)
- NMFS Office of Protected Resources Permits and Conservation Division (Permits Division) IHA (requested)
- USFWS Alaska Region Marine Mammal Management (3M) IHA (requested)

[1] This draft 4MP reflects the draft Biological Assessment submitted to NMFS and will be revised as needed for submission with the NMFS IHA application and USFWS IHA application.

Figure 1. Location of Proposed Cordova Harbor Rebuild Project

2 PROJECT DESCRIPTION

The City of Cordova is proposing to upgrade and restore their harbor. The Cordova Harbor is a transportation and service hub for the region surrounding the City of Cordova, offering year-round vessel access to dedicated fishing grounds and safe harbor to mariners. The harbor is past its useful life and is no longer able to adequately support the vessels using the harbor. The project would involve removing components associated with the existing dock structure in the South Harbor and installing new floats, supports, gangways, a boat grid, floating service dock, and an access ramp. The new South Harbor components would include electrical, water, sewage, fire line, and wireless connections. Sheet pile bulkhead would be installed along the north and eastern edges of the harbor to create an expanded uplands area. Commercial lease areas and green space would be designated at the North Harbor uplands. The project would also replace the creosote treated piles at the existing three-stage dock with steel piles. The project action area extends 4.5 kilometers from the South Harbor and 15.9 kilometers from the North Harbor. Construction would begin in August 2023 and be completed in June 2024. During Phase I, pile removal and installation activities is expected to occur for a total of approximately 433 hours over 170 days (not necessarily consecutive days). During Phase II, pile removal and installation activities are expected to occur for a total of approximately 148 hours over 88 days and dredging work is expected to occur for a total of approximately 660 hours over 77 days (not necessarily consecutive days). The project would occur within waters of the United States. No

blasting is proposed as part of this project. Table 1, Table 2, and Table 3 provide a more detailed overview of the project components.

Table 1. Cordova Harbor Rebuild Project Groundwork Summary – Phase I and II

Construction Activity	Description					
	Soil Type	Phase (Harbor)	Area (acres)	Total Quantity (cubic yards)	Total Time (hours)	# of Days
Excavating (Above HTL)	Alluvial, Gravel, and Riprap	I (South)	1.0	10,000	300	35
Dredging	Alluvial, Gravel, and Riprap	II (North)	1.5	22,000	660	77
Filling	Alluvial, Gravel, and Riprap	I (South) (Above HTL)	1.0	15,000	300	35
		II (North and Boat Launch)	1.5	47,970	946	110

Table 2. Cordova Harbor Rebuild Project Pile Size, Quantity, and Installation Method -Phase I

	In-Water (Below High Tide Line)							In-Air (Above High Tide Line)			
	Perm Pile Removal	Perm Pile Removal	Temp Pile Installation	Temp Pile Removal	Perm Pile Installation	Perm Pile Installation	Perm Pile Installation	Temp Pile Installation	Temp Pile Removal	Perm Pile Installation	Perm Pile Installation
Diameter of Piles (inches)	12	12	24	24	16	18	30	24	24	18	14x89
Pile Type	Timber	Steel	Steel Pipe	Steel Pipe	Steel Pipe	Steel Pipe	Steel Pipe	Steel Pipe	Steel Pipe	Steel Pipe	Steel H
Total # of Piles	130	61	61	61	155	70	30	70	70	70	140
Vibratory Pile Driving											
Total Quantity	130	61	61	61	155	70	30	70	70	70	140
Max # Piles Vibrated Per Day	25	25	6	10	10	10	6	6	10	6	10
Vibratory Time Per Pile (minutes)	10	10	10	10	15	20	30	10	10	10	15
Vibratory Time Per Day (hours)	4.2	4.2	1.0	1.7	2.5	3.3	3.0	1.0	1.7	1.0	2.5
Number of Days	5.2	2.4	10.2	6.1	15.5	7.0	5.0	11.7	7.0	11.7	14.0
Vibratory Time Total (hours)	21.7	10.2	10.2	10.2	38.8	23.3	15.0	11.7	11.7	11.7	35
Impact Pile Driving											
Total Quantity	--	--	--	--	73	35	20	--	--	35	70
Max # Piles Impacted Per Day	--	--	--	--	6	6	6	--	--	4	6
# of Strikes Per Pile	--	--	--	--	240	240	360	--	--	180	150
Impact Time Per Pile (minutes)	--	--	--	--	20	20	20	--	--	20	20
Impact Time Per Day (hours)	--	--	--	--	2.0	2.0	2.0	--	--	1.3	2.0
Number of Days	--	--	--	--	12.2	5.8	3.3	--	--	8.8	11.7
Impact Time Total (hours)	--	--	--	--	24.3	11.7	7	--	--	12	23
Down-The-Hole Pile (DTH) Drilling											
Total Quantity	--	--	--	--	50	20	16	--	--	18	35
Max # of Piles Installed per Day	--	--	--	--	4	4	4	--	--	4	5
# of Strikes Per Pile	--	--	--	--	54000	54000	54000	--	--	2700	40500
# of Strikes Per Second	--	--	--	--	10	10	10	--	--	10	10
Total Drilling Time Per Pile (minutes)	--	--	--	--	90	90	90	--	--	60	80
Actual Drilling Time Per Pile (minutes)	--	--	--	--	75	75	75	--	--	45	60
Time per Day (hours)	--	--	--	--	5	5	5	--	--	3	5
Number of Days	--	--	--	--	12.5	5.0	4.0	--	--	4.5	7.0
DTH Drilling Time Total (hours)	--	--	--	--	62.5	25	20	--	--	13.5	35

[1] For Phase I, in-water pile installation and removal activities includes the following project components in the South Harbor: South Harbor demolition; G, H, I, J, K, N, and N' main walk floats; access trestle, fixed dock, and drive down dock and transfer bridge.

[2] In-air pile installation and removal activities includes the South Harbor bulkhead.

Table 3. Cordova Harbor Rebuild Project Pile Size, Quantity, and Installation Method -Phase II

	Permanent Pile Removal	Temporary Pile Installation		Perm Pile Installation		
Diameter of Piles (inches)	12	24	24	24		
Pile Type	Timber	Steel Pipe			Steel H	Steel Sheet
Total # of Piles	268	31	31	24	80	80
Vibratory Pile Driving						
Total Quantity	268	31	31	24	80	80
Max # Piles Vibrated Per Day	25	6	10	10	4	4
Vibratory Time Per Pile (minutes)	10	10	10	20	15	15
Vibratory Time Per Day (hours)	4.2	1.0	1.7	3.3	1.0	1.0
Number of Days	10.7	5.2	3.1	2.4	20.0	20.0
Vibratory Time Total (hours)	44.7	5.2	5.2	8	20	20
Impact Pile Driving						
Total Quantity	--	--	--	10	32	32
Max # Piles Impacted Per Day	--	--	--	4	4	4
# of Strikes Per Pile	--	--	--	20	20	20
Impact Time Per Pile (minutes)	--	--	--	20	20	20
Impact Time Per Day (hours)	--	--	--	1.3	1.3	1.3
Number of Days	--	--	--	2.4	8.0	8.0
Impact Time Total (hours)	--	--	--	3	11	11
DTH Drilling						
Total Quantity	--	--	--	5	16	--
Max # of Piles Installed per Day	--	--	--	2	3	--
# of Strikes Per Pile	--	--	--	54000	54000	--
# of Strikes Per Second	--	--	--	4	4	--
Total Drilling Time Per Pile (minutes)	--	--	--	150	150	--
Actual Drilling Time Per Pile (minutes)	--	--	--	60	60	--
Time per Day (hours)	--	--	--	2	3	--
Number of Days	--	--	--	2.4	5.3	--
DTH Drilling Time Total (hours)	--	--	--	4.8	16	--

3 SPECIES COVERED UNDER THE IHA

There are three ESA-listed species under NMFS jurisdiction that have ranges that extend into the project area (humpback and fin whales and Steller sea lions). However, take has only been requested for Western Distinct Population Segment (WDPS; DPS) Steller sea lions that are known to frequent the area (Table 4). Take has also been requested for northern sea otters, harbor seals, killer whales, and Dall's porpoise, which are not listed under the ESA. For additional information about species with ranges in the project action area, see Appendix A.

Table 4. Species Known to Occur in Project Area and Requested Take Types and Numbers (may be updated following issuance of IHAs)

Species	Hearing Group	Level A	Level B
Phase I			
Steller Sea Lion (WDPS; *Eumetopias jubatus*)	Otariid (OW)	102	1,305
Northern Sea Otter (*Enhydra lutris kenyoni*)	Otariid (OW)	30	790
Harbor Seal (*Phoca vitulina*)	Phocid (PW)	114	1,114
Killer Whale (*Orcinus orca*)	Mid-Frequency (MF) Cetacean	0	107
Dall's Porpoise (*Phocoenoides dalli*)	High-Frequency (MF) Cetacean	0	33
Phase II			
Steller Sea Lion (WDPS; *E. jubatus*)	OW	--	--
Northern Sea Otter (*E. lutris kenyoni*)	OW	97	244
Harbor Seal (*P. vitulina*)	PW	199	613

There are various ESA-listed and MMPA-listed species with habitat ranges that overlap with the ensonified area of the project; however, these species have not been observed in the project area. No Level A or B take is requested for the following species: humpback whale (ESA-listed, *Megaptera novaeangliae*), fin whale (ESA-listed, *Balaenoptera physalus*), northern fur seal (*Callorhinus ursinus*), pacific white-sided dolphin (*Lagenorhynchus obliquidens*), harbor porpoise (*Phocoena phocoena*), minke whale (*Balaenoptera acutorostrata*), and gray whale (*Eschrichtius robustus*). In-water project construction activities will be shut down if any individuals of these species or any other species not listed in Table 4 are observed approaching the Level B shutdown zone to ensure there is no Level A or B take of these species.

4 MONITORING AND SHUTDOWN ZONES

The project site is delineated into six units based on construction activities and the capacity for sound to travel based on physical barriers such as the harbor breakwater and Spike Island. Monitoring and shutdown zones are outlined based on these units presented in Figure 2.

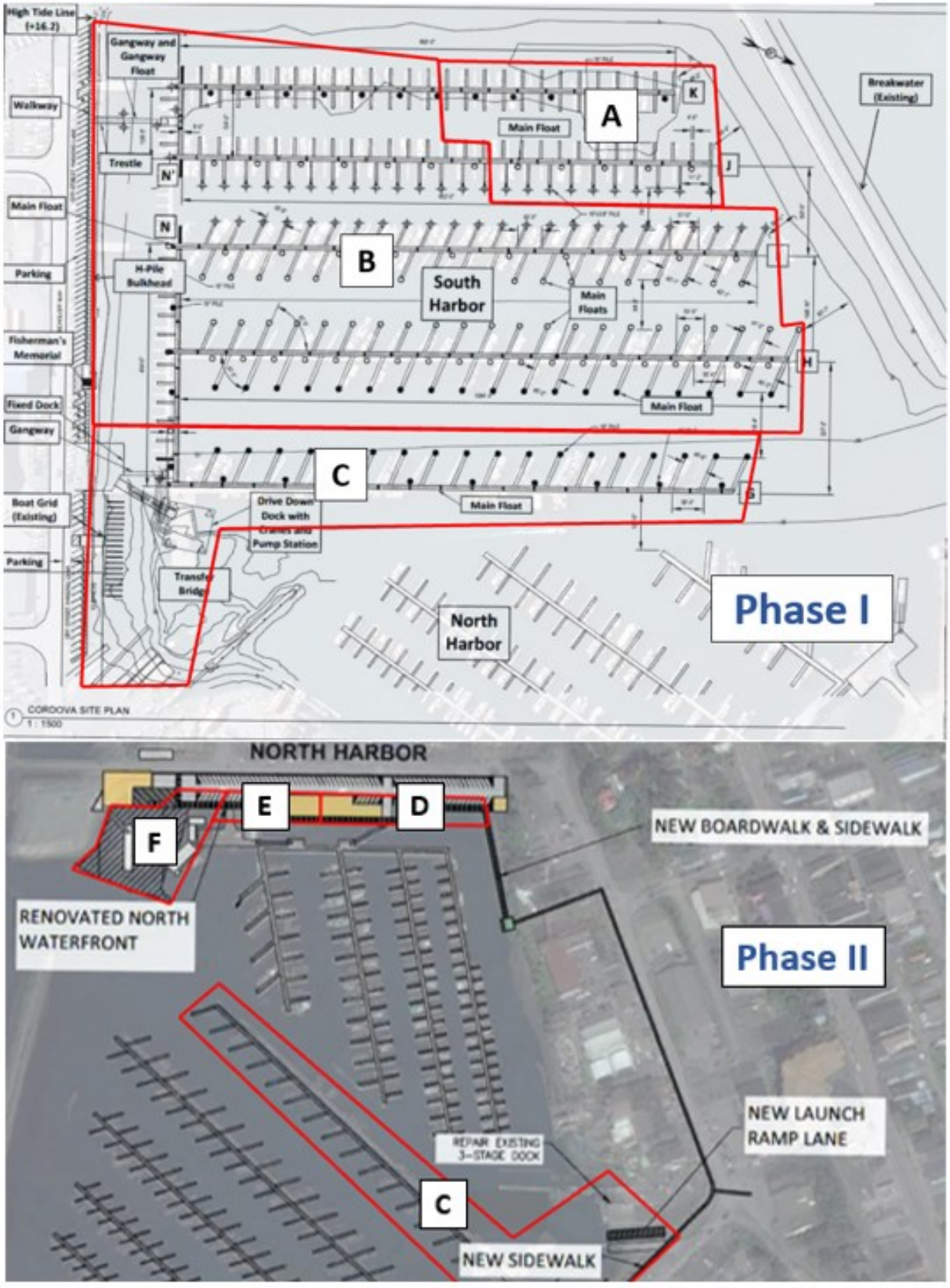
The harassment zones will be monitored throughout the permitted in-water or over-water construction activity. The following mitigation measures will be taken based on species, in-water activity, and distance of the mammalian from the project location:

- If a permitted marine mammal enters a Level B monitoring zone, a Level B take will be recorded and animal behaviors documented. Permitted construction activities would continue without cessation unless the animal approaches or enters the shutdown zone.
- If a marine mammal approaches or appears in a Level A shutdown zone, all permitted construction activities will immediately halt until the marine mammal has left the shutdown zone or has not been sighted for 15 minutes (pinnipeds and small cetaceans) or 30 minutes (large cetaceans and sea otters).
- If a non-permitted marine mammal approaches or appears in a Level B zone, all permitted construction activities will immediately halt until the marine mammal has left the Level B zone or has not been sighted for 15 minutes (pinnipeds, small cetaceans, and otters) or 30 minutes (large cetaceans and sea otters).

Takes, in the form of Level A or Level B harassment, of marine mammals other than permitted species are not authorized and will be avoided by shutting down construction activities before these species enter the Level B monitoring zone.

Because species are impacted differently by noise, species-specific monitoring and shutdown zones have been calculated for this project. These monitoring and shutdown zones are summarized in Table 5 and Table 6 and Figure 3 and Figure 4. Figures of the monitoring and shutdown zones are also provided in Appendix B.

Figure 2. Cordova Harbor Rebuild Project Proposed Action Area Units



4.1 Level A Monitoring and Shutdown Zones

Shutdown zones are defined as areas where sound pressure levels (SPLs) meet or exceed the level that would cause auditory injury to marine mammals. Level A shutdown zones are intended to protect marine mammals from auditory injury. In-water activities would be halted upon the sighting of a marine mammal that is in (or anticipated to enter) the shutdown zone. For select species where Level A take has been requested, the Level A zone will function as a monitoring zone to observe and record if Level A take occurs.

Further, there will be a nominal 10-meter shutdown zone for construction activity where acoustic injury is not the primary concern. This type of work could include (but is not limited to) the following activities: movement of the barge to the pile location; positioning of the pile on the substrate via a crane (i.e., stabbing the pile); and removal of the pile from the water column/substrate via a crane (i.e., deadpull). For these activities, monitoring would take place starting 15 minutes before initiation and ending when the action is complete. This can be monitored by the vessel operator or construction personnel when a PSO is not present. Radial distances to Level A shutdown zone boundaries are defined in Table 5 and shown in Figure 3 below.

