PORT OF ALASKA MODERNIZATION PROGRAM

Biological Assessment

Cargo Terminals Replacement (CTR) Project

Rev. 01

August 2024

Prepared by

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Recommended Citation:
Don Young Port of Alaska (POA). 2024. Port of Alaska Modernization Program Cargo Terminals Replacement Project: Biological Assessment. Prepared by HDR, Inc., Anchorage, Alaska, and Illingworth & Rodkin, Petaluma, California, for the Don Young Port of Alaska under contract to Jacobs.

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Acronyms and Abbreviations

°C	degrees Celsius
61N Environmental	61 North Environmental
ADF&G	Alaska Department of Fish and Game
BA	Biological Assessment
BiOp	Biological Opinion
BOEM	Bureau of Ocean Energy Management
CFR	Code of Federal Regulations
CPOA	closest point of approach
CTR	Cargo Terminals Replacement
CV	coefficient of variation
dB re 1 µPa	decibels referenced to a pressure of 1 microPascal
dB	decibels
dBA	A-weighted decibels
DOR	Designer of Record
DOT&PF	Alaska Department of Transportation and Public Facilities
DPS	distinct population segment
EFH	Essential Fish Habitat
ESA	Endangered Species Act
FR	*Federal Register*
ft	feet/foot
G&G	geophysical and geotechnical
Hz	Hertz
I&R	Illingworth & Rodkin, Inc.
ICRC	Integrated Concepts and Research Corporation
IHA	Incidental Harassment Authorization
IPCC	Intergovernmental Panel on Climate Change
ITS	Incidental Take Statement
KABATA	Knik Arm Bridge and Toll Authority
km	kilometer(s)
km^2	square kilometer(s)
LOA	Letters of Authorization
LOC	Letter of Concurrence
MHW	Mean High Water

mi	mile(s)
mi^2	square miles
MLLW	Mean Lower Low Water
MMO	Marine Mammal Observer
MMPA	Marine Mammal Protection Act
MTRP	Marine Terminal Redevelopment Project
N	number
NEPA	National Environmental Policy Act
NES	North Extension Stabilization
NES1	NES Step 1
NES2	NES Step 2
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPFMC	North Pacific Fishery Management Council
OSP	Optimal Sustainable Population
PAMP	Port of Alaska Modernization Program
PBF	physical or biological feature
PCE	primary constituent element
PCT	Petroleum and Cement Terminal
Photo-ID	photo-identification
POA	Port of Alaska
POL1	Petroleum, Oil, and Lubricants Terminal 1
POL2	Petroleum, Oil, and Lubricants Terminal 2
Project	General Cargo Terminals Replacement Project
PSO	Protected Species Observer
PTS	permanent threshold shift
rms	root mean square
SEL	sound exposure level
SEL_{cum}	cumulative sound exposure level
SFD	South Floating Dock
SPL	sound pressure level
SPLASH	Structure of Populations, Levels of Abundance, and Status of Humpbacks
SSL	sound source level
T1	Terminal 1
T2	Terminal 2

TL	transmission loss
TL_c	transmission loss coefficient
TPP	Test Pile Program
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
WSDOT	Washington State Department of Transportation
μPa	microPascal(s)

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Section 1. Introduction

1.1 Background and Project Summary

The Don Young Port of Alaska (POA), located on Knik Arm in upper Cook Inlet (Figure 1-1), provides critical infrastructure for the citizens of Anchorage and a majority of the citizens of Alaska. Marine-side infrastructure and facilities at the POA were constructed largely in the 1960s and are in need of replacement because they are substantially past their design life and in poor and deteriorating structural condition. Those facilities include three general cargo terminals, one petroleum terminal, one petroleum and cement terminal, and the failing North Extension. To address deficiencies, the POA is modernizing its marine terminals through the Port of Alaska Modernization Program (PAMP) to enable safe, reliable, and cost-effective Port operations. The PAMP will support infrastructure resilience over a 75-year design life.

The PAMP is critical to maintaining food and fuel security for the state. At the completion of the PAMP, the POA will have modern, safe, resilient, and efficient facilities, through which more than 90 percent of Alaskans will continue to obtain food, supplies, tools, vehicles, and fuel. The PAMP is divided into five separate phases; these phases are designed to include projects that have independent utility yet streamline agency permitting. The projects associated with the PAMP include (Figure 1-2):

- **Phase 1:** Petroleum and Cement Terminal (PCT) and South Floating Dock (SFD) Replacement (completed in 2022).
- **Phase 2A:** North Extension Stabilization (NES) Step 1 (NES1; landside construction began in 2023, and in-water work began in 2024).
- **Phase 2B:** General Cargo Terminals Replacement (**this Project; slated to begin construction in 2025**).
- **Phase 3:** Replacement of Petroleum, Oil, and Lubricants Terminal 2 (POL2).
- **Phase 4:** North Extension Stabilization Step 2 (NES2).
- **Phase 5:** Demolition of Terminal 3.

This Project is Phase 2B of the PAMP, and landside construction will commence in 2025. In-water construction will commence in 2026. The Project includes new construction of Terminal 1 (T1) and Terminal 2 (T2), which include planned wharves and access trestles. The two new terminals will be located 140 feet (ft) seaward of existing Terminals 1, 2, and 3. It is anticipated that this more seaward location of the new terminals will reduce sedimentation, improve room for handling of berthing ships, and allow construction of the new terminals while the existing terminals remain in use. The Project also includes demolition of the existing Petroleum, Oil, and Lubricants Terminal 1 (POL1) and general cargo terminals (Terminal 1, Terminal 2, and Terminal 3) as needed to advance construction of T1 and T2.

The Cargo Terminals Replacement (CTR) Project is situated in Knik Arm of the northern Cook Inlet. Knik Arm provides habitat for the federally endangered distinct population segment (DPS) of Cook Inlet beluga whales (*Delphinapterus leucas*), and portions of Knik Arm are designated as critical habitat for the DPS. The federally endangered western DPS of Steller sea lions (*Eumetopias jubatus*) has also been observed in the vicinity of the POA. The federally endangered Western North Pacific DPS and the federally threatened Mexico DPS of humpback whales (*Megaptera novaeangliae*) also occur in Cook Inlet, and it is possible but unlikely that they would occur in the vicinity of the POA. On 16 March 2023, the National Marine Fisheries Service (NMFS) proposed listing the sunflower sea star (*Pycnopodia helianthoides*) as threatened under the Endangered Species Act (ESA). The POA is considered to be outside the range of the proposed sunflower sea star (NMFS 2023). Proposed activities during construction of CTR with the potential to affect species listed under the ESA and their critical habitat include in-water pile installation and removal.

Section 7 of the ESA requires that federal agencies ensure that any action they authorize, fund, or carry out does not jeopardize the continued existence of any federally endangered or threatened species and does not adversely modify designated critical habitat of such species. When a federal action agency authorizes, funds, or carries out an action, it must consult with NMFS and/or the U.S. Fish and Wildlife Service (USFWS) if the agency determines that the action may affect ESA-listed species. For the actions described in this Biological Assessment (BA), two federal action agencies must authorize the CTR Project: the U.S. Army Corps of Engineers (USACE) and NMFS. The CTR Project will have to be authorized by USACE through an issuance of a Section 10 permit and Section 408 permission under the Rivers and Harbors Act of 1899 as well as a Clean Water Act Section 404 discharge authorization. The POA has also requested that the NMFS Protected Resources Division authorize marine mammal take associated with the proposed action through a request for Incidental Take Regulations and issuance of Letters of Authorization (LOA) pursuant to the requirements of the Marine Mammal Protection Act (MMPA). This BA describes the CTR Project and is intended to fulfill the requirements for formal consultation under Section 7 of the ESA. This assessment provides an analysis of potential effects of the CTR Project on the ESA-listed western DPS of Steller sea lions, Cook Inlet beluga whales, and Mexico DPS humpback whales and designated critical habitat for these ESA-listed entities (as applicable) and recommends determinations of effect. The proposed threatened sunflower sea star does not occur in the Action Area and was therefore given a no effect determination. No other ESA-listed species are known to occur in the Action Area.

1.2 Project Purpose and Need

The purpose of the Project is to replace the existing general cargo docks. The Project will address deteriorating conditions of the existing cargo facilities; improve operational safety and efficiency; accommodate modern (existing and future) shipping operations; and improve the resiliency of the POA against extreme seismic events, all while sustaining ongoing cargo operations.

This Project is urgently needed due to severe corrosion of the foundation piles and deteriorating structural conditions at Terminals 1, 2, and 3. The existing terminals are more than 50 years old and suffer from severe damage to the foundation piles caused by corrosion and seismic forces. The piles have nearly exceeded their useful service life, and multiple engineering investigations have highlighted the increased potential of wharf and trestle structure failure during a future major seismic event. The remaining service life of the cargo terminals is unknown. These facilities must be replaced with new resilient terminals for the Port to continue to meet its critical role serving Anchorage and the State of Alaska’s general cargo needs as well as supporting national defense and military readiness capabilities.

The geographical isolation of Alaska and the POA’s role as the containerized logistic hub and distribution center for much of the state make the cargo terminals a critical lifeline for the southcentral region and Alaska. There are no other ports with the cargo capacity, proximity to Alaska’s population centers, and intermodal transportation capabilities that can support the logistic missions sustained by the POA, including commerce, national defense, and earthquake resiliency/disaster response and recovery.