Table 5. Cordova Harbor Rebuild Project Level A Monitoring and Shutdown Zones – Phase I and II (Figure 3 Legend)

Unit	Method	Pile Type	Distance (Meters)	Hearing Group
Unit A	**Barge movements, pile positioning**		10	MF OW PW HF
	Vibratory	24-inch steel removal, 24-inch timber removal	10	MF OW
			25	PW
			35	HF
		24-inch templates, 16-inch, 18-inch	10	MF OW PW
			25	HF
		30-inch	10	MF OW PW
			25	HF
	Impact	16-inch, 18-inch	10	MF OW
			75	PW
			185	HF
		30-inch	25	MF
			35	OW
			360	PW
			500	HF
	DTH	16-inch, 18-inch	35	MF
			40	OW
			500	PW HF
		30-inch	75	MF OW
			500	PW HF
Unit B	**Barge movements, pile positioning**		10	MF OW PW HF
	Vibratory	24-inch steel removal, 24-inch timber removal	10	OW MF
			25	PW
			35	HF
		24-inch templates, 16-inch, 18-inch	10	OW PW MF
			25	HF
		30-inch	10	MF OW PW
			25	HF
	Impact	16-inch, 18-inch	10	MF OW
			75	PW
			185	HF
		30-inch	25	MF
			35	OW
			360	PW
			800	HF
	DTH	16-inch, 18-inch	35	MF
			40	OW
			500	PW
			1,080	HF
		30-inch	75	MF OW
			925	PW
			2,050	HF

Table 5. Cordova Harbor Rebuild Project NMFS-Managed Species Level A Monitoring and Shutdown Zones – Phase I and II (Figure 3 Legend; *continued*)

Unit	Method	Pile Type	Distance (Meters)	Hearing Group
Unit C	**Barge movements, pile positioning**		10	MF OW PW HF
	In-water fill		100	MF OW PW HF
	Vibratory	24-inch steel removal, 24-inch timber removal	10	MF OW
			25	PW
			35	HF
		24-inch templates, 16-inch, 18-inch, 24-inch	10	MF OW PW
			25	HF
		30-inch	10	MF OW PW
			25	HF
	Impact	16-inch, 18-inch, 24-inch	10	MF OW
			75	PW
			185	HF
		30-inch	25	MF
			35	OW
			360	PW
			800	HF
	DTH	16-inch, 18-inch, 24-inch	35	MF
			40	OW
			500	PW
			850	HF
		30-inch	75	MF OW
			850	PW HF
Unit D	**Barge movements, pile positioning**		10	MF OW PW HF
	Vibratory	24-inch templates, sheet piles, H-piles	10	MF OW PW
			25	HF
	Impact	H-piles	25	OW PW
			185	MF
			410	HF
		Sheet piles	75	OW PW
			850	MF
			1,885	HF
	DTH	H-piles	75	MF OW
			925	PW
			2,050	HF

Table 5. Cordova Harbor Rebuild Project NMFS-Managed Species Level A Monitoring and Shutdown Zones – Phase I and II (Figure 3 Legend; *continued*)

Unit	Method	Pile Type	Distance (Meters)	Hearing Group
Unit E	**Barge movements, pile positioning**		10	OW PW HF MF
	Vibratory	24-inch templates, sheet piles, H-piles	10	OW PW MF
			25	HF
	Impact	H-piles	25	OW MF
			185	PW
			410	HF
		Sheet piles	75	OW MF
			850	PW
			1,885	HF
	DTH	H-piles	75	OW MF
			925	PW
			2,050	HF
Unit F	**Barge movements, pile positioning, dredging**		10	MF OW PW HF
	Vibratory	24-inch templates, 24-inch, H, and sheet piles	10	MF OW PW
			25	HF
		24-inch timber removal	10	OW MF
			25	PW
			35	HF
	Impact	24-inch	10	OW MF
			75	PW
			185	HF
		H-piles	25	OW MF
			185	PW
			410	HF
		Sheet piles	75	OW MF
			850	PW
			1,885	HF
	DTH	24-inch	35	MF
			40	OW
			500	PW
			1,080	HF
		H-piles	75	MF OW
			925	PW
			2,050	HF

Figure 3. Cordova Harbor Rebuild Project Distances to Level A Shutdown Zones

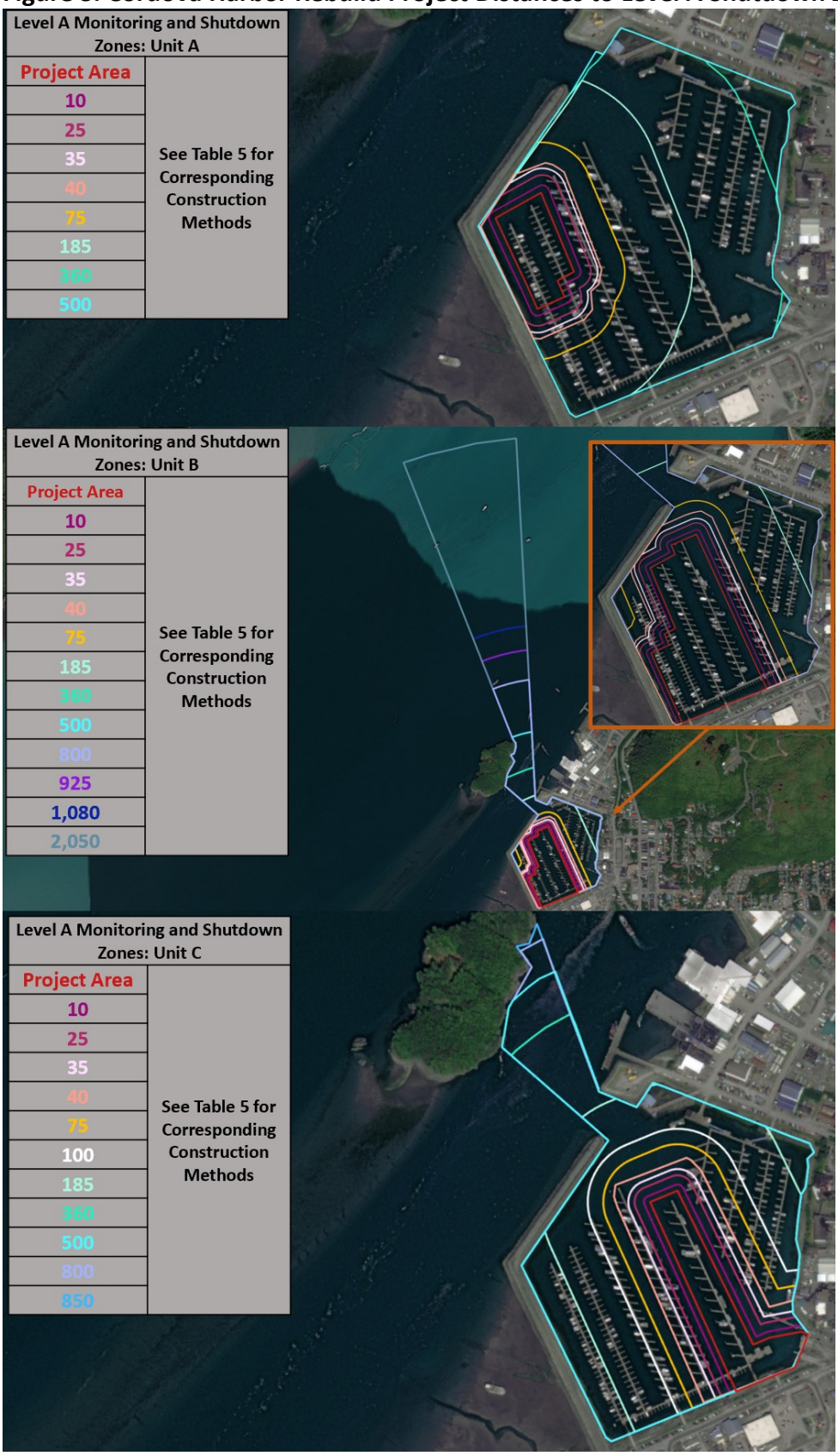
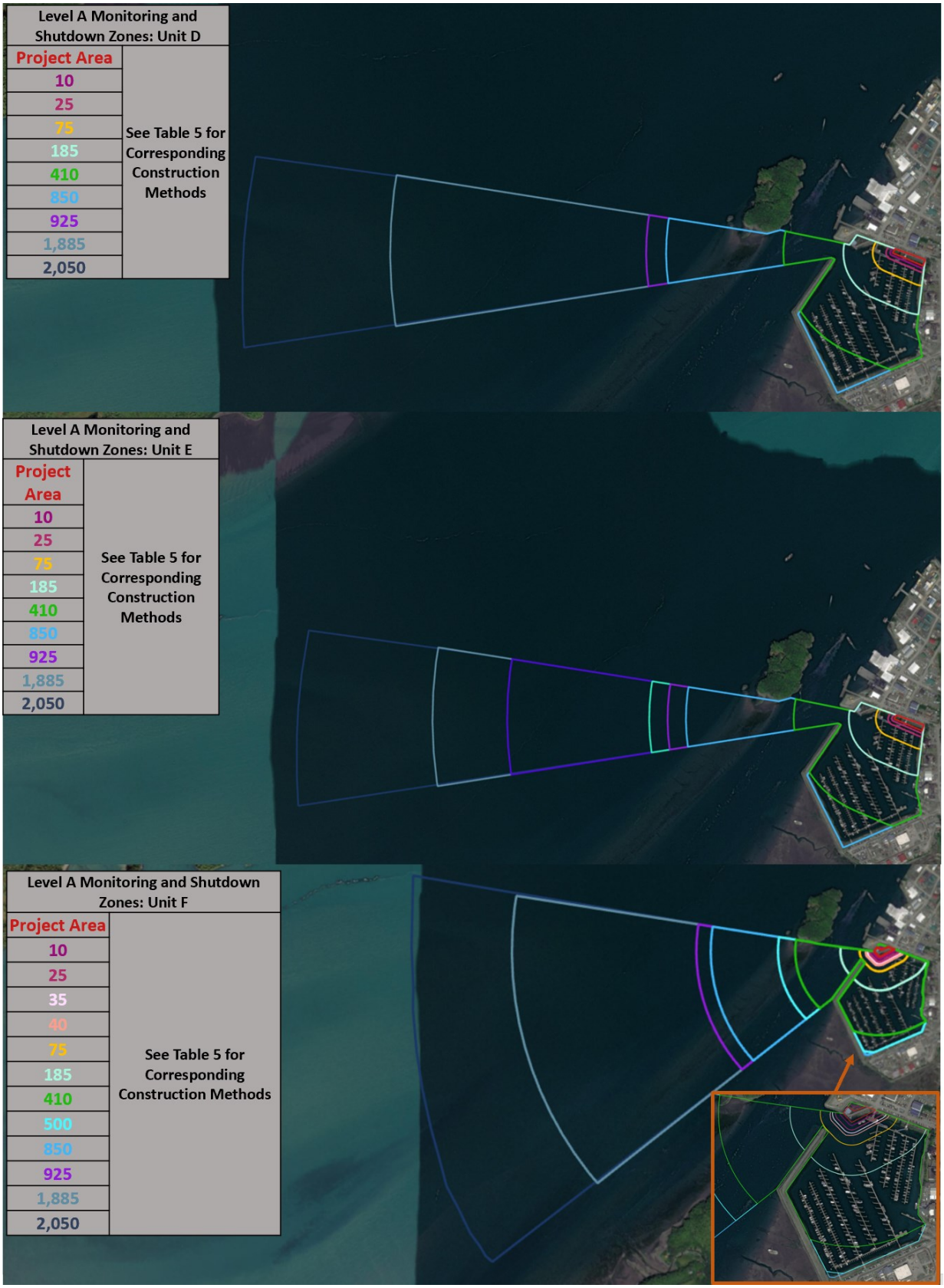


Figure 3. Cordova Harbor Rebuild Project Distances to Level A Shutdown Zones (*continued*)



4.2 Level B Monitoring and Shutdown Zones

Level B monitoring and shutdown zones have been determined based on in-water activity type. Level B monitoring zones represent areas where the SPLs generated from pile driving activities meet or exceed 120 dB root mean square (rms) during vibratory pile driving and DTH drilling and 160 dB rms during impact pile driving.

These monitoring zones serve as an area within which instances of permitted marine mammal harassment (Level B Take) will be documented, if in-water work is actively occurring. Alternatively, for non-permitted marine mammals, it acts as a shutdown area in which in-water work should cease if they approach or appear likely to enter. These Level B zones also allow PSOs to be aware of the presence of permitted marine mammals as they near the shutdown zone and prepare for shutdowns if required. Level B monitoring/shutdown zones are presented in Table 6 and Figure 4 below.

Table 6. Cordova Harbor Rebuild Project Level B Monitoring and Shutdown Zones – Phase I and II (Figure 4 Legend)

Unit	Method	Pile Type	Distance (Meters)
Unit A	Vibratory	24-inch timber removal, 24-inch steel removal, 24-inch templates, 16-inch, 18-inch, 30-inch	25 (Sea Otters)
		24-inch timber removal, 24-inch steel removal, 24-inch templates, 16-inch, 18-inch, 30-inch	500
	Impact	16-inch, 18-inch	275
		30-inch	500
	DTH	16-inch, 18-inch	40 (Sea Otters)
		30-inch	100 (Sea Otters)
		16-inch, 18-inch, 30-inch	500
Unit B	Vibratory	In-air (Bulkhead)	25 (OW)
			70 (PW)
		24-inch steel removal, 24-inch timber removal, 24-inch templates, 16-inch, 18-inch, 30-inch	25 (Sea Otters)
			4,500
	Impact	In-air (Bulkhead)	25 (OW)
			70 (PW)
		16-inch, 18-inch	275
		30-inch	1,000
	DTH	16-inch, 18-inch	40 (Sea Otters)
		30-inch	100 (Sea Otters)
		16-inch, 18-inch, 30-inch	4,500
Unit C	In-water fill	N/A	300
	Vibratory	In-air (Bulkhead)	25 (OW)
			70 (PW)
		24-inch steel removal, 24-inch timber removal, 24-inch templates, 16-inch, 18-inch, 30-inch	25 (Sea Otters)
		24-inch timber and steel removal, 24-inch templates, 16-inch, 18-inch, 30-inch	850
	Impact	In-air (Bulkhead)	25 (OW)
			70 (PW)
		16-inch, 18-inch	275
		30-inch	850
	DTH	16-inch, 18-inch	40 (Sea Otters)
		30-inch	100 (Sea Otters)
		16-inch, 18-inch, 30-inch	850

Table 6. Cordova Harbor Rebuild Project Level B Monitoring and Shutdown Zones – Phase I and II (Figure 4 Legend)

Unit	Method	Pile Type	Distance (Meters)
Unit D	Vibratory	24-inch templates, H, and sheet piles	25 (Sea Otters)
		24-inch templates	5,425
		Sheet	6,310
		H piles	7,150
	Impact	H piles	350
			410 (HF only) *
		Sheet piles	1,000
			1,580 (LF only) *
			1,885 (HF only) *
	DTH	H piles	100 (Sea Otters)
			7,150
Unit E	Vibratory	24-inch templates, H, and sheet piles	25 (Sea Otters)
		24-inch templates	5,425
		Sheet	6,310
		H piles	10,000
	Impact	H piles	350
			410 (HF only) *
		Sheet piles	1,000
			1,580 (LF only) *
			1,885 (HF only) *
	DTH	H piles	100 (Sea Otters)
			15,850
Unit F	Vibratory	24-inch templates, 24-inch timber removal, 24-inch, H, and sheet piles	25 (Sea Otters)
		24-inch templates, 24-inch	5,425
		24-inch timber removal, Sheet piles	6,310
		H piles	10,000
	Impact	24-inch	275
		H piles	350
			410 (HF only) *
		Sheet piles	1,000
			1,580 (LF only) *
			1,885 (HF only) *
	DTH	24-inch	40 (Sea Otters)
			13,600
		H piles	100 (Sea Otters)
			36,400

* Indicates Level A zone. Where Level A zone radii are larger than the corresponding Level B radii, the Level A zone is shown.