1.3 Consultation History

At least eight Section 7 ESA consultations have been completed for construction-related activities at the POA, with one other pending. These include:

- 2009 Biological Opinion (BiOp; NMFS 2009) that consulted on the effects of the proposed Marine Terminal Redevelopment Project (MTRP) on Cook Inlet beluga whales.
- 2011 BiOp (NMFS 2011) that consulted on the effects of the MTRP on Cook Inlet beluga whales.
- 2016 BiOp (NMFS 2016a) that consulted on the effects of the POA Test Pile Program (TPP) on the western DPS of Steller sea lions and Cook Inlet beluga whales and their critical habitat.

- 2018 Letter of Concurrence (LOC; NMFS 2018a) that informally consulted on the effects of a fender pile replacement project at the POA's main terminals on Cook Inlet beluga whales.
- 2018 LOC (NMFS 2018b) that informally consulted on the effects of transitional dredging at the PCT facility on Cook Inlet beluga whales and the western DPS of Steller sea lions.
- 2020 BiOp (NMFS 2020a) that consulted on the effects of the POA PCT Project (Phases 1 and 2) on the western DPS of Steller sea lions, humpback whales, and Cook Inlet beluga whales and their designated or proposed critical habitat.
- 2021 BiOp (NMFS 2021) that consulted on the effects of the SFD Project on Cook Inlet beluga whales, Mexico DPS humpback whales, and the western DPS of Steller sea lions and their designated or proposed critical habitat.
- 2022 LOC (NMFS 2022) that informally consulted in the effects of a geotechnical sampling program for the upcoming CTR Project on the western DPS of Steller sea lions and Cook Inlet beluga whales and their designated critical habitat.
- 2023 BiOp (NMFS 2023) that consulted on the effects of the NES1 Project on the western DPS Steller sea lions, Mexico DPS humpback whales, and Cook Inlet beluga whales and their designated critical habitat.

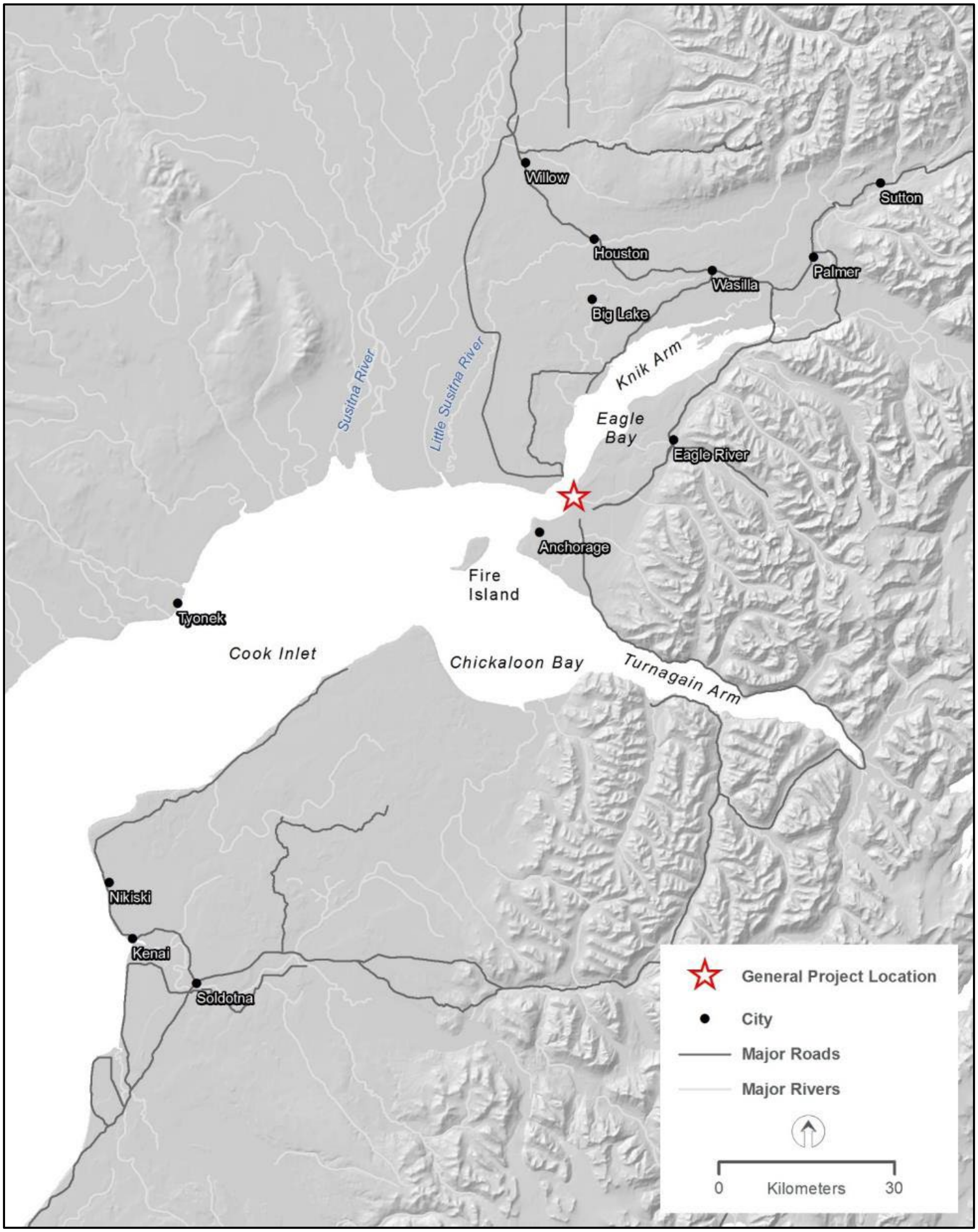

Figure 1-1. Proposed CTR Project Location and Vicinity

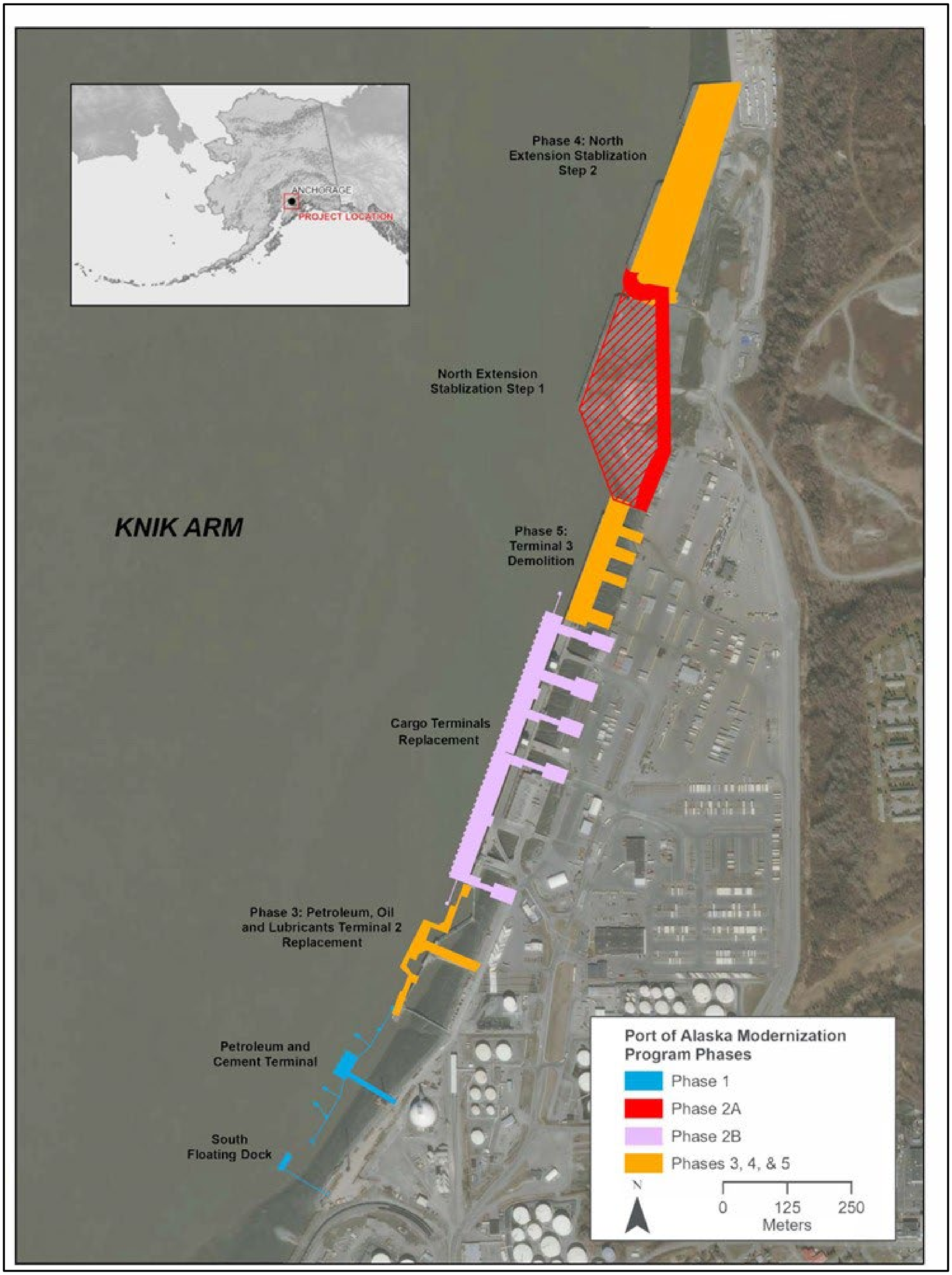

Figure 1-2. Port of Alaska Modernization Program Phases

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Section 2. Project Description

2.1 General Description

The POA's boundaries currently occupy an area of approximately 129 acres. Other commercial and industrial activities related to secured maritime operations are located near the POA on Alaska Railroad Corporation property immediately south of the POA, on approximately 111 acres. The new T1 and T2 southernmost ends will be approximately 1.4 kilometers (km; 0.9 mile [mi]) north of Ship Creek, a location of heightened marine mammal activity during seasonal runs of several salmon species.