Figure 4. Cordova Harbor Rebuild Project Monitoring Zones – Phase I and II

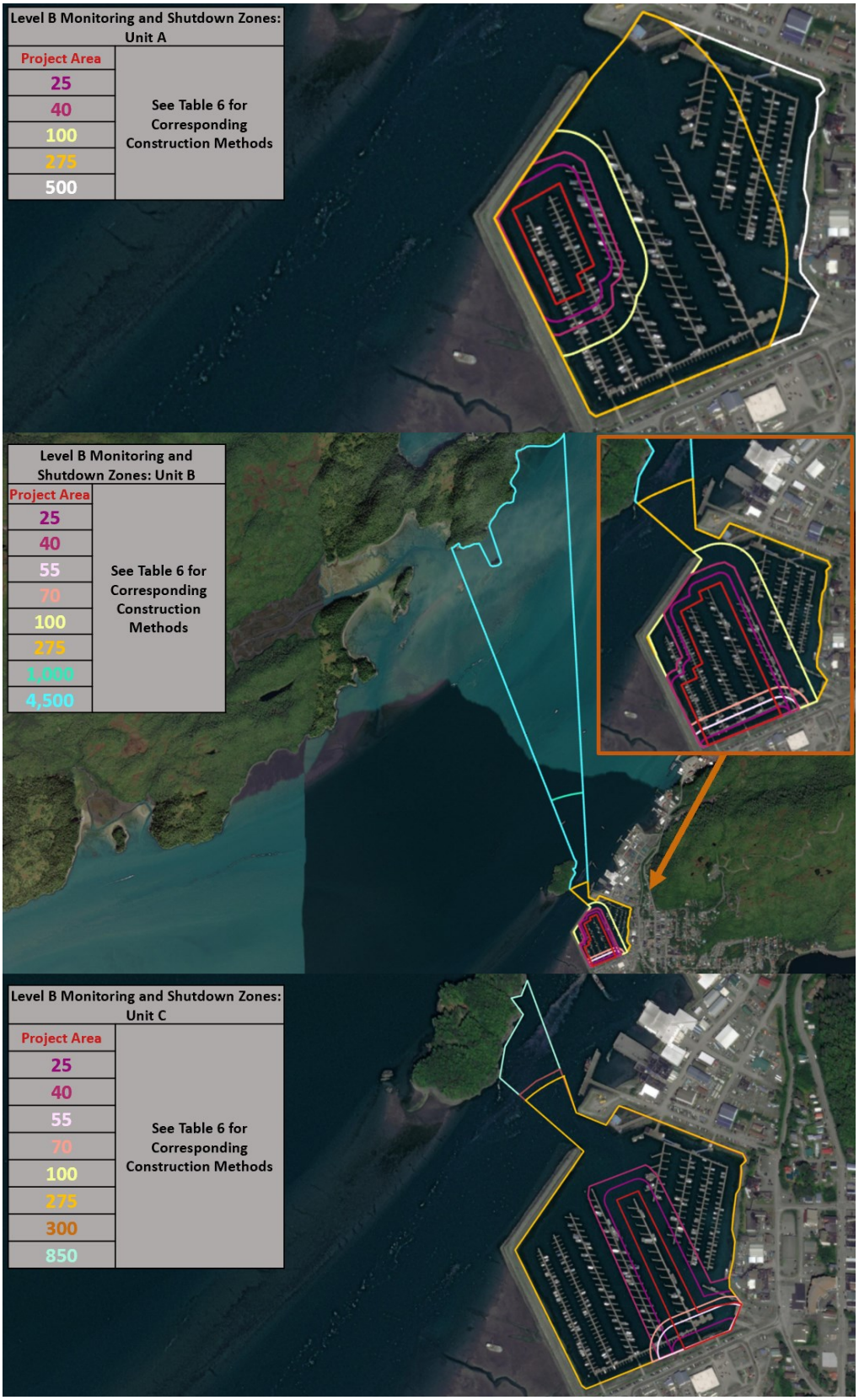
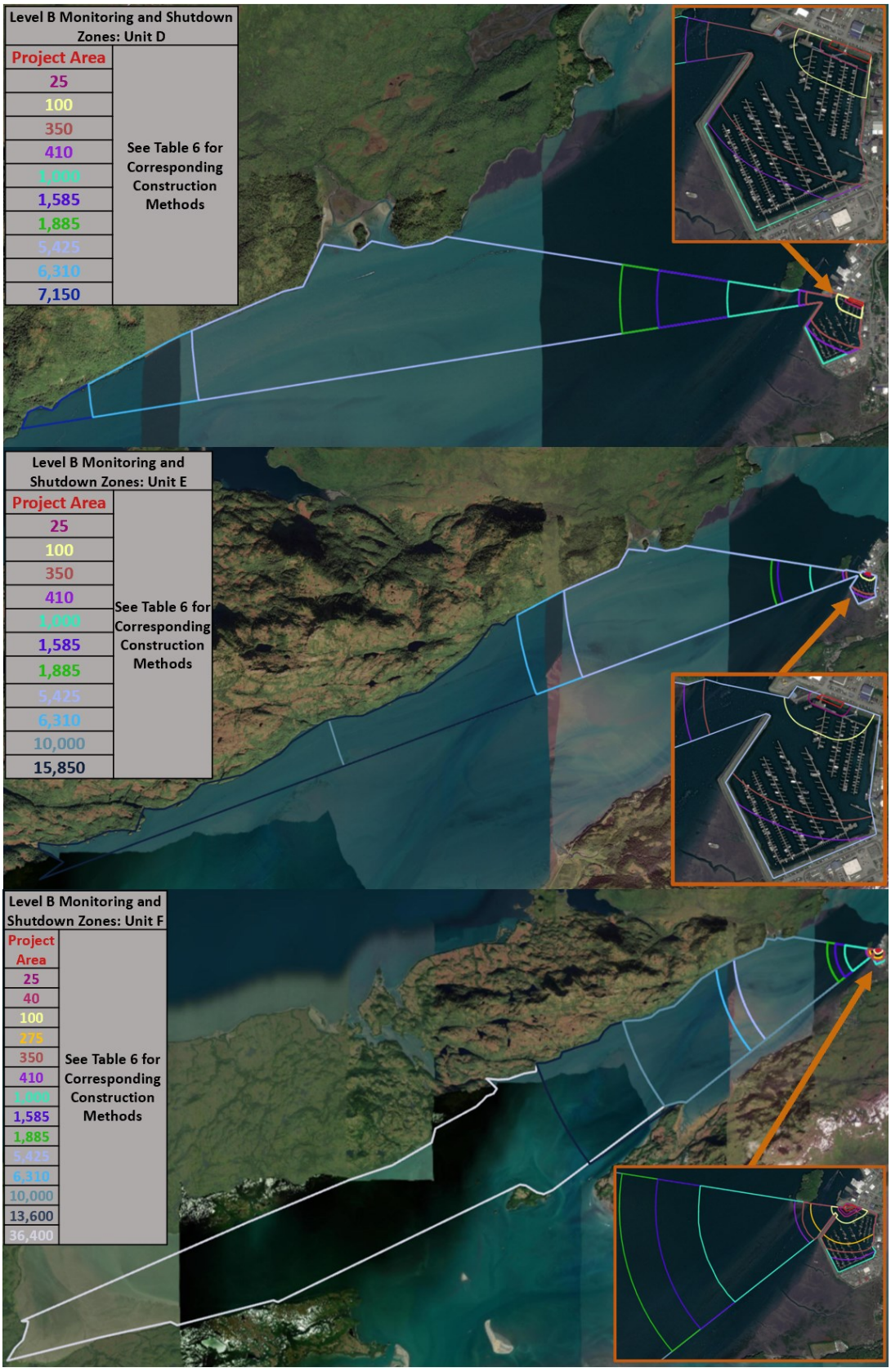


Figure 4. Cordova Harbor Rebuild Project Monitoring Zones – Phase I and II (*continued*)



5 MITIGATION MEASURES

The purpose of a marine mammal monitoring plan is to observe for marine mammals in the area where potential sound effects may occur. Work will be stopped or delayed if a non-permitted marine mammal is sighted in the Level B monitoring area or Level A shutdown area. Work will not begin or resume until the marine mammal has moved out of the monitoring area on its own accord.

The following mitigation measures will be implemented during in-water activities to limit impacts to marine mammals, including ESA-listed species.

5.1 General Conditions and Requirements

- The contractor is required to conduct briefings for construction supervisors and crews and the monitoring team prior to the initiation of pile driving activity and upon hiring new personnel to explain responsibilities, communication procedures, the marine mammal monitoring protocol, and operational procedures.
- The contractor is required to employ PSOs during all in-water construction activities.
- Marine mammal monitoring must take place starting 30 minutes prior to initiation of in-water work and ending 30 minutes after completion of in-water work. In-water work may commence when observers have declared the appropriate zones clear of marine mammals. In the event of a delay or shutdown of activity resulting from marine mammals in the shutdown zone (Table 5 and Table 6), their behavior must be monitored and documented until they leave of their own volition, at which point the activity may begin or resume.
- In-water work must be halted or delayed If a marine mammal is observed entering or within an established shutdown zone (Table 5 and Table 6). Pile driving may not commence or resume until either: the animal has voluntarily left and has been visually confirmed beyond the shutdown zone; 15 minutes have passed without subsequent observations of small cetaceans and pinnipeds; or 30 minutes have passed without subsequent observations of large cetaceans or sea otters.
- The contractor must use soft start techniques when impact pile driving.
- In-water work must be delayed or halted immediately if a species for which authorization has not been granted, or a species for which authorization has been granted but the authorized takes are met, is observed approaching or within the monitoring zone (Table 5 and Table 6). Activities must not start or resume until the animal has been confirmed to have left the area or the observation time period, as indicated in the conditions above, has elapsed.

- Should light or environmental conditions deteriorate such that marine mammals within the entire largest Level A shutdown zone would not be visible (e.g., fog, heavy rain), pile driving and removal must be delayed until the PSOs are confident marine mammals within the shutdown zone could be detected.

- PSOs will work in shifts lasting no longer than 4 hours with at least a 1-hour break between shifts, and will not perform PSO duties for more than 12 hours in a 24-hour period (to reduce PSO fatigue).

5.2 Observer Qualifications and Requirements

- Visual acuity in both eyes (correction is permissible) sufficient to discern moving targets at the water's surface and ability to estimate target size and distance. Use of binoculars and/or spotting scope may be necessary to correctly identify the target.
- Advanced education in biological science, wildlife management, mammalogy or related fields (Bachelor's degree or higher is preferred), or equivalent Alaska Native traditional knowledge. PSOs may substitute education or training for experience.
- Experience and ability to conduct field observations and collect data according to assigned protocols (this may include academic experience).
- Experience or training in field identification of marine mammals (cetaceans and pinnipeds).
- Training, knowledge of or experience with vessel operation and pile driving operations sufficient to provide personal safety during observations.
- Writing skills sufficient to prepare a report of observations. Reports should include: the number, type, and location of marine mammals observed; the behavior of marine mammals in the area of potential sound effects during construction; dates and times when observations and in-water construction activities were conducted; dates and times when in-water construction activities were suspended because of marine mammals; etc.
- Ability to communicate orally as needed, by radio or in person, with project personnel to provide real time information about marine mammals observed in the area.
- PSOs must be independent (i.e., not construction personnel) and have no other assigned tasks during monitoring periods.
- A lead observer or monitoring coordinator must be designated if a team of three or more PSOs are required. The lead observer must have prior experience working as a marine mammal observer during construction.
- The contractor must submit PSO CVs for approval by NMFS prior to the onset of pile driving.

5.3 Data Collection

5.3.1 Environmental Conditions and Construction Activities

PSOs will use the monitoring forms and construction activities log to document the following (Appendix C):

- Environmental Conditions
    - Environmental conditions will be recorded at the beginning and end of every monitoring period and as conditions change.

    - Recordings will include PSO names, location of the observation station, time and date of the observation, weather conditions, air temperature, sea state, cloud cover, visibility, glare, tide, and ice coverage (if applicable).
- Construction Activities:
    - PSOs will record the time that observations begin and end as well as the durations of shutdowns.
    - PSOs will document the reason for stopping work, time of shutdown, and type of pile installation or other in-water work taking place.
    - PSOs will document other, non-project-related activities that could disturb marine mammals in the area, such as the presence of large and small vessels.

PSOs will record all communications with the construction crew. The environmental conditions and construction activities log will be checked for quality assurance and quality control by the lead PSO for submission at the end of every monitoring day. Upon request, the data will be submitted to NMFS along with the final report.

5.3.2 Sightings

Observers will use an approved Marine Mammal Sighting Form and Grid Maps (Appendices D and E) which will be completed by each observer for each survey day and location. Sighting forms will be used by observers to record the following:

- Date and time that permitted construction activity begins or ends;
- Weather parameters (e.g., percent cloud cover, percent glare, visibility) and sea state (determined by the Beaufort Wind Force Scale);
- Species, numbers, and, if possible, sex and age class of observed marine mammals;
- Construction activities occurring during each sighting;
- Behavioral patterns observed, including bearing and direction of travel;
- Behavioral reactions just prior to, or during, soft-start and shutdown procedures;
- The marine mammal's location, distance from the observer, and distance from pile removal activities;
- Whether mitigation measures, including shutdown procedures, were required by an observation, including the duration of each shutdown;
- Observer rotations including the time of rotation and the initials of the incoming observer.

The observation record forms will be checked for quality assurance and quality control by the lead PSO for submission at the end of every monitoring day. Upon request, the data will be submitted to NMFS, and it will be included with the final report.

5.4 Equipment

The following equipment will be required to conduct observations for this project:

- Appropriate Personal Protective Equipment;
- Portable VHF radios for the observers to communicate with other observers and the pile driving supervisor;
- Cellular phone as backup for radio communication;
- Contact information for the other observers, the pile driving supervisor, and the NMFS point of contact;
- Daily tide tables for the project area;
- Binoculars (quality 7 x 50 or better) and a rangefinder;
- Hand-held GPS unit, map and compass, or grid map to record locations of marine mammals;
- Copies of the 4MP, IHA, and other relevant permit requirement specifications in a sealed, clear, plastic cover;
- Notebook with pre-standardized monitoring Observation Record forms and Grid Maps (Appendices D and E).

5.5 Number and Location of PSOs

The number of locations of observers are determined to ensure that there is full coverage of the entire action area during all in-water activities. Locations are chosen based on site accessibility and field of vision.

5.5.1 South Harbor Locations

One to three PSOs will be onsite during in-water activities in the South Harbor associated with the Cordova Harbor Rebuild Project, stationed in the following locations (Figure 5):

- PSO 1: stationed along the South Harbor parking area
- PSO 2: stationed on the Breakwater Trail
- PSO 3: stationed at a viewpoint along New England Cannery Road.

The number and locations of monitors will be based on the following in-water work scenarios presented in Table 7.

Table 7. Cordova Harbor Rebuild Project South Harbor PSO Scenarios

Unit	Construction	Piles	PSO Locations
Unit A	Vibratory	24-inch timber removal, 24-inch steel removal, 24-inch templates, 16-inch, 18-inch, 30-inch	PSO 1
	Impact	16-inch, 18-inch, 30-inch	PSO 1
	DTH	16-inch, 18-inch, 30-inch	PSO 1
Unit B	Vibratory	In-air (Bulkhead)	PSO 1
		24-inch steel removal, 24-inch timber removal, 24-inch templates, 16-inch, 18-inch, 30-inch	PSO 1, PSO 2, PSO 3
	Impact	In-air (Bulkhead), 16-inch, 18-inch	PSO 1
		30-inch	PSO 1 and PSO 2

Unit	Construction	Piles	PSO Locations
	DTH	16-inch, 18-inch, 30-inch	PSO 1, PSO 2, PSO 3
Unit C	Vibratory	In-air (Bulkhead)	PSO 1
		24-inch timber and steel removal, 24-inch templates, 16-inch, 18-inch, 30-inch	PSO 1 and PSO 2
	Impact	In-air (Bulkhead), 16-inch, 18-inch	PSO 1
		30-inch	PSO 1 and PSO 2
	DTH	16-inch, 18-inch, 30-inch	PSO 1 and PSO 2

5.5.2 North Harbor Locations

Two to four PSOs will be onsite during in-water activities in the North Harbor associated with the Cordova Harbor Rebuild Project, stationed in the following locations (Figure 6):

- PSO 1: stationed along the North Harbor parking area
- PSO 2: stationed on the Breakwater Trail
- PSO 3: stationed at a viewpoint along the shore near Saddle Point
- PSO 4: stationed at a viewpoint along Whitshed Road.
- PSO 5: roving on a boat in Orca Inlet[2]

The number and locations of monitors will be based on the following in-water work scenarios presented in Table 8.

Table 8. Cordova Harbor Rebuild Project North Harbor PSO Scenarios

Unit	Construction	Piles	PSO Locations
Unit D	Vibratory	24-inch templates, sheet, and H-piles	PSO 1, PSO 2, PSO 3
	Impact	Sheet and H-piles	PSO 1 and PSO 2
	DTH	H piles	PSO 1, PSO 2, PSO 3
Unit E	Vibratory	24-inch templates and sheet pile	PSO 1, PSO 2, PSO 3
		H piles	PSO 1, PSO 2, PSO 3, PSO 4
	Impact	Sheet and H-piles	PSO 1 and PSO 2
	DTH	H piles	PSO 1, PSO 2, PSO 3, PSO 4, PSO 5
Unit F	Dredging	N/A	PSO 1 and PSO 2
	Vibratory	24-inch timber removal, 24-inch templates, 24-inch, sheet, and H-piles	PSO 1, PSO 2, PSO 3, PSO 4
	Impact	24-inch	PSO 1
		Sheet and H-piles	PSO 1 and PSO 2
	DTH	24-inch, H piles	PSO 1, PSO 2, PSO 3, PSO 4, PSO 5

[2] A boat-based PSO would only be used when the tide is sufficiently high enough for a boat to access southern Orca Inlet while DTH drilling was occurring in Unit E and Unit F because the mudflats in Orca Inlet are exposed at a zero tide.

Figure 5. Cordova Harbor Rebuild Project South Harbor PSO Locations

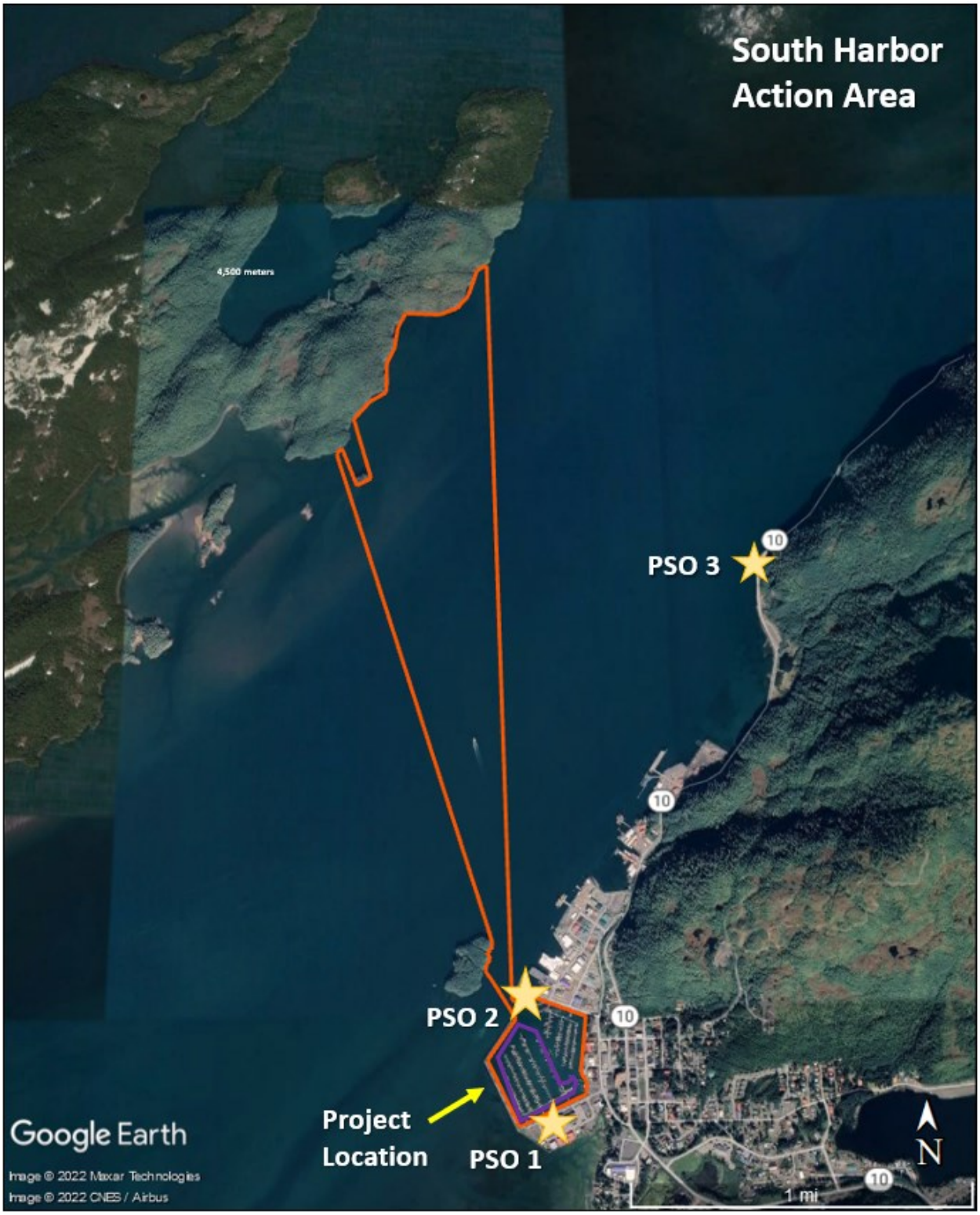


Figure 6. Cordova Harbor Rebuild Project North Harbor PSO Locations

5.6 Strike Avoidance

Vessels will adhere to the Alaska Humpback Whale Approach Regulations when transiting to and from the project site (see 50 CFR §§ 216.18, 223.214, and 224.103(b)). These regulations require that all vessels:

- Do not approach, or cause a vessel or object to approach, within 100 yards of a humpback whale;
- Do not obstruct the path of oncoming humpback whales causing them to surface within 100 yards of the vessel;
- Do not disrupt the normal behavior or prior activity of a whale; and Operate at a slow, safe speed when near a humpback whale (safe speed is defined in regulation 33 CFR § 83.06).