In no particular order, construction of the Project will include completion of the following components:

- Component 1. Ground improvement stabilization of the shoreline
- Component 2. Shoreline expansion and protection
- Component 3. General cargo terminals (new T1 and T2) construction
- Component 4. Demolition of existing terminals (POL1 and general cargo terminals [existing Terminals 1, 2, and 3])
- Component 5. Onshore utilities and storm drain outfall replacement

New terminals T1 and T2 will be constructed as seismically resilient adjoining terminals on a continuous berthline with mooring features and appurtenances as required to support safe ship mooring for lift-on/lift-off and roll-on/roll-off cargo handling operations. The new T1 wharf will be 870 ft x 120 ft with two 36-ft-wide trestles of varying length. The new T2 wharf will be 938 ft x 120 ft with three access trestles each approximately 300-foot-long. The southern and northern access trestles would be 36-foot-wide. The middle trestle would be 60-foot-wide to provide an additional emergency vehicle access lane. Both T1 and T2 wharves will be constructed using 72-inch-diameter steel piles. The T1 and T2 access trestles will be constructed using 48- and 72-inch-diameter steel piles. The 48-inch-diameter piles will be installed in the dry. Two 144-inch-diameter steel monopile mooring dolphins with associated mooring systems and access catwalks will be constructed, one on the south end of T1 and one on the north end of T2. Mooring dolphins, as their name implies, are used for mooring only and provide a place for a vessel to be secured by lines (ropes). Use of mooring dolphins helps control transverse and longitudinal movements of berthed vessels.

Both new terminals will be designed to accommodate lift-on/lift-off container operations serviced by rail-mounted ship-to-shore cranes. Structural, in-deck, and surface features to support operational interface for three 100-gauge rail-mounted gantry cranes, and associated appurtenances along with an on-terminal combination stevedore-operations building, will be included on the wharf. Additionally, T2 will be designed to support roll-on/roll-off container operations and other multi-purpose cargo functions. Construction will also include installation of power, lighting, communications, and signal infrastructure to terminal and onshore electrically powered features; potable water service including ship's water; and fire-flow water for terminal-related operations. The onshore stevedore-operations building will also be constructed with a connection to the onshore, existing public utility infrastructure.

In addition to these permanent structures, temporary work including temporary pile installation and removal will be required to support construction. Temporary piles will likely be 36-inch-diameter steel, and marine mammal take calculations are based on that pile size; however, 24-inch steel piles may be used in place of some of the larger temporary piles. Various work boats and barges will be utilized and will be moored at or in the immediate vicinity of the Project.

During pile installation, it may become necessary to remove relic anode sleds. Old anode sleds are currently buried in the sediment behind the existing terminals. If an old sled is encountered in the footprint of a new pile to be installed, the anode sled will be excavated and removed. The excavated anode sled(s) will be hauled to an appropriate disposal location in an upland area. All other relic anode sleds will be abandoned in place.

Project component activities, locations, and approximate estimated quantities for 7 years (6 years of in-water construction) are summarized in Table 2-1, and each component is described in more detail below. For this Project, “in the dry” indicates a location that is above the high tide line or is in the intertidal zone but de-watered, with no standing water.

Table 2-1. Summary of Cargo Terminals Replacement Project Activities, Locations, and Quantities for 7 Years

Component Number	Type of Activity	Location	Size and Type	Total Amount or Number
1. Shoreline Stabilization				
	Placement of temporary construction work pads	In the dry In water	Granular fill and rock	61,100 cubic yards below HTL (3.6 acres)
	Ground Improvements	In the dry	Cementitious materials and aggregate materials	Unknown
2. Shoreline Expansion and Protection				
	Excavation/dredging of silt	In the dry In water	Silt, granular fill, and rock	50,000 cubic yards
	Protection of shoreline	In the dry	Granular fill and armor rock	60,000 cubic yards
3. General Cargo Terminals Construction				
	Installation of permanent piles	In water; in the dry	48-, 72-, and 144-inch steel pipe piles	363 piles
	Installation of temporary piles	In water; in the dry	36-inch steel pipe piles	674 piles
	Removal of temporary piles	In water; in the dry	36-inch steel pipe piles	236 piles
	Installation of concrete pile caps, deck, and utilities	Above water	Concrete, steel	281,535 square feet
4. Demolition of Existing Terminals (POL1 and Terminals 1, 2, and 3)				
	Demolition and removal of concrete pile caps, deck, and utilities	POL1 and T1 Above water	Concrete, steel	173,798 square feet
	Cutting of piles at mudline or leaving in place	POL1 and T1 In water, in the dry	16- to 42-inch steel pipe	1,508 piles
	Demolition and removal of concrete pile caps, deck, and utilities	T2 and T3 Above water	Concrete, steel	159,677 square feet
	Cutting of piles at mudline or leaving in place	T2 and T3 In water, in the dry	16- to 42-inch steel pipe	1,525 piles
5. Onshore Utilities and Storm Drain Outfall Replacement				
	Addition of electrical, water, and gas pipes and conduit	Above water, on land	Concrete, steel pipes	Unknown
	Addition of drain pipes and manholes	Above water, on land	Concrete, steel pipes	Unknown
	Addition of outflow pipe through armor rock	In water	Concrete, steel pipes	4 outfalls

Notes: HTL = high tide line; POL1 = Petroleum, Oil, and Lubricants Terminal 1; T1 = Terminal 1; T2 = Terminal 2; T3 = Terminal 3.

2.1.1 Component 1. Ground Improvement Stabilization of the Shoreline

A ground improvement technique such as deep soil mixing or a similar technique will be used to stabilize the shoreline. Deep soil mixing and similar techniques mechanically mix weak soils with a cement binder, causing the soils to behave more like soft rock. This process is used to create foundations for buildings and roads and is used in earthquake-prone areas to prevent soil liquefaction. Liquefaction is a phenomenon that occurs when loosely packed water-logged sediments at or near the ground surface lose their strength in response to strong ground-shaking. Soil composition of the tidal flats adjacent to T1 and T2 exhibit potential for liquefaction and likelihood of large ground deformations during seismic events. Soil improvements at trestle abutments, and potentially between the abutments, will mitigate the potential for seismic-induced slope failure that could result in structural failure.

Construction will include installation of soil improvements in the five locations where the access trestles meet the beach to provide geotechnical stability to the embankment. Centered at each of the five trestle abutments, the ground improvement technique will create approximately 200- by 96-ft blocks of treated soil extending from the surface to the top of the clay layer approximately 85 ft deep (Figure 2-1). The size of the block is designed to create enough contact area with the clay layer to restrain and significantly reduce the overall ground movements of the liquefiable soils surrounding the trestle abutment. Ground improvements will extend along the embankment in areas between the abutments.

The drilling process to conduct ground improvement will likely require containment and collection of the cement/soil slurry and spoils during construction. Drying beds will be constructed beyond the shoreline to contain the excess slurry until it can be disposed of off-site or incorporated into other portions of the Project. The drying beds will be removed once construction is completed.

During construction, a temporary soil work pad will be constructed at each of the five trestles to provide a level temporary work surface. The ground improvement panels/columns will extend approximately 80 ft seaward and shoreward of the crest of the slope and approximately 30 ft to either side of the trestle structure (Figure 2-1). Temporary armoring will protect the work pad from water forces while in use. After completion of the ground improvement work, the temporary construction work pads will be removed and the foreshore graded and armored. Placement of temporary work pads will take place on land or in the dry.

Ground improvement work will take place “in the dry,” either above the high tide line or in the intertidal zone but de-watered. No impacts on marine mammals are anticipated from ground improvement work. Take of marine mammals from ground improvement work and placement of temporary work pads is not requested.

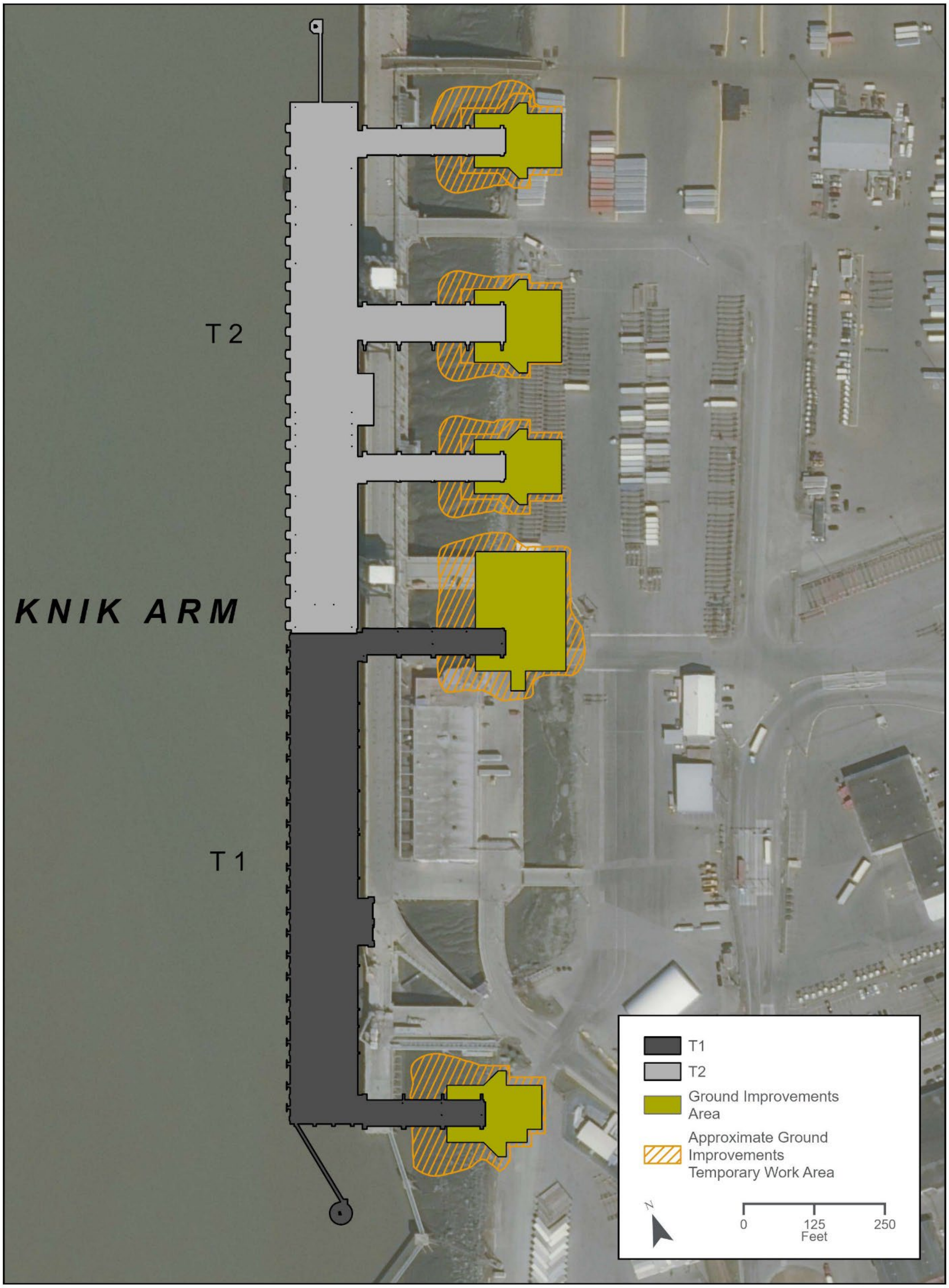

Figure 2-1. Component 1: Ground Improvement Locations and Approximate Areas

2.1.2 Component 2. Shoreline Expansion and Protection

The shoreline behind the existing Terminals 1, 2, and 3 is irregular, with two areas where the shoreline is located about 30 meters to the east of the typical shoreline (Figure 2-2). Areas that are above the high-water line or below the tide line in a dewatered state will be excavated from the landward side to remove deposited silts before the areas are then filled with more dense, stable materials such as clean granular fill and rock. If the material is unable to be excavated in the dry, it will be dredged. The filled area will provide a consistent shoreline and additional container storage area. See Table 2-1 for estimated quantities.

After ground improvement work and shoreline expansion have been completed, the slope along the shore will be secured with armor stone placed over the clean granular and rock fill. Placement of armor rock requires good visibility of the shore, as each rock is placed carefully to interlock with surrounding armor rock. It is therefore anticipated that placement of most armor rock, filter rock, and granular fill will occur in the dry at low tide levels; however, some placement of armor rock, filter rock, and granular fill may occur in shallow water. After placement of armor rock, the top of the fill will be paved to match the existing backland pavements.

No impacts on marine mammals from expansion and protection of the shoreline, including excavation or dredging of silts and placement of granular fill, filter rock, and armor rock, are anticipated. Take of marine mammals from expansion and protection of the shoreline is therefore not requested.

A separate USACE permitting process is being undertaken by the POA to authorize dredging in areas affected by construction that cannot be accessed by the USACE annual maintenance dredging program.

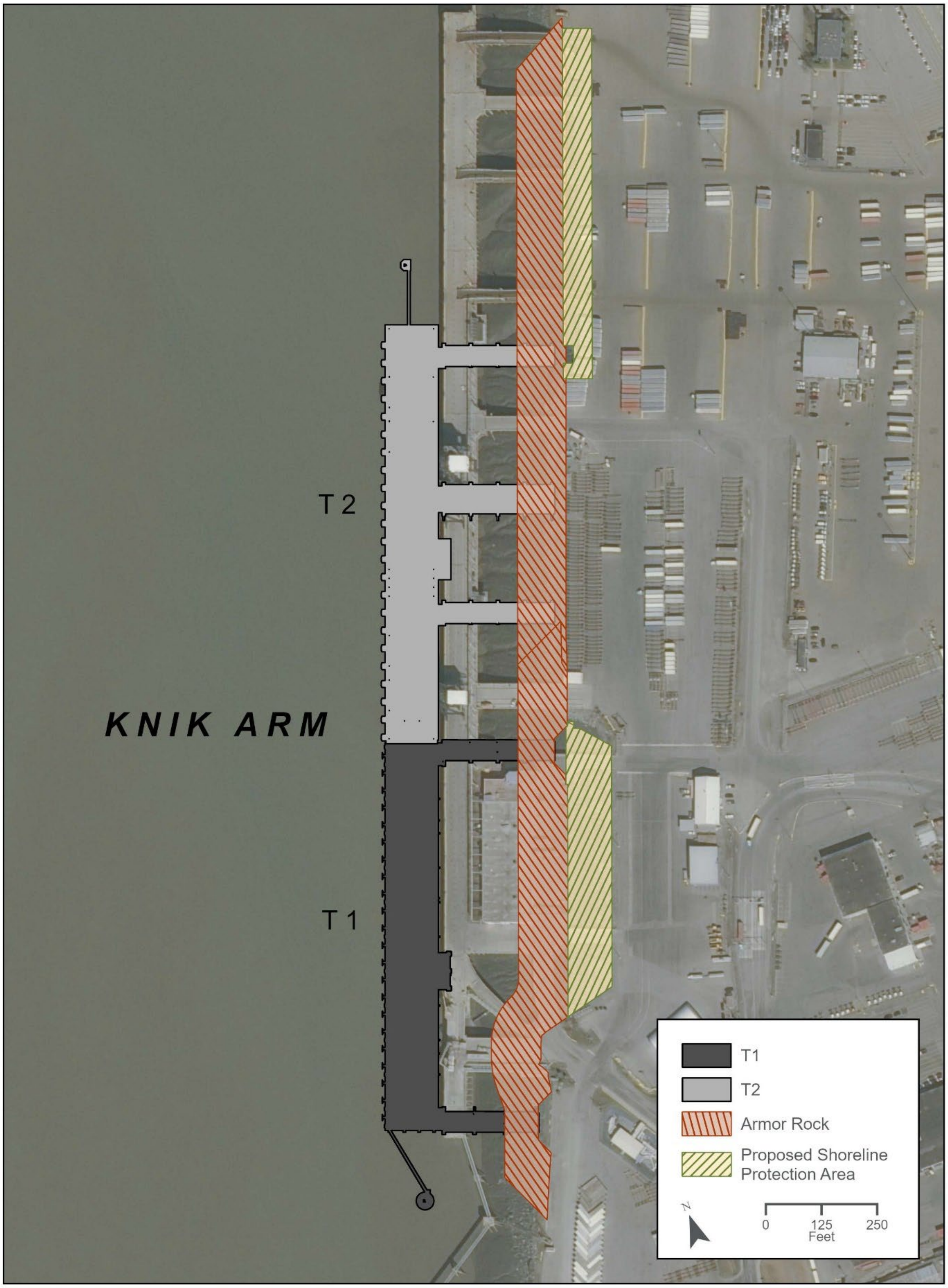

Figure 2-2. Component 2: Shoreline Expansion and Protection Areas

2.1.3 Component 3. General Cargo Terminals Construction

Two new cargo terminals will be constructed, T1 and T2, which include new wharves and access trestles (Figure 2-3). Pile installation and removal is anticipated to take place for the 6-year period starting in 2026. Other terminal construction activities above water and on land may occur year-round. Construction dates may change because of unexpected project delays, ongoing construction activities in other areas of the POA, timing of ice-out and spring breakup, and other factors. Project design and construction methods have been modified to achieve the least practicable adverse impact on marine mammals (see Section 2.3, Avoidance and Minimization of Project Impacts). Use of a bubble curtain during impact and vibratory installation of all permanent 72- and 144-inch piles, and during vibratory installation and removal of temporary piles during months with historically higher beluga whale abundance (August through October), will reduce propagation of sound in the water (see Section 2.1.3.3, Noise Mitigation for Pile Installation and Removal).