Vessels will follow the NMFS Marine Mammal Code of Conduct for other species of marine mammals, which recommend: maintaining a minimum distance of 100 yards; not encircling or trapping marine mammals between boats, or between boats and the shore; and putting engines in neutral if approached by a whale or other marine mammal to allow the animals to pass.

5.7 Monitoring Techniques

5.7.1 Pre-Activity Monitoring

The following monitoring methods will be implemented before permitted construction begins:

- The lead PSO and Contractor Superintendent will meet at the start of each day to discuss planned construction activities for the day and to conduct a radio/phone check.
- Prior to the start of permitted activities, observers will conduct a 30-minute pre-watch of the shutdown and monitoring zones. They will ensure that no marine mammals are present within the shutdown zone before permitted activities begin.
- The shutdown zone will be cleared when marine mammals have not been observed within the zone for the 30-minute pre-watch period. If a marine mammal is observed within the shutdown zone, a soft-start cannot proceed until the animal has left the zone or has not been observed for 15 minutes (for pinnipeds) or 30 minutes (for cetaceans and sea otters).
- When all applicable exclusion zones are clear, the observers will radio the pile driving supervisor. Permitted activities will not commence until the pile driving supervisor receives verbal confirmation that the zones are clear.
- If permitted species are present within the monitoring zone, work will not be delayed, but observers will monitor and document the behavior of individuals that remain in the monitoring zone.
- In case of fog or reduced visibility, observers must be able to see all of the shutdown zones before permitted activities can begin.

5.7.2 Soft Start Procedures

Soft start procedures will be used prior to periods of vibratory and impact driving to allow marine mammals to leave the area prior to exposure to maximum noise levels.

- For vibratory hammers, the contractor shall run the vibratory hammer for no more than 30 seconds followed by a quiet period of at least 60 seconds without vibratory removal of piles. This process shall be repeated twice more within 10 minutes before beginning vibratory removal operations that last longer than 30 seconds.
- For impact hammers, the contractor will initiate approximately three strikes at a reduced energy level, followed by a 30-second waiting period. This procedure would be repeated twice more.
- If work ceases for more than 30 minutes, soft start procedures must be used prior to continuing work.

5.7.3 During Activity Monitoring

If permitted species are observed within the monitoring zone during permitted activities, a Level B takes will be recorded and behaviors will be documented. Work will not stop unless an animal enters or appears likely to enter the shutdown zone.

5.7.4 Inclement Weather

Orca Inlet and the Cordova Harbor occasionally experience increased sea states and inclement weather. If inclement weather, limited visibility, or increased sea state restricts the observers' ability to make observations, in-water activities will not be initiated or continued until the largest Level A shutdown zone for the activity is visible.

If visibility is diminished, but the parameters for initiating or continuing work, referenced above, are met the following should occur:

- All appropriate PSO locations for the planned in-water activities should be occupied for the entirety of the monitoring period regardless of visibility.
- All PSO locations should collectively determine what percentage of the Level B zone is visible for use in calculating extrapolations. The lead PSO should document this with time stamps as conditions change and this percentage should be adopted by all PSO locations.
- Extrapolate takes for each species with authorized take using the equation below.

Percentage of visible Level B zone ÷ Number of individuals sighted in the visible portion of the Level B zone = extrapolated takes for species

5.7.5 Shutdowns

If a marine mammal enters or appears likely to enter its respective shutdown zone:

- The observers will immediately alert the pile driving supervisor.
- All permitted activities will immediately halt.
- In the event of a shutdown, permitted pile installation or removal activities may resume only when the animal(s) within or approaching the shutdown zone has been visually confirmed beyond or heading away from the shutdown zone, or 15 minutes (for pinnipeds) or 30 minutes (for cetaceans and sea otters) have passed without observation of the animal. Observers will contact the pile driving supervisor and inform them that activities can re-commence.

5.7.6 Breaks in Work

Shutdown and monitoring zones will continue to be monitored during an in-water construction delay. No exposures will be recorded for permitted species in the monitoring zone if there are no concurrent permitted construction activities.

If permitted activities cease for more than 30 minutes and monitoring has not continued, pre-activity monitoring and soft start procedures must recommence. This includes breaks due to scheduled or unforeseen construction practices or breaks due to permit-required shutdown. Work can begin following the 30-minute pre-watch monitoring protocols. Work cannot begin if an animal is within the shutdown zone or if visibility is not clear throughout the Level A shutdown zones.

5.7.7 Post Activity Monitoring

Monitoring of the shutdown and monitoring zones will continue for 30 minutes following completion of in-water activities. PSOs will continue to record observations during this post-watch period, with a focus on observing and reporting unusual or abnormal behaviors.

If construction were to resume during the post-watch period, PSOs will follow pre-watch protocols to ensure that that the shutdown and monitoring zones are clear prior to work resuming.

6 REPORTING

6.1 Notification of Intent to Commence Construction

The contractor will inform NMFS Alaska Region Permits Division and USFWS Alaska Region 3M one week prior to commencing construction activities.

6.2 Weekly Sighting Counts

A summary of the following will be submitted to the construction project manager at the conclusion of each week of construction activity (Friday evening):

- Completed monitoring forms for the week
- Completed environmental conditions and construction activity logs for the week
- Preliminary counts of sightings and takes per species

6.3 Interim Monthly Reports

The contractor will submit brief, monthly reports to the NMFS Alaska Region Permits Division and USFWS Alaska Region 3M summarizing PSO observations and recorded takes during construction. Monthly reporting will allow NMFS to track takes (including extrapolated takes) and reinitiate consultation in a timely manner, if necessary. Monthly reports will be submitted by email to NMFS at akr.section7@noaa.gov and to USFWS at fw7_mmm_reports@fws.gov.

The reporting period for each monthly PSO report will be the entire calendar month, and reports will be submitted by the end of business hours on the tenth day of the month following the end of the reporting period (e.g., the monthly report covering September 1–30, 2023, would be submitted to the NMFS and USFWS by close of business on October 10, 2023).

6.4 Final Report

The contractor will submit a draft final report by email to NMFS at akr.section7@noaa.gov and to USFWS at fw7_mmm_reports@fws.gov no later than 90 days following the end of construction activities. The contractor will provide a final report within 30 days following resolution of NMFS 's and USFWS's comments on the draft report. If no comments are received from the agencies within 30 days, the draft final report will be considered the final report.

The final reports will contain, at minimum, the following information:

- A summary of construction activities, including start and end dates.
- A description of any deviation from the initially proposed pile numbers, pile types, average driving times, etc.
- A table summarizing all marine mammal sightings during the construction period, including:
    - dates, times, species, numbers, locations, and behaviors of any observed ESA-listed marine mammals, including all observed humpback whales and Steller sea lions;
    - daily average number of individuals of each species (differentiated by month as appropriate) detected within the Level A and Level B zones, and whether estimated as taken, if appropriate; and
    - the number of shut-downs throughout all monitoring activities.
- A brief description of any impediments to obtaining reliable observations during construction period.
- A description of any impediments to complying with these mitigation measures.
- Appendices containing all PSO daily logs and marine mammal sighting forms.

6.5 Reporting Injured or Dead Marine Mammals

If it is clear that project activity has caused the take of a marine mammal in a manner prohibited by the (requested) IHA, such as unauthorized Level A harassment, serious injury, or mortality, the contractor shall immediately cease the specified activities and report the incident the NMFS Alaska Region Permits Division and the NMFS statewide 24-hour Stranding Hotline (877) 925-7773. If a sea otter, report to the USFWS Marine Mammal Management Office at (800) 362–5148, or the Alaska SeaLife Center in Seward (888) 774–7325, or both.

The report must include the following:

- Time and date of the incident
- Description of the incident
- Environmental conditions (e.g., wind speed and direction, Beaufort Sea state, cloud cover and visibility);
- Description of all marine mammal observations in the 24 hours preceding the incident;
- Species identification or description of the animal(s) involved;
- Fate of the animal(s); and;
- Photographs or video footage of the animal(s) (if available).

Activities will not resume until NMFS or USFWS is able to review the circumstances of the unauthorized take. NMFS or USFWS would work with the contractor to determine what measures are necessary to minimize the likelihood of further unauthorized take and ensure ESA and MMPA compliance. The contractor may not resume their activities until notified by NMFS or USFWS.

In the event that the contractor discovers an injured or dead marine mammal within the action area, and the lead PSO determines that the cause of the injury or death is unknown and the death is relatively recent (e.g., in less than a moderate state of decomposition), the contractor will immediately report the incident to the NMFS Permits Division or USFWS Alaska Region 3M, and the NMFS Alaska Regional Stranding Coordinator or Hotline.

The report must include the same information identified in the paragraph above. Activities may continue while NMFS or USFWS reviews the circumstances of the incident. NMFS or USFWS will work with the contractor to determine whether additional mitigation measures or modifications to the activities are appropriate.

In the event that the contractor discovers an injured or dead marine mammal and the lead PSO determines that the injury or death is not associated with or related to the activities authorized in the IHA (e.g., previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), the contractor must report the incident to the NMFS Permits Division and the NMFS Alaska Regional Stranding Coordinator or Hotline within 24 hours of the discovery. If a sea otter, it must be reported to USFWS within 24 hours of the discovery to either the USFWS Marine Mammal Management Office at (800) 362–5148 (business hours), or the Alaska SeaLife Center in Seward (888) 774–7325 (24 hours a day), or both. The contractor will provide photographs, video footage (if available), or other documentation of the stranded animal sighting to NMFS or USFWS.

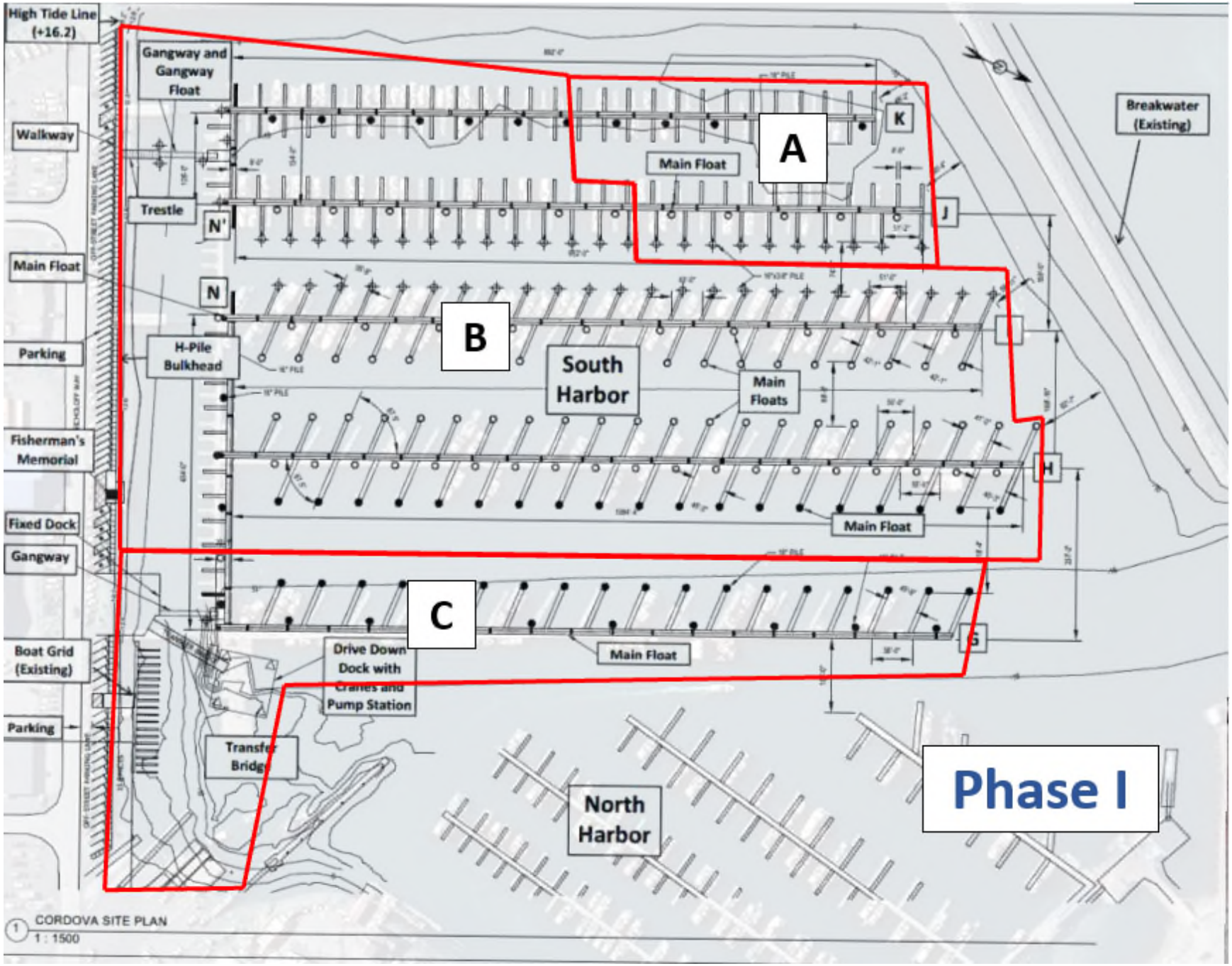
Appendix A: List of Species with Ranges in the Project Action Area

Species Under NMFS Jurisdiction that May Occur in the Project Vicinity

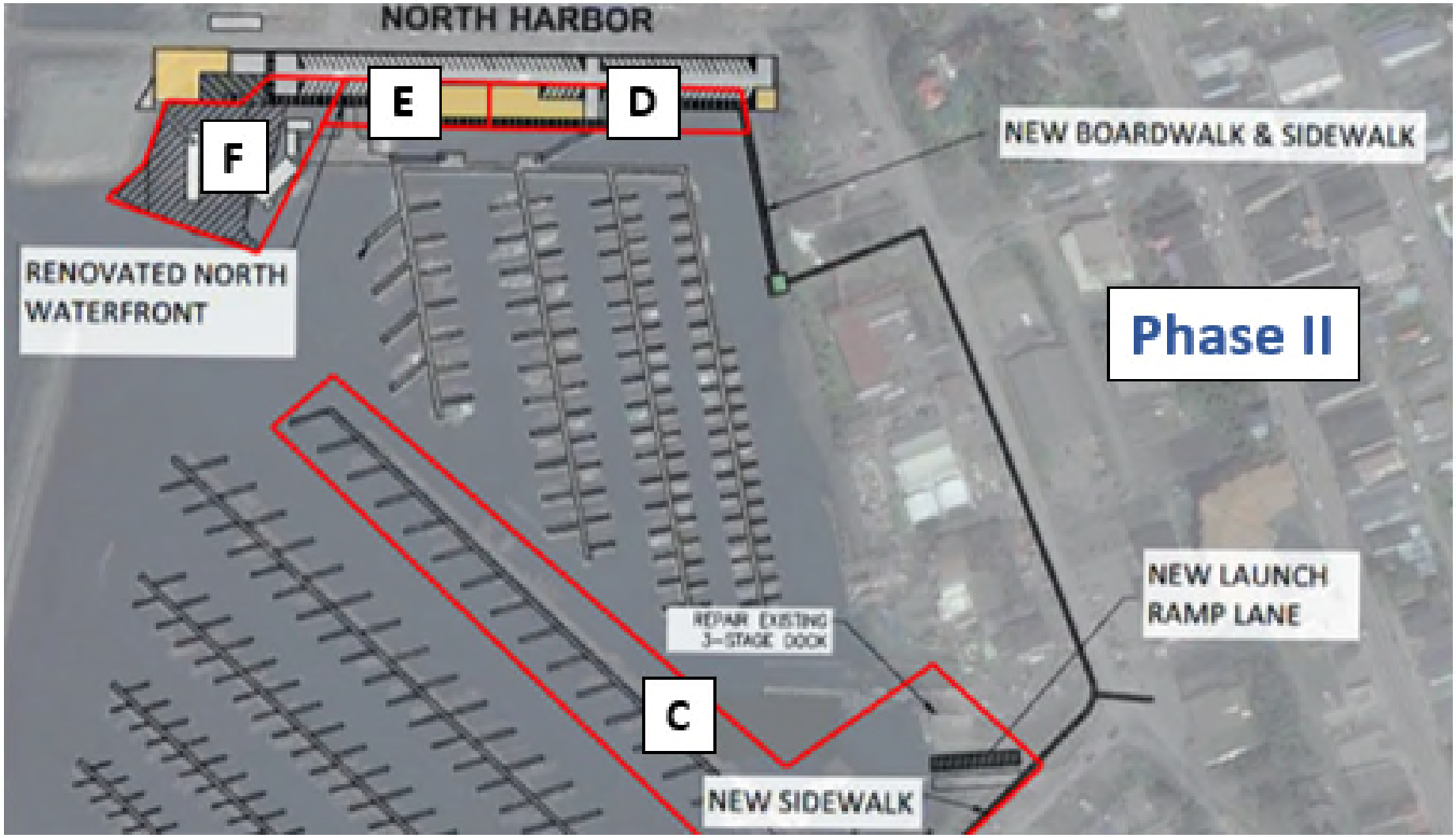
Species	Status Listing	Jurisdiction	Occurrence	Link to Species Profile
Steller Sea Lion (*Eumatopia jubatus*)	ESA Endangered (WDPS)	NMFS	Common	https://www.fisheries.noaa.gov/species/steller-sea-lion
Humpback Whale (*Megaptera novaeangliae*)	ESA Threatened Mexico DPS/ North Pacific DPS	NMFS	Rare	https://www.fisheries.noaa.gov/species/humpback-whale
Fin Whale (*Balaenoptera physalus*)	ESA Endangered	NMFS	Rare	https://www.fisheries.noaa.gov/species/fin-whale
Northern Sea Otter (*Enhydra lutris kenyoni)*	MMPA	USFWS	Common	https://www.fws.gov/species/northern-sea-otter-enhydra-lutris-kenyoni
Northern Fur Seal (*Callorhinus ursinus*)	MMPA	NMFS	Rare	https://www.fisheries.noaa.gov/species/northern-fur-seal
Harbor Seal (*Phoca vitulina*)	MMPA	NMFS	Common	https://www.fisheries.noaa.gov/species/harbor-seal
Pacific White-Sided Dolphin (*Lagenorhynchus obliquidens*)	MMPA	NMFS	Rare	https://www.fisheries.noaa.gov/species/pacific-white-sided-dolphin
Harbor Porpoise (*Phocoena phocoena*)	MMPA	NMFS	Infrequent	https://www.fisheries.noaa.gov/species/harbor-porpoise
Dall's Porpoise (*Phocoenoides dalli*)	MMPA	NMFS	Infrequent	https://www.fisheries.noaa.gov/species/dalls-porpoise
Minke Whale (*Balaenoptera acutorostrata*)	MMPA	NMFS	Rare	https://www.fisheries.noaa.gov/species/minke-whale
Gray Whale (*Eschrichtius robustus*)	MMPA	NMFS	Rare	https://www.fisheries.noaa.gov/species/gray-whale