The two new terminals will be located 140 ft seaward of the existing Terminals 1, 2, and 3. New T1 and T2 will be pile-supported structures, and their construction will occur over a period of six in-water construction seasons. Construction of each terminal will require installation and removal of temporary steel pipe piles, including template piles, and installation of permanent steel pipe piles. Pile installation will occur in water depths that range from a few feet or dry (dewatered) conditions nearest the shore to approximately 20 meters (70 ft) at the outer face of the wharves, depending on tidal stage; the mean diurnal tide range at the POA is approximately 8.0 meters (26 ft; NOAA 2015).

Construction activities will occur at multiple locations across the Project site simultaneously. It is anticipated that in-water pile installation and removal will occur at one or two locations; however, it is possible that installation and removal will occur at up to three locations at the same time. It is also possible that two or three hammers may be used to increase production rates, especially during months when beluga whale attendance is anticipated to be low. At most, two vibratory hammers will be simultaneously active in-water at any given time to minimize potential impacts on marine mammals due to the larger ensonified zones associated with simultaneous use of more than one vibratory hammer. Duration of active hammer use is anticipated to be brief each day (see Section 2.1.3.1), and it is therefore anticipated that overlap in use of hammers will be uncommon. Pile installation and removal will occur intermittently over the work period, for durations of minutes to hours at a time. Use of two or three hammers (though no more than two vibratory at a time) will serve to reduce the overall duration of in-water pile installation and removal during each construction season, minimizing potential impacts on marine mammals, although this decrease cannot be quantified. One construction crane will likely be based on a floating work barge, and one will likely be based on land or on an access trestle.

It is important to note that T1 and T2 construction activities and components may change as the design is revised, construction contracts are awarded, and construction details are further refined. The Project description included in this BA represents the planned approach for construction of T1 and T2. Actual field conditions may require minor adjustments to this construction approach to address issues that may arise due to constructability, construction phasing, safety, or encountering an erratic in the soil profile.

2.1.3.1 Pile Installation and Removal

Vibratory and impact hammers will be used for installation of 48-, 72-, and 144-inch permanent piles. Vibratory hammers will be used for installation and removal of 24- and/or 36-inch temporary piles; an impact hammer may be used if necessary. Some temporary and permanent steel pipe piles will be installed or removed in the dry, depending on construction sequencing and tide heights. To avoid potential impacts on marine mammals from in-water pile installation and removal, conducting these activities in the dry will be maximized as feasible. However, until the Construction Contractor and Designer of Record (DOR) for both terminals are under contract, the exact number of piles that may be installed and removed in the dry is unknown. It is anticipated that the permanent and temporary piles in the three bents nearest the shore for all five trestles will be installed in the dry at low tide levels. An additional bent will be installed in the dry for the northernmost trestle of T1 and for the three trestles of T2. Estimated numbers of piles of each size that will be installed and/or removed in the dry are presented in Table 2-2.

When a pile is installed or removed in the dry, it will be assumed that no exposure of marine mammals occurs to elevated sound levels that are defined as Level B harassment, and no take of marine mammals occurs. Take of marine mammals from pile installation and removal in the dry is therefore not requested, and marine mammal monitoring will not be conducted during pile installation and removal in the dry.

Although some piles will be installed or removed in the dry, it is anticipated that most piles will be installed or removed in water. The estimated total and annual numbers of in-water pile installations and removals are presented in Table 2-2 through Table 2-9. Table 2-10 presents the estimated monthly and annual distribution of in-water pile installation and removals. Installation and removal of piles in water with a vibratory or impact hammer will impart sound energy into the water that could rise to the level of harassment to marine mammals. Estimated potential take of marine mammals associated with pile installation and removal with an impact or vibratory hammer is described in Section 7. To avoid and minimize potential impacts of pile installation and removal on marine mammals, a minimum 100-meter shutdown zone will be implemented during all in-water pile installation and removal.

Estimates of installation and removal durations were calculated based on Wave Equation Analyses of Pile Driving specific to the Project as well as existing data from both PCT and SFD construction.

2.1.3.2 Pile Cutting

To avoid potential impacts on marine mammals from removal of temporary piles with a vibratory hammer, a majority of in-water temporary piles (approximately 90 percent) will be cut off at the mudline and remain in place or will remain in place intact (without cutting). Temporary piles will be removed that conflict with construction or operations or that can be removed in the dry. Leaving piles in place below the mudline supports stability of the soil. Also, many piles are corroded and may break during removal, with the lower part remaining in place. The existing structure is closer to shore than new construction, and many piles can be cut or removed in the dry when their locations are dewatered.

The number of piles that will be cut or remain in place will be maximized as feasible. Restrictions on pile removal timing or methods will not be acceptable to the POA because progression of new construction will be contingent upon removal of some existing piles, and the details of that will be known only as construction progresses. Additionally, the POA cannot prescribe means and methods to the Construction Contractor. Until the Construction Contractor and DOR for both terminals are under contract, the exact number of piles that may be cut or can remain in place is unknown. Impacts on marine mammals from pile cutting are not anticipated. Take of marine mammals from pile cutting is therefore not requested.

Table 2-2. Component 3: Pile Installation and Removal

Pile Diameter and Type	Number of Piles		
	In-water	In the Dry	Total Piling Events
Permanent Pile Installation			
48" Trestle	0	16	16
72" Wharf	284	0	284
72" Trestle	48	13	61
144" Monopile Mooring Dolphin	2	0	2
Total Number of Permanent Installations	334	29	363
Temporary Pile Installation and Removal			
36" Installation	513	161	674
36" Removal	75	161	236
Total Number of Temporary Installations and Removals	588	322	910
Project Total	**922**	**351**	**1,273**

Table 2-3. Component 3: Summary of Total Numbers and Types of In-water Piles to be Installed and Removed during 6 Years of In-water Project Construction

Pile Diameter and Type	Number of Piles	Impact Duration per Pile (minutes)	Impact Strikes per Pile	Vibratory Duration per Pile (minutes)	Total Duration of Activity per Pile (impact minutes + vibratory minutes)	Total Days of Installation and Removal for All Years	Typical Production Rate in Piles per Day (range)
Total							
Permanent Pile Installation							
72" Wharf	284	86	5,743	10	96	169	1.7 (0.5–3)
72" Trestle	48	86	5,743	10	96	15	1.7 (0.5–3)
144" Monopile Mooring Dolphin	2	120	5,000	15	135	4	0.5 (0.2–1)
Total Number of Permanent Installations	**334**	-	-	-	-	-	-
Temporary Pile Installation and Removal							
36" Installation	513	0	0	30	30	177	3 (2–4)
36" Removal	75	0	0	45	45	18	3 (2–4)
Total Number of Temporary Installations and Removals	**588**	-	-	-	-	-	-
Total	**922**	**28,792 (479.9 hours)**	**1,916,676**	**22,115 (368.6 hours)**	**50,907 (848.5 hours)**	-	-

Note: For all years, pile sizes, and hammer types, the durations of hammer use and numbers of strikes are estimated averages and may be higher or lower based on the Contractor's means and methods.

Table 2-4. Component 3: Summary of Numbers and Types of In-water Piles to be Installed and Removed during Year 1 of In-water Project Construction

Pile Diameter and Type	Number of Piles	Impact Duration per Pile (minutes)	Impact Strikes per Pile	Vibratory Duration per Pile (minutes)	Total Duration of Activity per Pile (impact minutes + vibratory minutes)	Total Days of Installation and Removal for Year 1	Typical Production Rate in Piles per Day (range)
Year 1 (2026)							
Permanent Pile Installation							
72" Wharf	60	86	5,743	10	96	36	1.7 (0.5–3)
72" Trestle	9	86	5,743	10	96	4	1.7 (0.5–3)
144" Monopile Mooring Dolphin	0	120	5,000	15	135	0	0.5 (0.2–1)
Total Number of Permanent Installations	**69**	-	-	-	-	-	-
Temporary Pile Installation and Removal							
36" Installation	75	0	0	30	30	25	3 (2–4)
36" Removal	8	0	0	45	45	3	3 (2–4)
Total Number of Temporary Installations and Removals	**83**	-	-	-	-	-	-
Total	**152**	**5,934 (98.9 hours)**	**396,267**	**3,300 (55.0 hours)**	**9,234 (153.9 hours)**	-	-

Note: For all years, pile sizes, and hammer types, the durations of hammer use and numbers of strikes are estimated averages and may be higher or lower based on the Contractor’s means and methods.

Table 2-5. Component 3: Summary of Numbers and Types of In-water Piles to be Installed and Removed during Year 2 of In-water Project Construction

Pile Diameter and Type	Number of Piles	Impact Duration per Pile (minutes)	Impact Strikes per Pile	Vibratory Duration per Pile (minutes)	Total Duration of Activity per Pile (impact minutes + vibratory minutes)	Total Days of Installation and Removal for Year 2	Typical Production Rate in Piles per Day (range)
Year 2 (2027)							
Permanent Pile Installation							
72" Wharf	61	86	5,743	10	96	36	1.7 (0.5–3)
72" Trestle	0	86	5,743	10	96	0	1.7 (0.5–3)
144" Monopile Mooring Dolphin	0	120	5,000	15	135	0	0.5 (0.2–1)
Total Number of Permanent Installations	**61**	-	-	-	-	-	-
Temporary Pile Installation and Removal							
36" Installation	65	0	0	30	30	22	3 (2–4)
36" Removal	7	0	0	45	45	3	3 (2–4)
Total Number of Temporary Installations and Removals	**72**	-	-	-	-	-	-
Total	**133**	**5,246 (87.4 hours)**	**350,323**	**2,875 (47.9 hours)**	**8,121 (135.4 hours)**	-	-

Note: For all years, pile sizes, and hammer types, the durations of hammer use and numbers of strikes are estimated averages and may be higher or lower based on the Contractor's means and methods.

Table 2-6. Component 3: Summary of Numbers and Types of In-water Piles to be Installed and Removed during Year 3 of In-water Project Construction

Pile Diameter and Type	Number of Piles	Impact Duration per Pile (minutes)	Impact Strikes per Pile	Vibratory Duration per Pile (minutes)	Total Duration of Activity per Pile (impact minutes + vibratory minutes)	Total Days of Installation and Removal for Year 3	Typical Production Rate in Piles per Day (range)
Year 3 (2028)							
Permanent Pile Installation							
72" Wharf	18	86	5,743	10	96	11	1.7 (0.5–3)
72" Trestle	9	86	5,743	10	96	4	1.7 (0.5–3)
144" Monopile Mooring Dolphin	0	120	5,000	15	135	0	0.5 (0.2–1)
Total Number of Permanent Installations	**27**	-	-	-	-	-	-
Temporary Pile Installation and Removal							
36" Installation	160	0	0	30	30	54	3 (2–4)
36" Removal	16	0	0	45	45	6	3 (2–4)
Total Number of Temporary Installations and Removals	**176**	-	-	-	-	-	-
Total	**203**	**2,322 (38.7 hours)**	**155,061**	**5,790 (96.5 hours)**	**8,112 (135.2 hours)**	-	-

Note: For all years, pile sizes, and hammer types, the durations of hammer use and numbers of strikes are estimated averages and may be higher or lower based on the Contractor's means and methods.

Table 2-7. Component 3: Summary of Numbers and Types of In-water Piles to be Installed and Removed during Year 4 of In-water Project Construction

Pile Diameter and Type	Number of Piles	Impact Duration per Pile (minutes)	Impact Strikes per Pile	Vibratory Duration per Pile (minutes)	Total Duration of Activity per Pile (impact minutes + vibratory minutes)	Total Days of Installation and Removal for Year 4	Typical Production Rate in Piles per Day (range)
Year 4 (2029)							
Permanent Pile Installation							
72" Wharf	52	86	5,743	10	96	36	1.7 (0.5–3)
72" Trestle	9	86	5,743	10	96	3	1.7 (0.5–3)
144" Monopile Mooring Dolphin	0	120	5,000	15	135	0	0.5 (0.2–1)
Total Number of Permanent Installations	**61**	-	-	-	-	-	-
Temporary Pile Installation and Removal							
36" Installation	70	0	0	30	30	24	3 (2–4)
36" Removal	7	0	0	45	45	3	3 (2–4)
Total Number of Temporary Installations and Removals	**77**	-	-	-	-	-	-
Total	**138**	**5,246 (87.4 hours)**	**350,323**	**3,025 (50.4 hours)**	**8,271 (137.9 hours)**	-	-

Note: For all years, pile sizes, and hammer types, the durations of hammer use and numbers of strikes are estimated averages and may be higher or lower based on the Contractor’s means and methods.

Table 2-8. Component 3: Summary of Numbers and Types of In-water Piles to be Installed and Removed during Year 5 of In-water Project Construction

Pile Diameter and Type	Number of Piles	Impact Duration per Pile (minutes)	Impact Strikes per Pile	Vibratory Duration per Pile (minutes)	Total Duration of Activity per Pile (impact minutes + vibratory minutes)	Total Days of Installation and Removal for Year 5	Typical Production Rate in Piles per Day (range)
Year 5 (2030)							
Permanent Pile Installation							
72" Wharf	45	86	5,743	10	96	25	1.7 (0.5–3)
72" Trestle	12	86	5,743	10	96	4	1.7 (0.5–3)
144" Monopile Mooring Dolphin	0	120	5,000	15	135	0	0.5 (0.2–1)
Total Number of Permanent Installations	**57**	-	-	-	-	-	-
Temporary Pile Installation and Removal							
36" Installation	80	0	0	30	30	34	3 (2–4)
36" Removal	8	0	0	45	45	4	3 (2–4)
Total Number of Temporary Installations and Removals	**88**	-	-	-	-	-	-
Total	**145**	**4,902 (81.7 hours)**	**327,351**	**3,330 (55.5 hours)**	**8,232 (137.2 hours)**	-	-

Note: For all years, pile sizes, and hammer types, the durations of hammer use and numbers of strikes are estimated averages and may be higher or lower based on the Contractor's means and methods.

Table 2-9. Component 3: Summary of Numbers and Types of In-water Piles to be Installed and Removed during Year 6 of In-water Project Construction

Pile Diameter and Type	Number of Piles	Impact Duration per Pile (minutes)	Impact Strikes per Pile	Vibratory Duration per Pile (minutes)	Total Duration of Activity per Pile (impact minutes + vibratory minutes)	Total Days of Installation and Removal for Year 6	Typical Production Rate in Piles per Day (range)
Year 6 (2031)							
Permanent Pile Installation							
72" Wharf	48	86	5,743	10	96	29	1.7 (0.5–3)
72" Trestle	9	86	5,743	10	96	2	1.7 (0.5–3)
144" Monopile Mooring Dolphin	2	120	5,000	15	135	4	0.5 (0.2–1)
Total Number of Permanent Installations	**59**	-	-	-	-	-	-
Temporary Pile Installation and Removal							
36" Installation	63	0	0	30	30	20	3 (2–4)
36" Removal	29	0	0	45	45	2	3 (2–4)
Total Number of Temporary Installations and Removals	**92**	-	-	-	-	-	-
Total	**151**	**5,142 (85.7 hours)**	**337,351**	**3,795 (63.3 hours)**	**8,937 (149.0 hours)**	-	-

Note: For all years, pile sizes, and hammer types, the durations of hammer use and numbers of strikes are estimated averages and may be higher or lower based on the Contractor’s means and methods.

While the exact sequence of construction is not known, Table 2-10 shows an estimated schedule of pile installation and removal. The POA is aware that August through October are months with high beluga whale abundance and plans to complete in-water work as early in the construction season as possible. The POA also recognizes that more work shutdowns for beluga whales are likely to take place in high abundance months, which provides incentive to complete work earlier in the season. This schedule is an estimate based on best available information and is not intended to be a limitation on the number of pile installation or removal hours that may occur in any given month or year. Table 2-10 has been used to estimate beluga whale potential exposure (take) in Section 6.1.1.3. If there are significant changes to the construction schedule, the POA will confer with NMFS to determine if modifications to the LOA/Incidental Harassment Authorization (IHA) application submitted for this Project or re-initiation of Section 7 consultation is necessary or required.

Table 2-10. Estimated Annual and Monthly Distribution of In-water Pile Installation and Removal for Component 3

Number of Piles									
Year 1	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Total**
24- or 36-Inch Temporary Pile Installation	5	12	12	12	12	12	6	4	75
24- or 36-Inch Temporary Pile Removal	1	1	1	1	1	1	1	1	8
72-Inch Permanent Pile Installation	5	11	11	11	9	9	9	4	69
144-Inch Permanent Pile Installation	0	0	0	0	0	0	0	0	0
Year 2	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Total**
24- or 36-Inch Temporary Pile Installation	6	10	10	10	10	10	5	4	65
24- or 36-Inch Temporary Pile Removal	1	1	1	1	1	1	1	0	7
72-Inch Permanent Pile Installation	5	9	9	9	9	8	8	4	61
144-Inch Permanent Pile Installation	0	0	0	0	0	0	0	0	0
Year 3	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Total**
24- or 36-Inch Temporary Pile Installation	13	26	26	26	26	26	13	4	160
24- or 36-Inch Temporary Pile Removal	1	3	3	3	2	2	1	1	16
72-Inch Permanent Pile Installation	4	4	4	3	3	3	3	3	27
144-Inch Permanent Pile Installation	0	0	0	0	0	0	0	0	0
Year 4	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Total**
24- or 36-Inch Temporary Pile Installation	5	11	11	12	11	11	5	4	70
24- or 36-Inch Temporary Pile Removal	1	1	1	1	1	1	1	0	7
72-Inch Permanent Pile Installation	5	9	9	9	9	8	8	4	61
144-Inch Permanent Pile Installation	0	0	0	0	0	0	0	0	0
Year 5	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Total**
24- or 36-Inch Temporary Pile Installation	5	12	12	12	12	11	11	5	80
24- or 36-Inch Temporary Pile Removal	1	1	1	1	1	1	1	1	8
72-Inch Permanent Pile Installation	3	9	9	9	8	8	8	3	57
144-Inch Permanent Pile Installation	0	0	0	0	0	0	0	0	0
Year 6	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Total**
24- or 36-Inch Temporary Pile Installation	5	10	10	10	10	10	4	4	63
24- or 36-Inch Temporary Pile Removal	1	1	1	1	1	4	10	10	29
72-Inch Permanent Pile Installation	3	9	9	9	8	8	8	3	57
144-Inch Permanent Pile Installation	0		2		0	0	0	0	2