Appendix B: Shutdown and Monitoring Zone Maps

Cordova Harbor Rebuild Project Action Area Units – Phase I

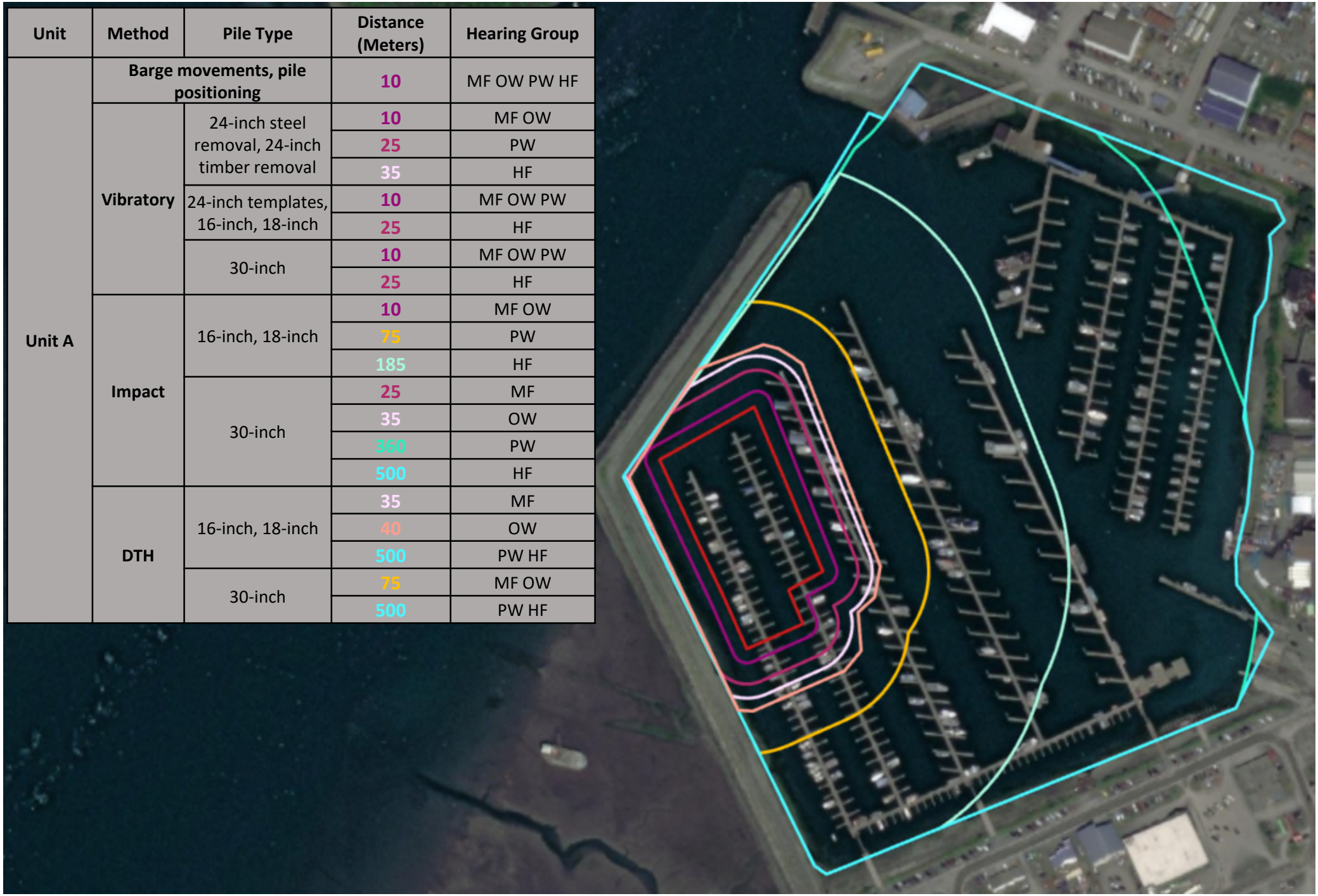


Cordova Harbor Rebuild Project Action Area Units – Phase II



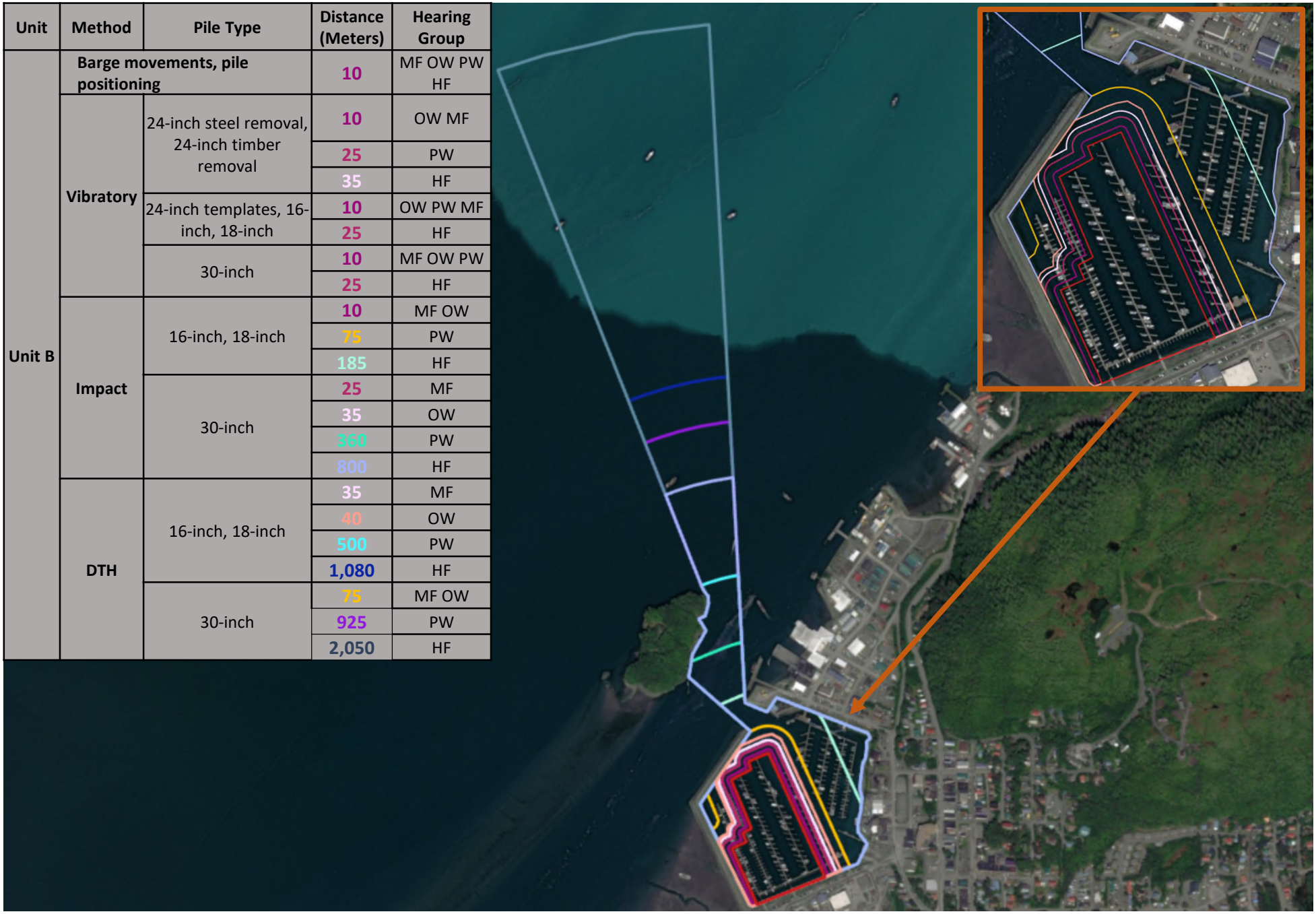
Cordova Harbor Rebuild Project Distances to Level A Monitoring and Shutdown Zones: Unit A

Unit	Method	Pile Type	Distance (Meters)	Hearing Group
Unit A	Barge movements, pile positioning		10	MF OW PW HF
	Vibratory	24-inch steel removal, 24-inch timber removal	10	MF OW
			25	PW
			35	HF
		24-inch templates, 16-inch, 18-inch	10	MF OW PW
			25	HF
		30-inch	10	MF OW PW
			25	HF
	Impact	16-inch, 18-inch	10	MF OW
			75	PW
			185	HF
		30-inch	25	MF
			35	OW
			360	PW
			500	HF
	DTH	16-inch, 18-inch	35	MF
			40	OW
			500	PW HF
		30-inch	75	MF OW
			500	PW HF



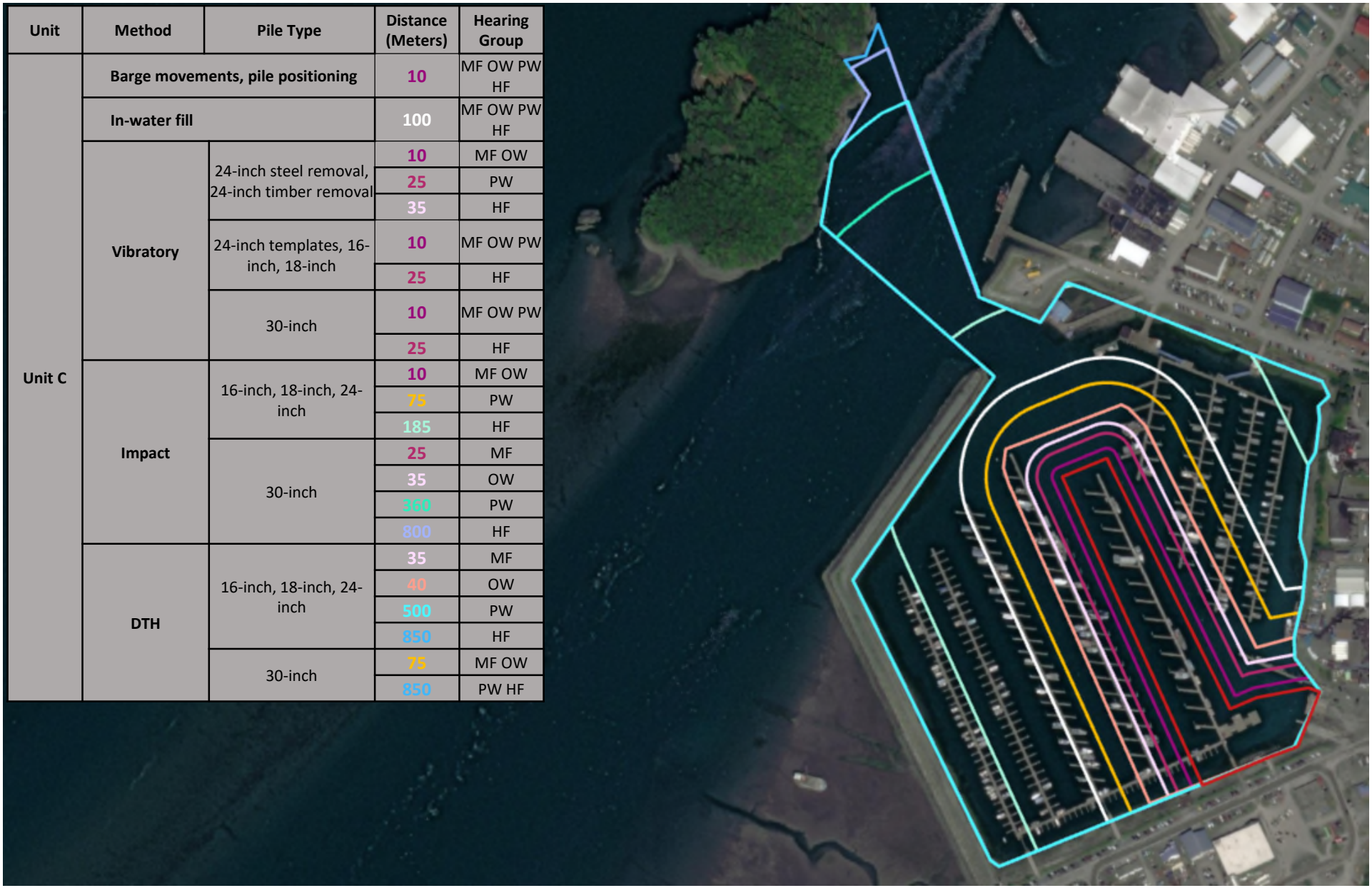
Cordova Harbor Rebuild Project Distances to Level A Shutdown Zones: Unit B

Unit	Method	Pile Type	Distance (Meters)	Hearing Group
Unit B	Barge movements, pile positioning		10	MF OW PW HF
	Vibratory	24-inch steel removal, 24-inch timber removal	10	OW MF
			25	PW
			35	HF
		24-inch templates, 16-inch, 18-inch	10	OW PW MF
			25	HF
		30-inch	10	MF OW PW
			25	HF
	Impact	16-inch, 18-inch	10	MF OW
			75	PW
			185	HF
		30-inch	25	MF
			35	OW
			360	PW
			800	HF
	DTH	16-inch, 18-inch	35	MF
			40	OW
			500	PW
			1,080	HF
		30-inch	75	MF OW
			925	PW
			2,050	HF



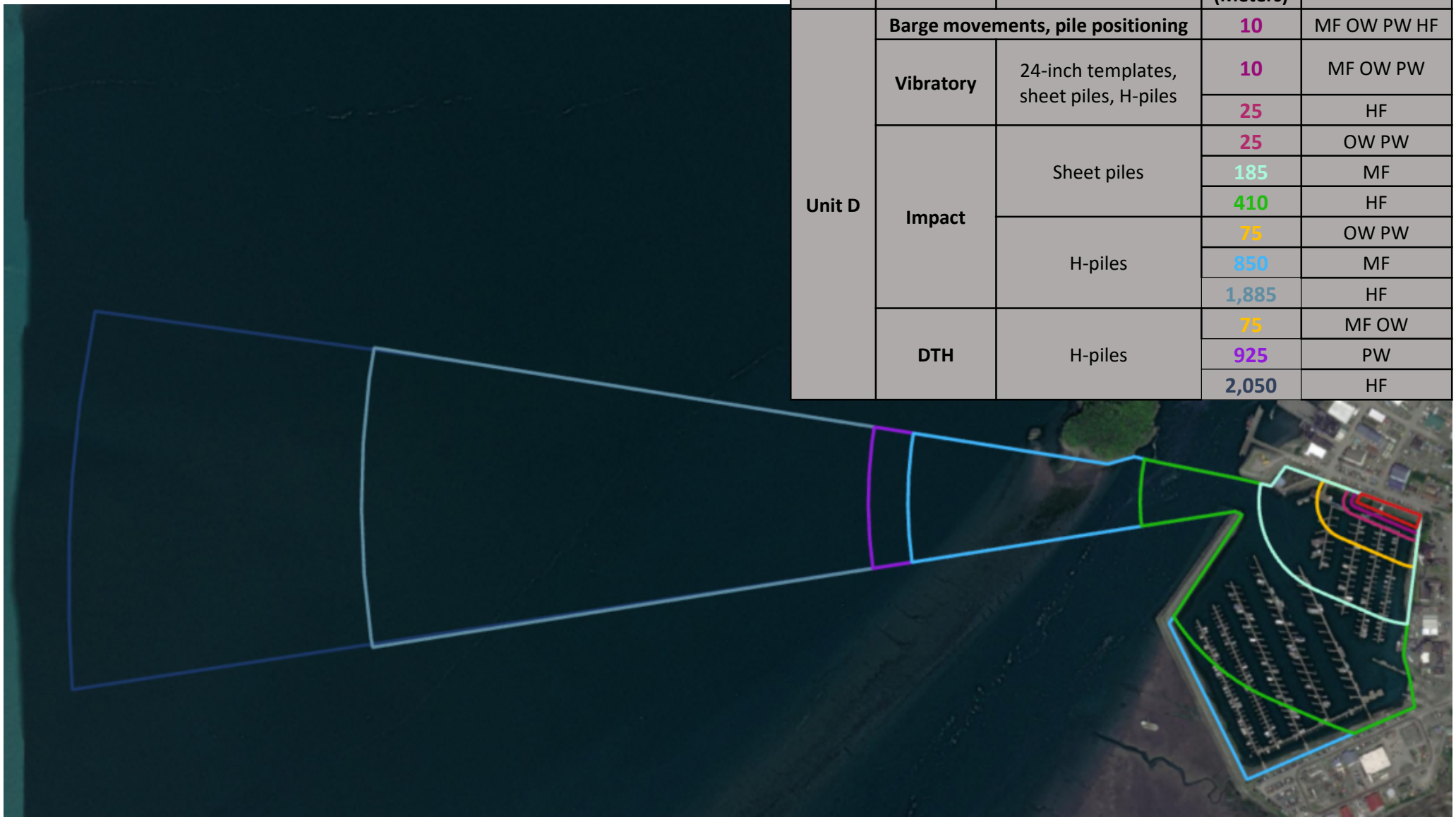
Cordova Harbor Rebuild Project Distances to Level A Shutdown Zones: Unit C

Unit	Method	Pile Type	Distance (Meters)	Hearing Group
Unit C	Barge movements, pile positioning		10	MF OW PW HF
	In-water fill		100	MF OW PW HF
	Vibratory	24-inch steel removal, 24-inch timber removal	10	MF OW
			25	PW
			35	HF
		24-inch templates, 16-inch, 18-inch	10	MF OW PW
			25	HF
		30-inch	10	MF OW PW
			25	HF
	Impact	16-inch, 18-inch, 24-inch	10	MF OW
			75	PW
			185	HF
		30-inch	25	MF
			35	OW
			360	PW
			800	HF
	DTH	16-inch, 18-inch, 24-inch	35	MF
			40	OW
			500	PW
			850	HF
		30-inch	75	MF OW
			850	PW HF



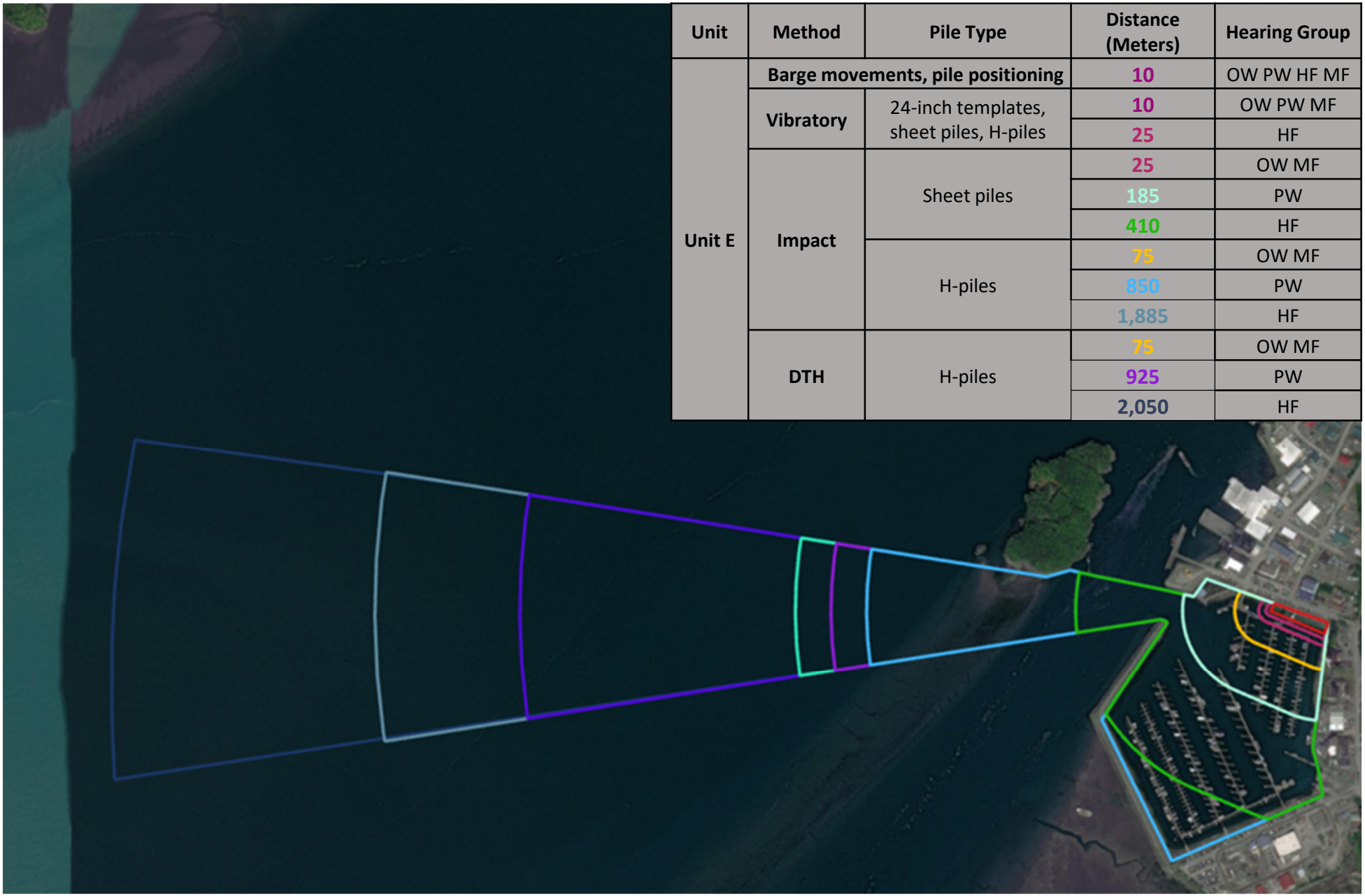
Cordova Harbor Rebuild Project Distances to Level A Shutdown Zones: Unit D

Unit	Method	Pile Type	Distance (Meters)	Hearing Group
Unit D	**Barge movements, pile positioning**		10	MF OW PW HF
	Vibratory	24-inch templates, sheet piles, H-piles	10	MF OW PW
			25	HF
	Impact	Sheet piles	25	OW PW
			185	MF
			410	HF
		H-piles	75	OW PW
			850	MF
			1,885	HF
	DTH	H-piles	75	MF OW
			925	PW
			2,050	HF



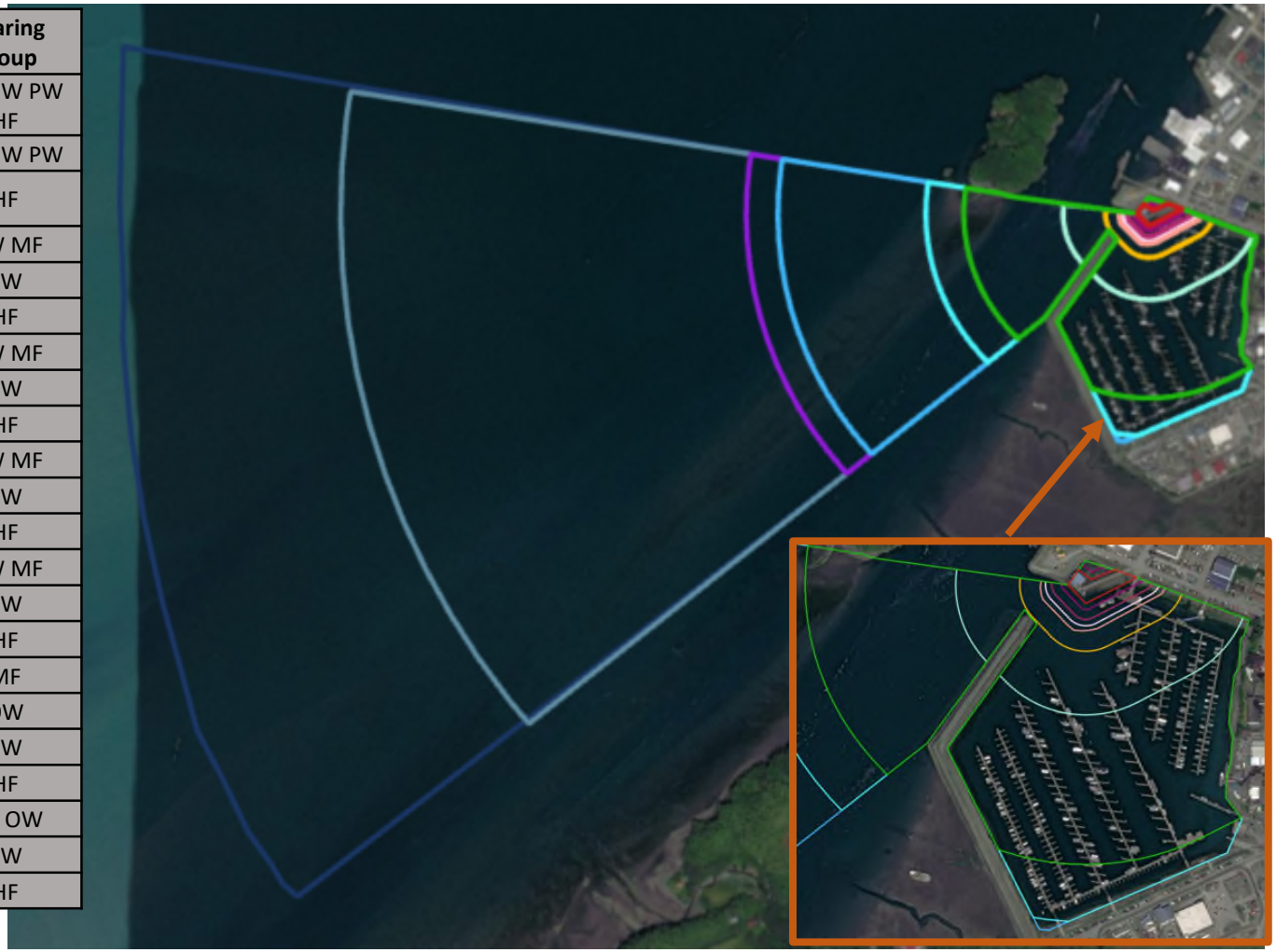
Cordova Harbor Rebuild Project Distances to Level A Shutdown Zones: Unit E

Unit	Method	Pile Type	Distance (Meters)	Hearing Group
Unit E	Barge movements, pile positioning		10	OW PW HF MF
	Vibratory	24-inch templates, sheet piles, H-piles	10	OW PW MF
			25	HF
	Impact	Sheet piles	25	OW MF
			185	PW
			410	HF
		H-piles	75	OW MF
			850	PW
			1,885	HF
	DTH	H-piles	75	OW MF
			925	PW
			2,050	HF



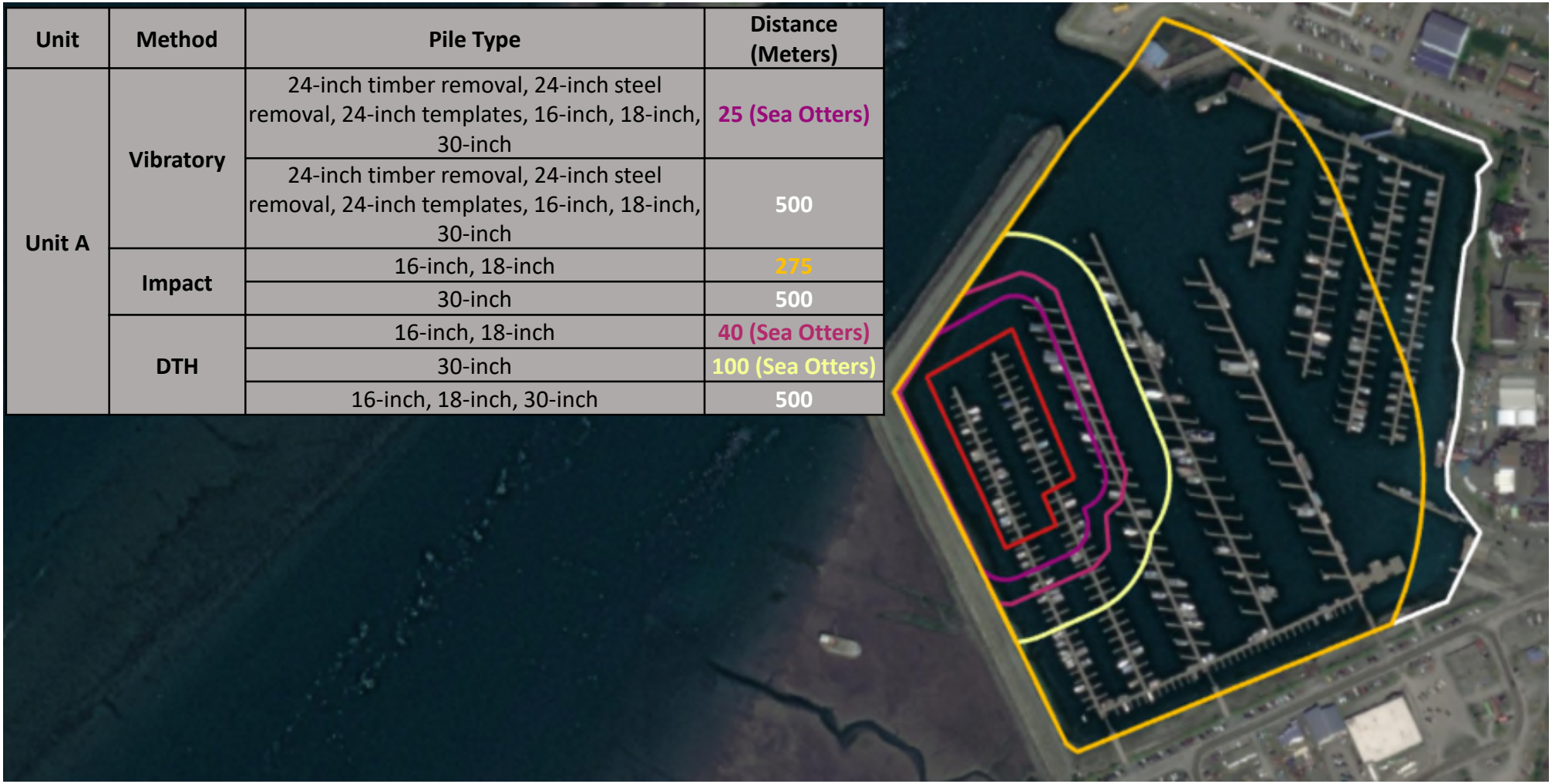
Cordova Harbor Rebuild Project Distances to Level A Shutdown Zones: Unit F

Unit	Method	Pile Type	Distance (Meters)	Hearing Group
Unit F	**Barge movements, pile positioning, dredging**		10	MF OW PW HF
	Vibratory	24-inch templates, 24-inch, H, and sheet piles	10	MF OW PW
			25	HF
		24-inch timber removal	10	OW MF
			25	PW
			35	HF
	Impact	24-inch	10	OW MF
			75	PW
			185	HF
		Sheet piles	25	OW MF
			185	PW
			410	HF
		H-piles	75	OW MF
			850	PW
			1,885	HF
	DTH	24-inch	35	MF
			40	OW
			500	PW
			1080	HF
		H-piles	75	MF OW
			925	PW
			2,050	HF



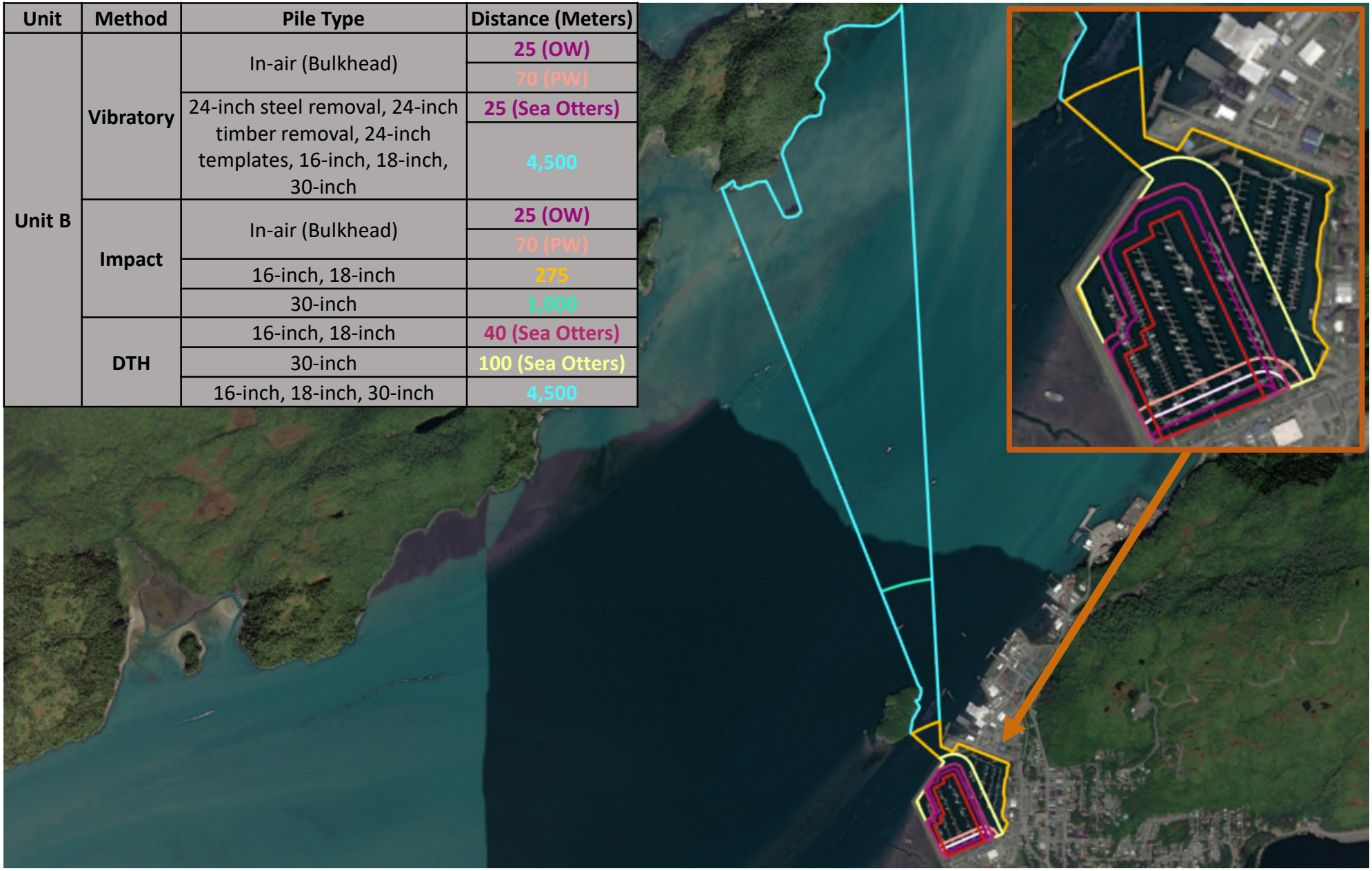
Cordova Harbor Rebuild Project Distances to Level B Monitoring and Shutdown Zones: Unit A