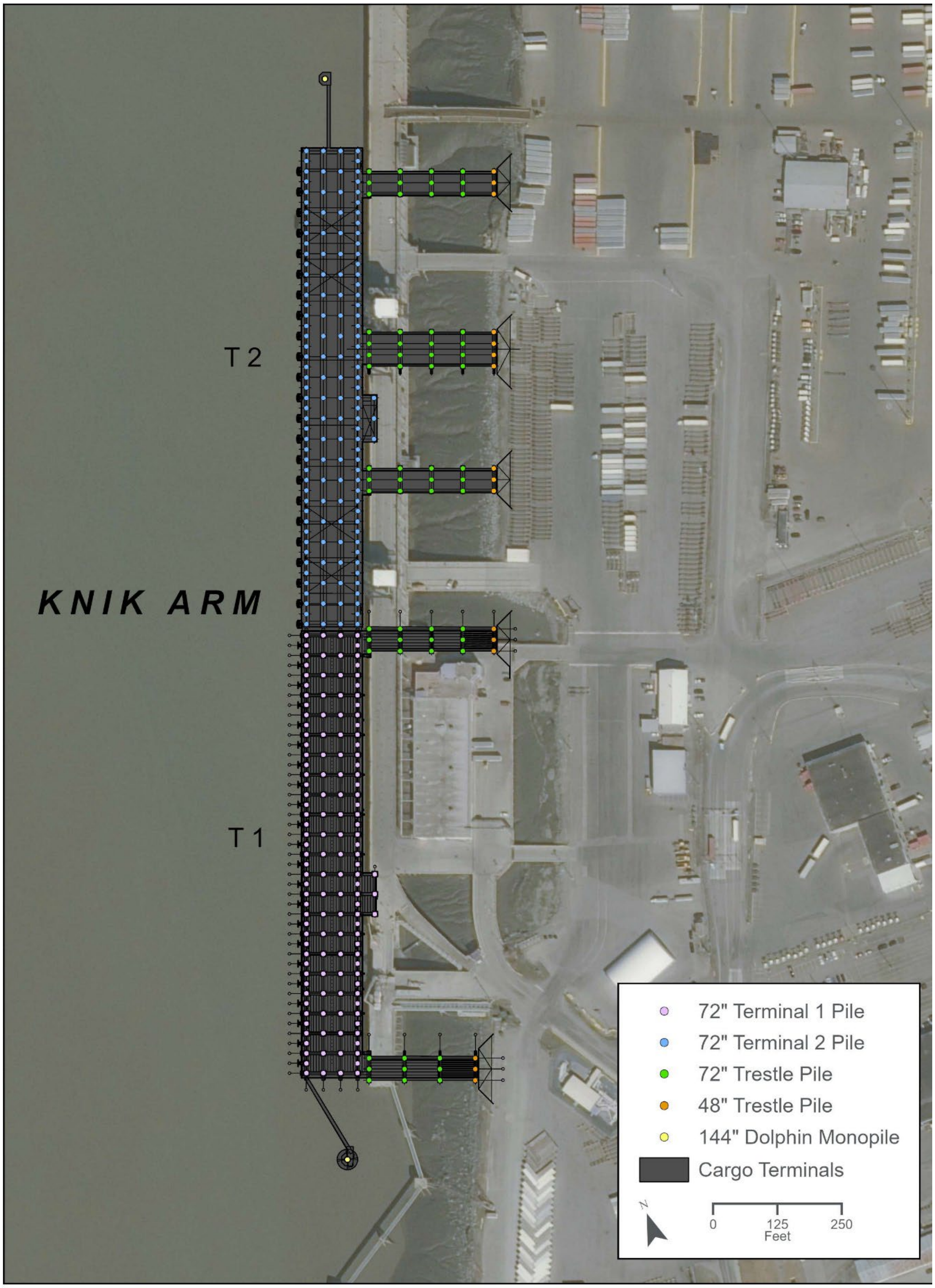

Figure 2-3. Component 3: Overview of the New Terminal 1 (T1) and Terminal 2 (T2)

2.1.3.3 Noise Mitigation for Pile Installation and Removal

The POA has collected sound measurements during pile installation and removal for 3 seasons (Austin et al. 2016; Illingworth & Rodkin [I&R] 2021a, 2021b); a summary of these data and findings can be found in Appendix A of the CTR LOA/IHA application (POA 2024). A confined air bubble curtain noise attenuation system (confined bubble curtain) was tested in 2016 during the PAMP TPP for 48-inch piles (Austin et al. 2016). During the 2016 TPP, the POA was authorized by NMFS to measure bubble curtain performance. Two of the test piles were installed without a bubble curtain, which allowed direct comparison of sound pressure levels with those produced by piles installed with a bubble curtain. Additionally, a third test pile was installed with an on-off test, which allowed comparison of sound pressure levels between those two conditions (bubble curtain on and bubble curtain off) without the confounding effects of differences between piles. During the PCT Project in 2020, a confined bubble curtain was used during installation and removal of 36-inch and installation of 48-inch plumb (vertical) piles; and in 2021, an unconfined air bubble curtain noise attenuation system (unconfined bubble curtain) was used during installation and removal of 36-inch piles and during installation of 144-inch piles (I&R 2021a, 2021b). Unfortunately, the POA was not authorized to collect data on unattenuated pile installation during the PCT Project. Therefore, the efficacy of the bubble curtains used during that project is difficult to evaluate in comparison with unattenuated piles, for which sound levels were estimated based on other project locations but not measured for the POA.

Vibratory Driving

The TPP found that for vibratory installation of 48-inch piles, an air bubble curtain provided about a 9-decibel (dB) reduction at 10 meters. The PCT 2020 measurements indicated 2- to 8-dB reduction for the 48-inch piles at 10 meters (I&R 2021a). No apparent reduction was found in the far-field at about 2,800 meters for the PCT. An 8-dB reduction at close-in positions was estimated for vibratory pile driving that occurred during the PCT Project in 2021 (I&R 2021b). While vibratory sounds were reduced at frequencies above 100 Hertz (Hz) in the acoustic far field, the overall distant sound levels were characterized by very-low-frequency sound at or below 100 Hz. There is no strong evidence that air bubble curtains reduce sound from vibratory driving effectively at very far distances when considering the very-low-frequency components of sound that make up the overall sound levels.

Based on the request from NMFS to use a bubble curtain during vibratory pile installation of permanent piles, a bubble curtain system will be used during vibratory pile installation of permanent 72- and 144-inch piles in all months and when water depth is greater than 3 meters. A bubble curtain system will be used during vibratory installation and removal for all temporary piles during months with historically higher beluga whale abundance (August through October) when water depth is greater than 3 meters. Only temporary piles will be installed and removed with a vibratory hammer without a bubble curtain during months with low beluga whale abundance (April through July and November).

Impact Driving

For the CTR Project, the POA will use a bubble curtain system for all impact pile installation. The TPP measured reductions of 9 to 12 dB for a 48-inch pile using an air bubble curtain. The PCT 2020 measurements (I&R 2021a) found reductions of about 10 dB when comparing the attenuated conditions that occurred with that project to unattenuated conditions for the TPP. As with the TPP, there appeared to be less reduction in the very far field. The TPP did not report the reduction in sound levels in the acoustic very far field; however, the computed distances to the 125 dB root-mean-square (rms) levels were essentially reduced by half with the air bubble curtain (from 1,291 to 698 meters). The PCT 2021 (I&R 2021b) measurements were conducted for impact driving of 144-inch piles. Since there was no unattenuated condition measured, the sound reduction could not be identified from the measured data.

For impact pile installation for the CTR Project, it is assumed that a well-designed and robust bubble curtain system will achieve a mean reduction of 7 dB near the source and 7 dB away from the source (i.e., beyond 500 meters). The POA plans to use an air bubble curtain system on all permanent piles, which will be installed with both vibratory and impact hammers. The bubble curtain by necessity will be installed around each permanent pile as it is stabbed and set, and therefore the bubble curtain will be available as a mitigation measure to reduce sound levels throughout each driving event for permanent 72- and 144-inch piles when water depth is greater than 3 meters.

In all previous years of the PAMP, bubble curtains were not used on battered piles (piles installed at an angle). Additionally, bubble curtains were not used on piles installed or removed in shallow water less than 3 meters deep or piles installed or removed "in the dry" (e.g., at times when the tide is low and the pile's location is dewatered). The tides at the POA have a mean range of about 8.0 meters (26 ft; NOAA 2015), and low water levels prevent proper deployment and function of a bubble curtain system.