Unit	Method	Pile Type	Distance (Meters)
Unit A	Vibratory	24-inch timber removal, 24-inch steel removal, 24-inch templates, 16-inch, 18-inch, 30-inch	25 (Sea Otters)
		24-inch timber removal, 24-inch steel removal, 24-inch templates, 16-inch, 18-inch, 30-inch	500
	Impact	16-inch, 18-inch	275
		30-inch	500
	DTH	16-inch, 18-inch	40 (Sea Otters)
		30-inch	100 (Sea Otters)
		16-inch, 18-inch, 30-inch	500



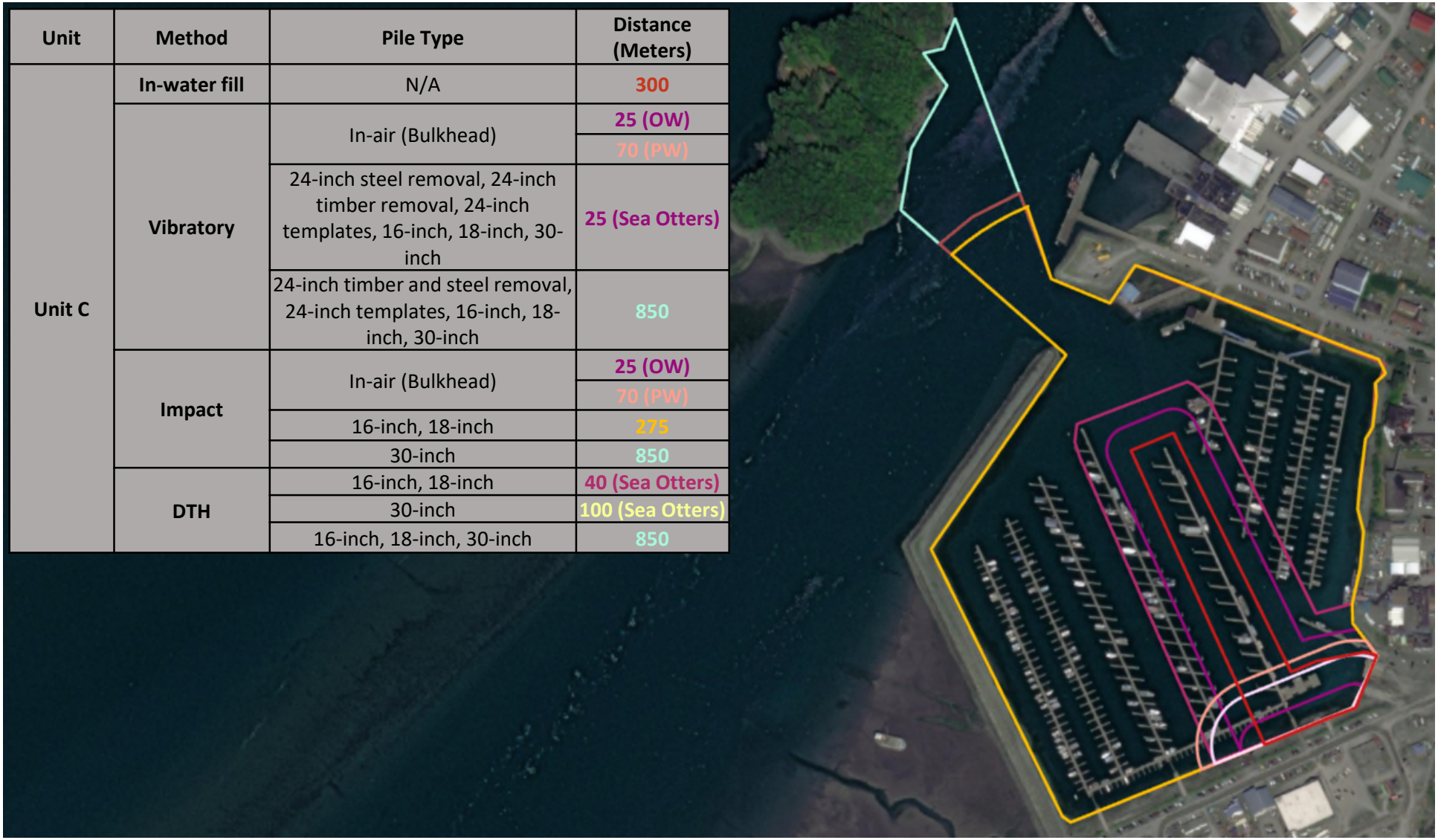
Cordova Harbor Rebuild Project Distances to Level B Monitoring and Shutdown Zones: Unit B

Unit	Method	Pile Type	Distance (Meters)
Unit B	Vibratory	In-air (Bulkhead)	25 (OW)
			70 (PW)
		24-inch steel removal, 24-inch timber removal, 24-inch templates, 16-inch, 18-inch, 30-inch	25 (Sea Otters)
			4,500
	Impact	In-air (Bulkhead)	25 (OW)
			70 (PW)
		16-inch, 18-inch	275
		30-inch	1,000
	DTH	16-inch, 18-inch	40 (Sea Otters)
		30-inch	100 (Sea Otters)
		16-inch, 18-inch, 30-inch	4,500



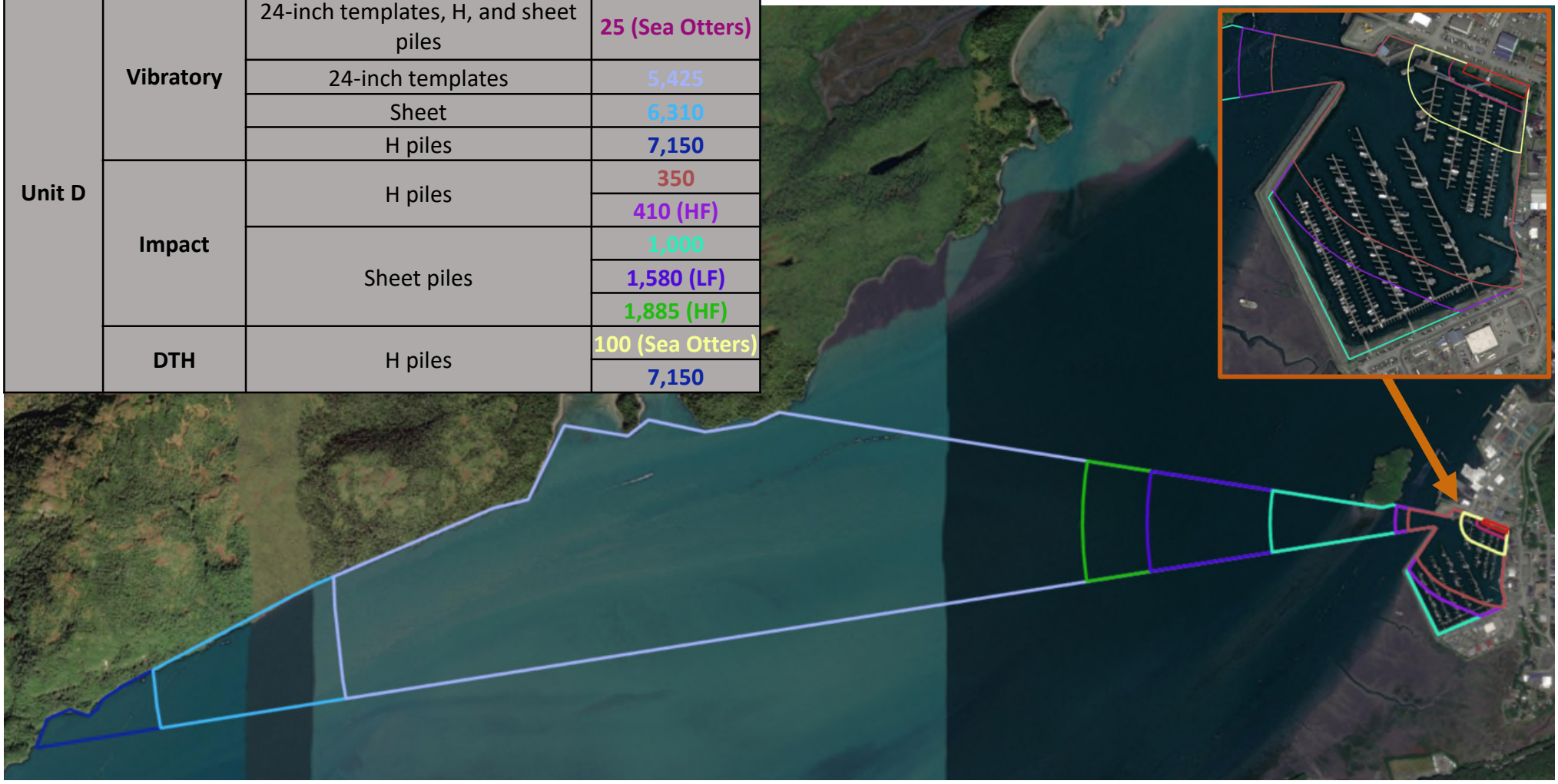
Cordova Harbor Rebuild Project Distances to Level B Monitoring and Shutdown Zones: Unit C

Unit	Method	Pile Type	Distance (Meters)
Unit C	In-water fill	N/A	300
	Vibratory	In-air (Bulkhead)	25 (OW)
			70 (PW)
		24-inch steel removal, 24-inch timber removal, 24-inch templates, 16-inch, 18-inch, 30-inch	25 (Sea Otters)
		24-inch timber and steel removal, 24-inch templates, 16-inch, 18-inch, 30-inch	850
	Impact	In-air (Bulkhead)	25 (OW)
			70 (PW)
		16-inch, 18-inch	275
		30-inch	850
	DTH	16-inch, 18-inch	40 (Sea Otters)
		30-inch	100 (Sea Otters)
		16-inch, 18-inch, 30-inch	850



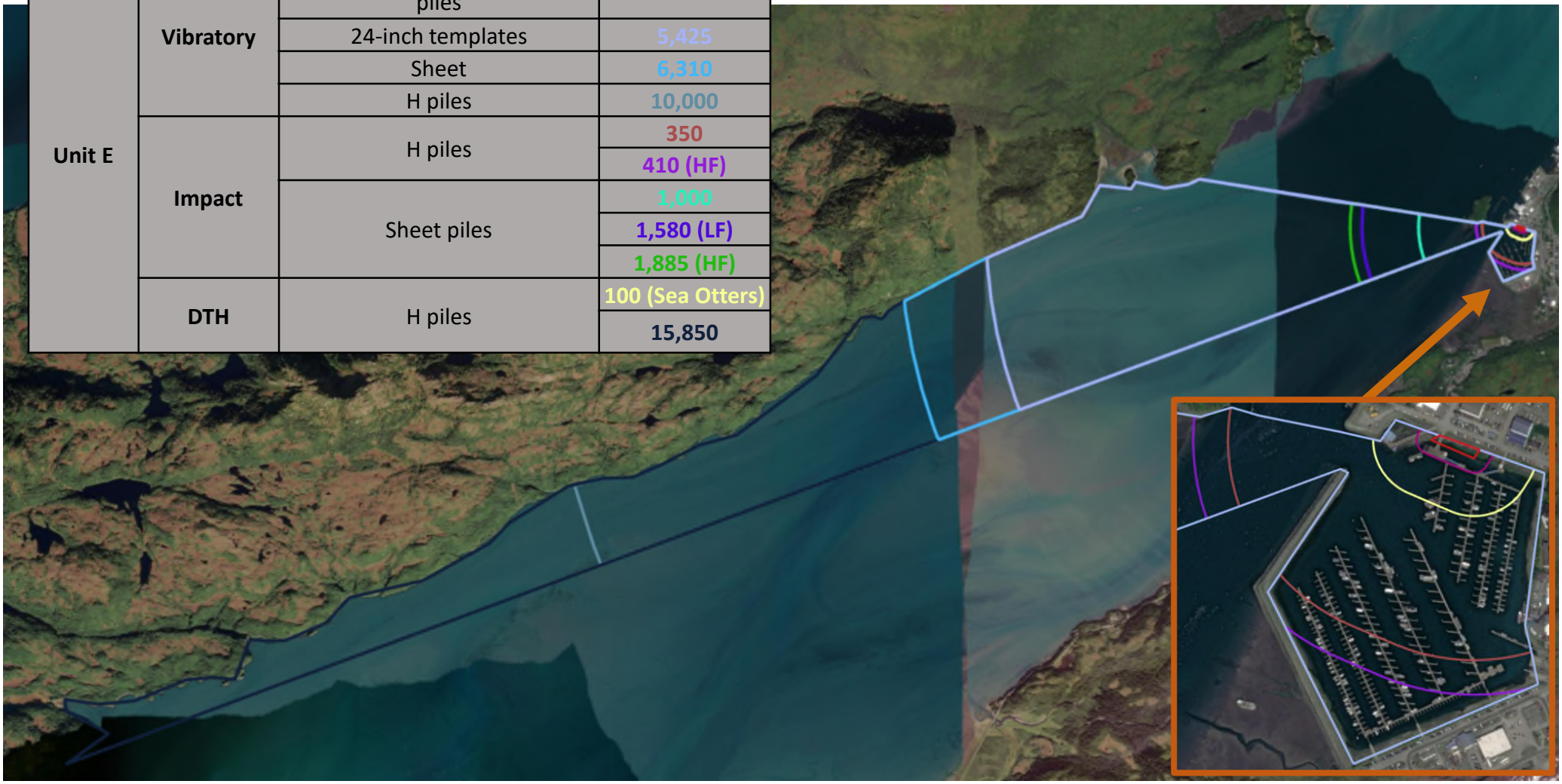
Cordova Harbor Rebuild Project Distances to Level B Monitoring and Shutdown Zones: Unit D

Unit	Method	Pile Type	Distance (Meters)
Unit D	Vibratory	24-inch templates, H, and sheet piles	25 (Sea Otters)
		24-inch templates	5,425
		Sheet	6,310
		H piles	7,150
	Impact	H piles	350
			410 (HF)
		Sheet piles	1,000
			1,580 (LF)
			1,885 (HF)
	DTH	H piles	100 (Sea Otters)
			7,150



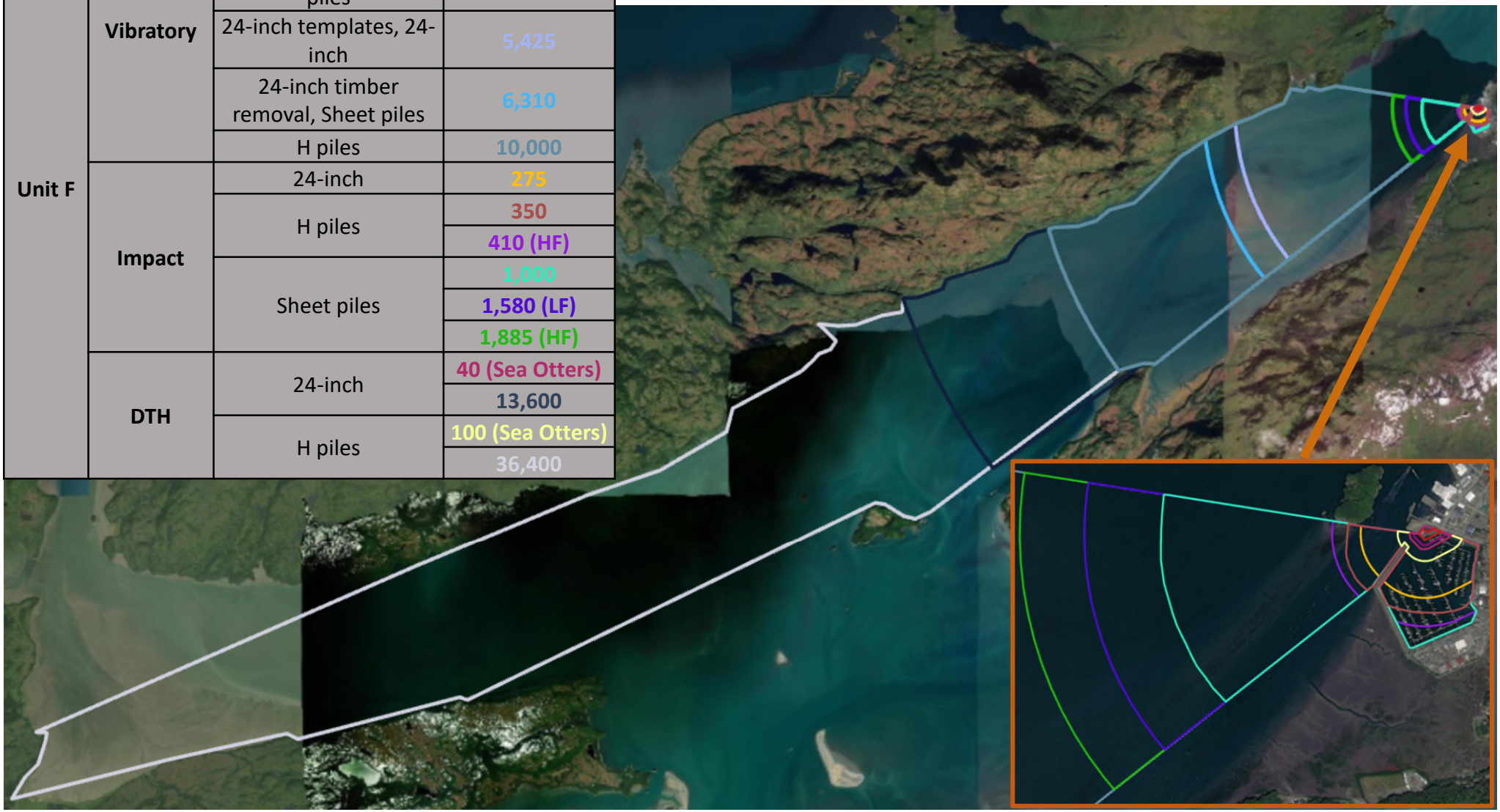
Cordova Harbor Rebuild Project Distances to Level B Monitoring and Shutdown Zones: Unit E

Unit	Method	Pile Type	Distance (Meters)
Unit E	Vibratory	24-inch templates, H, and sheet piles	25 (Sea Otters)
		24-inch templates	5,425
		Sheet	6,310
		H piles	10,000
	Impact	H piles	350
			410 (HF)
		Sheet piles	1,000
			1,580 (LF)
			1,885 (HF)
	DTH	H piles	100 (Sea Otters)
			15,850



Cordova Harbor Rebuild Project Distances to Level B Monitoring and Shutdown Zones: Unit F

Unit	Method	Pile Type	Distance (Meters)
Unit F	Vibratory	24-inch templates, 24-inch timber removal, 24-inch, H, and sheet piles	25 (Sea Otters)
		24-inch templates, 24-inch	5,425
		24-inch timber removal, Sheet piles	6,310
		H piles	10,000
	Impact	24-inch	275
		H piles	350
			410 (HF)
		Sheet piles	1,000
			1,580 (LF)
			1,885 (HF)
	DTH	24-inch	40 (Sea Otters)
			13,600
		H piles	100 (Sea Otters)
			36,400



Appendix C: Construction Activity and Communication Log

Construction Activity and Communication Log

Project:_____ Location: _____ Observer(s): _____ Date:_____

Time	Pile Size	Pile Type	Construction Type	Obs.	Construction Personnel	Communication/Comments

Filling Out Construction Activity and Communication Logs	
Data Columns	**Definition and How to Record**
General Information *(top of form)*	
Project	Time that monitoring by MMOs/PSOs began and ended, without interruption (military time)
Project Name	Whittier Head of the Bay Cruise Ship Dock
Monitoring Location	See 4MP
Observer	Names of Observers at each location
Date	MM/DD/YYYY
Construction and Communication Activities	
Time of event	Time that construction activities and all communications between MMOs/PSOs and construction crews take place
Type of construction activity	Type of construction activity occurring, including ramp up, startup, shutdown, type of pile installation technique, pile size, and pile type (permanent or temporary)
Communication	Information communicated between MMOs/PSOs and construction crew

Appendix D: Marine Mammal Sighting Form

MARINE MAMMAL OBSERVATION RECORD

Project Name:

Monitoring Location:

Date:

Time Effort Initiated:

Time Effort Completed:

Page of

Time	Visibility	Glare	Weather Condition	Wave Height	BSS	Wind	Swell
:	B – P – M – G – E	%	S – PC – L – R – F – OC – SN – HR	Lt/Mod/Hvy		N S E W	N S E W
:	B – P – M – G – E	%	S – PC – L – R – F – OC – SN – HR	Lt/Mod/Hvy		N S E W	N S E W
:	B – P – M – G – E	%	S – PC – L – R – F – OC – SN – HR	Lt/Mod/Hvy		N S E W	N S E W
:	B – P – M – G – E	%	S – PC – L – R – F – OC – SN – HR	Lt/Mod/Hvy		N S E W	N S E W
:	B – P – M – G – E	%	S – PC – L – R – F – OC – SN – HR	Lt/Mod/Hvy		N S E W	N S E W
:	B – P – M – G – E	%	S – PC – L – R – F – OC – SN – HR	Lt/Mod/Hvy		N S E W	N S E W

Event Code	Sight # (1 or 1.1 if re-sight)	Time/Dur (Start/End time if cont.)	WP/ Grid #/ DIR of travel	Zone/ Radius/ Impact Pile #?	Obs.	Sighting Cue	Species	Group Size	Behavior Code (see code sheet)	Construction Type	Mitigation Type	Exposure (Y/N)	Behavior Change/ Response to Activity/Comments/Human Activity/Vessel Hull # or Name/ Visibility Notes
E ON PRE/POST CON S M OR E OFF		: :	Grid N or S W or E			BL BO BR DF SA OTHER		Min: Max: Best:		DD JT FL V I OWC NOWC NONE	DE SD None		
E ON PRE/POST CON S M OR E OFF		: :	Grid N or S W or E			BL BO BR DF SA OTHER		Min: Max: Best:		DD JT FL V I OWC NOWC NONE	DE SD None		
E ON PRE/POST CON S M OR E OFF		: :	Grid N or S W or E			BL BO BR DF SA OTHER		Min: Max: Best:		DD JT FL V I OWC NOWC NONE	DE SD None		
E ON PRE/POST CON S M OR E OFF		: :	Grid N or S W or E			BL BO BR DF SA OTHER		Min: Max: Best:		DD JT FL V I OWC NOWC NONE	DE SD None		
E ON PRE/POST CON S M OR E OFF		: :	Grid N or S W or E			BL BO BR DF SA OTHER		Min: Max: Best:		DD JT FL V I OWC NOWC NONE	DE SD None		
E ON PRE/POST CON S M OR E OFF		: :	Grid N or S W or E			BL BO BR DF SA OTHER		Min: Max: Best:		DD JT FL V I OWC NOWC NONE	DE SD None		
E ON PRE/POST CON S M OR E OFF		: :	Grid N or S W or E			BL BO BR DF SA OTHER		Min: Max: Best:		DD JT FL V I OWC NOWC NONE	DE SD None		
E ON PRE/POST CON S M OR E OFF		: :	Grid N or S W or E			BL BO BR DF SA OTHER		Min: Max: Best:		DD JT FL V I OWC NOWC NONE	DE SD None		

Marine Mammal Observation Record – Sighting Codes

Behavior Codes

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

Sea State and Wave Height: Use Beaufort Sea State Scale for Sea State. This refers to the surface layer and whether it is glassy in appearance or full of white caps. In the open ocean, it also considers the wave height or swell, but in inland waters the wave height (swells) may never reach the levels that correspond to the correct surface white cap number. Therefore, include wave height for clarity.

Glare: Percent glare should be the total glare of observers' area of responsibility. Determine if observer coverage is covering 90 degrees or 180 degrees and document daily. Then assess total glare for that area. This will provide needed information on what percentage of the field of view was poor due to glare.

Swell Direction: Swell direction should be where the swell is coming from (S for coming from the south). If possible, record direction relative to fixed location (pier). Choose this location at beginning of monitoring project.

Wind Direction: Wind direction should also be where the wind is coming from.

Filling Out Sighting Forms	
Data Columns	**Definition and How to Record Data**
General Information *(Top of Form)*	
Project Name	Whittier Head of the Bay Cruise Ship Dock
Monitoring Location	See 4MP
Date	MM/DD/YYYY
Time effort initiated and completed	Time started pre-watch and time post-watch ended (military time). If there is more than one monitoring period in a day, start a new form for each period.
Environmental Conditions	
Environmental Conditions	Record at the start of monitoring period, when changes, and at the end of monitoring period.
Visibility	B-bad, P-poor, M-moderate, G-good, and E-excellent
Glare	Amount of water obstructed by glare (0–100%) and direction of glare (from south, north, or another direction)
Weather conditions	Dominant weather conditions: sunny (S), partly cloudy (PC), light rain (LR), steady rain (R), fog (F), overcast (OC), light snow (LS), snow (SN)
Wave Height	Lt-light, Mod-moderate, Hvy-heavy
Wind and Swell direction	From the north (N), northeast (NE), east (E), southeast (SE), south (S), southwest (SW), west (W), northwest (NW)
Beaufort Sea State	Scale 1-12. See BSS sheet.
Sightings	
Event Code	Indicates what events are happening at the time of the sighting, what events may have occurred due to the sighting, and observer rotations.
Time/Duration	Time first sighted and time of last sighting (military time).
Sighting Number	Chronological (1,2,3, etc.) If the same marine mammal is resighted at a distance greater than 25 meters from the original sighting location record as a resight (Ex. 1.1- same marine mammal as sighting 1, but sighted for a second time in different location)
WP/Grid #/DIR of Travel	Grid number that marine mammal was sighted in and direction of travel. Format should be ***grid map letter-grid*** (Example: If a marine mammal is sighted in grid **2B** on **Grid Map B** this should be denoted by **B-2B**).
Distance from pile	Distance in meters from in-water work

Observer (Obs.)	Initials of the Observer who sighted the marine mammal or who is coming on shift during a rotation
Sighting Cue	How was the marine mammal sighted
Species	Appropriate species abbreviation from code sheet
Group Size	Record the minimum and maximum number of individuals that were sighted. Then determine and record the best number of individuals.
Behavior	Behaviors observed using appropriate abbreviations from code sheet
Construction Type	Circle construction type that is actively occurring at the time and for the duration of the sighting.
Mitigation Type	Circle mitigation type, if any. Based upon monitoring and shutdown zones does a delay of work (pre-watch and post-watch) or a shutdown (monitoring period) need to occur.
Exposure	If a marine mammal enters its Level A or Level B distance and work is actively occurring it will be an exposure indicate yes (Y). If no work is actively occurring indicate no (N)

Event

Code	Activity Type
E ON	Effort On
E OFF	Effort Off
PRE	Pre-Construction Watch
POST	Post-Construction Watch
CON	Construction (see types)
S	Sighting
M	Mitigation
OR	Observer Rotation

Sighting Cues

Code	Distance Visible
BL	Blow
BO	Body
BR	Breach
DF	Dorsal Fin
SA	Surface Activity
OTHR	Other

Marine Mammal Species

Code	Marine Mammal Species
HPBK	Humpback Whale
DAPO	Dall's Porpoise
ORCA	Killer Whale
HSEA	Harbor Seal
STSL	Steller Sea Lion
SO	Sea Otter

Construction Type

Code	Activity Type
OWC	Over-Water Construction
NOWC	No Over-Water Construction
V	Vibratory Hammer
I	Impact Hammer
DR	Drilling
NONE	No Construction

Mitigation Codes

Code	Activity Type
DE	Delay onset of In-Water Work
SD	Shutdown In-Water Work

Visibility

Code	Distance Visible
B	Bad (<0.5km)
P	Poor (0.5-0.9km)
M	Moderate (0.9-3km)
G	Good (3-10km)
E	Excellent (>10km)

Weather Conditions

Code	Weather Condition
S	Sunny
PC	Partly Cloudy
L	Light Rain
R	Steady Rain
F	FOG
OC	Overcast
SN	Snow
HR	Heavy Rain

Wave Height

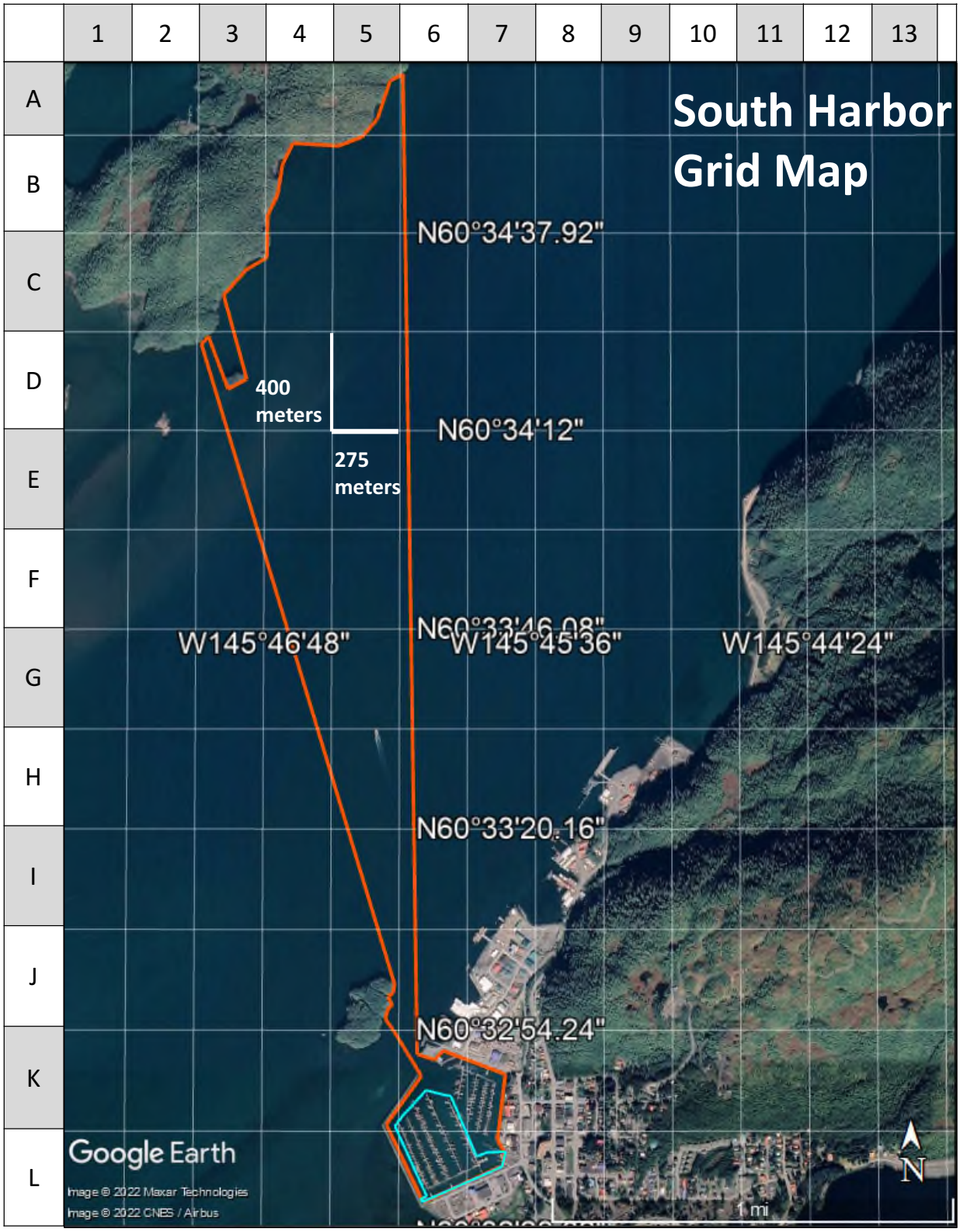
Code	Wave Height
Light	0-3 ft
Moderate	4-6 ft
Heavy	>6 ft

Estimating Wind Speed and Sea State with Visual Clues

Beaufort number	Wind Description	Wind Speed	Wave Height	Visual Clues
0	Calm	0 knots	0 feet	Sea is like a mirror. Smoke rises vertically.
1	Light Air	1-3 kts	< 1/2	Ripples with the appearance of scales are formed, but without foam crests. Smoke drifts from funnel.
2	Light breeze	4-6 kts	1/2 ft (max 1)	Small wavelets, still short but more pronounced, crests have glassy appearance and do not break. Wind felt on face. Smoke rises at about 80 degrees.
3	Gentle Breeze	7-10 kts	2 ft (max 3)	Large wavelets, crests begin to break. Foam of glassy appearance. Perhaps scattered white horses (white caps). Wind extends light flag and pennants. Smoke rises at about 70 deg.
4	Moderate Breeze	11-16 kts	3 ft (max 5)	Small waves, becoming longer. Fairly frequent white horses (white caps). Wind raises dust and loose paper on deck. Smoke rises at about 50 deg. No noticeable sound in the rigging. Slack halyards curve and sway. Heavy flag flaps limply.
5	Fresh Breeze	17-21kts	6 ft (max 8)	Moderate waves, taking more pronounced long form. Many white horses (white caps) are formed (chance of some spray). Wind felt strongly on face. Smoke rises at about 30 deg. Slack halyards whip while bending continuously to leeward. Taut halyards maintain slightly bent position. Low whistle in the rigging. Heavy flag doesn't extended but flaps over entire length.
6	Strong Breeze	22-27 kts	9 ft (max 12)	Large waves begin to form. White foam crests are more extensive everywhere (probably some spray). Wind stings face in temperatures below 35 deg F (2C). Slight effort in maintaining balance against wind. Smoke rises at about 15 deg. Both slack and taut halyards whip slightly in bent position. Low moaning, rather than whistle, in the rigging. Heavy flag extends and flaps more vigorous.
7	Near Gale	28-33 kts	13 ft (max 19)	Sea heaps up and white foam from breaking waves begins to be blown in streaks along the direction of wind. Necessary to lean slightly into the wind to maintain balance. Smoke rises at about 5 to 10 deg. Higher pitched moaning and whistling heard from rigging. Halyards still whip slightly. Heavy flag extends fully and flaps only at the end. Oilskins and loose clothing inflate and pull against the body.
8	Gale	34-40 kts	18 ft (max 25)	Moderately high waves of greater length. Edges of crests begin to break into the spindrift. The foam is blown in well-marked streaks along the direction of the wind. Head pushed back by the force of the wind if allowed to relax. Oilskins and loose clothing inflate and pull strongly. Halyards rigidly bent. Loud whistle from rigging. Heavy flag straight out and whipping.
9	Strong Gale	41-47 kts	23 ft (max 32)	High waves. Dense streaks of foam along direction of wind. Crests of waves begin to topple, tumble and roll over. Spray may affect visibility.
10	Storm	48-55 kts	29 ft (max 41)	Very high waves with long overhanging crests. The resulting foam, in great patches is blown in dense streaks along the direction of the wind. On the whole, the sea takes on a whitish appearance. Tumbling of the sea becomes heavy and shock-like. Visibility affected.
11	Violent Storm	56-63 kts	37 ft (max 52)	Exceptionally high waves (small and medium-sized ships might be for time lost to view behind the waves). The sea is completely covered with long white patches of foam lying along the direction of the wind. Everywhere, the edges of the wave crests are blown into froth. Visibility greatly affected.
12	Hurricane	64+ kts	45+ ft	The air is filled with foam and spray. The sea is completely white with driving spray. Visibility is seriously affected.

Appendix E: Grid Maps

Cordova Harbor Rebuild Project South Harbor Grid Map



Cordova Harbor Rebuild Project North Harbor Grid Map