When a pile was installed or removed in the dry, it was assumed that no exposure to sound that is defined as incidental harassment occurred and that no take of marine mammals occurred. When the pile was in water but the water was too shallow for deployment of a bubble curtain, the harassment zones for unattenuated pile installation were monitored, and potential for exposure to elevated sound levels was documented for these zones as required by the PCT IHA (85 *Federal Register* [FR] 19294, 86 FR 50057). The same assumptions and approach to mitigation associated with use of a bubble curtain will be used for this Project (Section 2.1.3.3).

2.1.4 Component 4. Demolition of Existing Terminals

Once the new T1, T2, and petroleum products transfer system are complete and operational, any remaining existing Terminal 1, Terminal 2, and POL1 platforms, wharves, and trestles will be dismantled (Figure 2-4). All temporary work structures will be removed. Existing permanent piles and most temporary piles will be cut and removed or left in place to avoid potential impacts on marine mammals in lieu of removal with a vibratory hammer.

Terminal 3 may be partially demolished during Phase 2B construction of T1 and T2, especially where the existing infrastructure may interfere with new construction. Elements of T3 that persist after Phase 2B is complete will remain in place until Phase 5, when they will be removed under a separate permitting process.

The selection of construction equipment by the Contractor, including cranes and barges, will determine the plans and sequencing for demolition. Portions of the existing terminals may be used for construction phasing and as support platforms for ongoing new construction, as feasible.

Demolition will take place above the water, and demolished decking, pipes, and other superstructure materials will be contained before they fall into the water, following best management practices. Demolished materials will be removed by barge or truck. Because work will take place out of water with best management practices in place to limit any release of material into Cook Inlet, in addition to cutting off or leaving existing piles in place, impacts on marine mammals from demolition of the existing terminals are not anticipated. Take of marine mammals from demolition is therefore not requested.

Figure 2-4. Component 4: Demolition of Existing Terminals

2.1.5 Component 5. Onshore Utilities and Storm Drain Outfall Replacement

The replacement of onshore utilities will involve construction on land and replacement of utilities above the high tide line, on land. No in-water work is anticipated as part of this component. Impacts on marine mammals from replacement of utilities are not anticipated. Take of marine mammals from replacement of utilities is therefore not requested.

The storm drain outfall replacement will involve construction on land and replacement of four outfall pipes above the high tide line, on land. No in-water work is anticipated as part of this component. Impacts on marine mammals from storm drain outfall replacement are not anticipated. Take of marine mammals from storm drain outfall replacement is therefore not requested.

2.2 Construction and Schedule Considerations

The CTR Project will require a full construction season each year for successful completion. A typical construction season at the POA extends from approximately mid-April to mid-October (6 months) and may include November. Exact dates of ice-out in spring and formation of new ice in fall vary from year to year and cannot be predicted with accuracy. In-water pile installation and removal generally cannot occur during the winter months when ice is present because of the hazards associated with moving ice floes that change directions four times per day, preventing the use of tugs, barges, workboats, and other vessels. Ice movement also prevents accurate placement of piles.

Restricting the POA from completing in-water pile installation and removal in months with historically higher beluga whale abundance (August through October) is impracticable and would force the CTR Project into one or more additional seasons of in-water construction. This would have severe negative repercussions on Project and program funding, in addition to potentially impacting marine mammals over a greater number of construction seasons.

Additional in-water construction seasons would require additional mobilization and demobilization of the Contractor's equipment spreads. The POA would also face added costs for price escalation and extended general conditions and overhead for both the Contractor and the construction supervision team. This would require the unplanned use of funding currently earmarked for future PAMP projects. Extending the CTR Project into one or more additional construction seasons would also potentially have severe negative impacts on the overall PAMP schedule. The replacement of T1 is scheduled to begin in 2025, with in-water work beginning in 2026. The fiscal and logistical (i.e., Port operations) impacts on the POA of extending the in-water CTR work into additional seasons would prevent the POA from being able to complete the T1 replacement project on schedule and would delay the start of construction on T2, which would delay funding and/or completion of both T1 and T2. Potential consequences of delay include de-rating of the structural capacity of the existing cargo terminals, a shutdown of dock operations due to deteriorated conditions, or an actual collapse of one or more dock structures. Any of these scenarios could have dire consequences for the populations of Anchorage and Alaska who are served by the POA. The potential for collapse increases with schedule delays, due to both worsening deterioration and the higher probability of a significant seismic event occurring before T1 and T2 replacement.

2.2.1 Dates and Durations

CTR in-water construction with potential impacts on marine mammals is scheduled to begin on 01 April 2026 and continue through 30 November of each of the 6 years, 2026 through 2031. These dates are estimates and may shift as contracting details, starting dates, ice-free conditions, production rates, and other factors vary.

The POA requests that NMFS issue the BiOp by 29 January 2025 in order to complete other National Environmental Policy Act (NEPA) actions for funding and landside construction work starting in 2025.

Other pending federal "actions" are reliant upon issuance of the BiOp at the earliest date possible in 2025. Permit applications have been submitted to the USACE Civil Works Division and USACE Regulatory Division, and potential federal grant awards could start as early as 2025. These other federal actions require NEPA compliance, which requires a BiOp under the ESA formal Section 7 consultation process, as does the LOA, inclusive of an Incidental Take Statement (ITS). Without the BiOp with the ITS, other NEPA actions for funding and preparations for the 2025 construction season cannot be completed.

2.2.2 Best Available Information

The Project Construction Contractor has not yet been identified, and therefore certain schedule details, construction means and methods, and design specifics presented herein may differ in limited degree from the work that will eventually be presented in the Contractor's Construction Work Plans. Estimates of duration for pile installation and removal were made based on prior experience with similar marine construction and demolition projects, including the recent construction of the POA PCT during 2020 and 2021. Actual durations for pile installation and removal may be longer or shorter, depending upon many variables associated with construction and the environment. Numbers of impact strikes may be greater or fewer. The sequencing of events is unknown at this time, and flexibility will be required to accommodate the myriad unavoidable Contractor logistical and operational challenges as well as to avoid disruption to critical day-to-day POA activities. Estimated numbers of hours and days for the different activities are not intended to be caps or limits on these activities. Descriptions of design and construction in this document are as accurate as possible at this stage of the Project but may vary slightly as design and construction advance. It is anticipated that the actual methods, including types of equipment and numbers of hours and days of each activity, will be determined based on the engineering specifications for the Project as determined by the Construction Contractor and DOR. The Project description in Section 2.1 consists of conservative predictions and estimates based on the best available information at this time. It is not anticipated that the Project would change such that potential impacts on marine mammals would substantially change from those described below. If substantial changes were to occur, the POA would coordinate with NMFS.

2.3 Avoidance and Minimization of Project Impacts

The POA is committed to minimizing the impacts of its activities through implementation of avoidance and minimization measures summarized in this section to eliminate the potential for injury and to minimize disturbance harassment of marine mammals. The avoidance and minimization measures presented in this BA are components of the proposed action and requirements of contractors during construction of the CTR Project. To mitigate potential impacts on marine mammals, the mitigation described in the pending draft LOA will be implemented (POA 2024). Marine Mammal Observers (MMOs, sometimes referred to as Protected Species Observers or PSOs) will be contracted through the Construction Contractor and will carry out marine mammal observations during all in-water pile installation and removal.

The POA is committed to minimizing impacts of its activities, including the CTR construction, on beluga whales and other marine mammals. The following measures have been applied to the preliminary design and construction methods to reduce the amount and duration of pile installation and removal:

- Using 72-inch steel piles instead of 48-inch steel piles to reduce total number of piles
- Using 72-inch steel piles instead of 48-inch steel piles to reduce total duration of pile installation
- Minimizing the number of temporary piles
- Minimizing the duration of installation and removal of piles
- Minimizing the number of piles in the design that require proofing or splicing

- Installing piles in the dry where and when possible to minimize the number of in-water pile installations
- Leaving approximately 90 percent of the in-water temporary piles in place or removing temporary piles by cutting at the mudline where and when possible, or removal in the dry, to reduce total duration of vibratory pile removal
- Leaving existing piles in place by cutting at the mudline where and when possible for demolition of existing terminals to reduce total duration of vibratory pile removal
- Months with historically lower beluga whale abundance (April through July and November): Using a bubble curtain system during impact and vibratory pile installation of permanent 72- and 144-inch piles when water depth is greater than 3 meters. Temporary piles will be installed and removed without a bubble curtain during months with historically lower beluga whale abundance.
- Months with historically higher beluga whale abundance (August through October): Using a bubble curtain system on all piles when water depth is greater than 3 meters
- Using a single 144-inch steel monopile for each of the two mooring dolphins versus using a battered pile design requiring extensive temporary pile templates and eight or more 36- to 48-inch permanent piles for each dolphin

Other Project design and construction methods that have been modified and refined to achieve the least practicable adverse impact on beluga whales and other marine mammals include:

- Limiting pile installation and removal to times when visibility for marine mammal presence is possible based on favorable sighting conditions
- Limiting pile installation and removal to daylight hours between civil dawn and civil dusk
- Starting in-water work as early as possible in April or May (sea-ice dependent) when beluga whale abundance historically has been low
- Prioritizing the use of impact pile driving over vibratory pile driving, when possible, to decrease the size of the ensonified area
- When practicable, employing two or three construction crews to operate multiple hammers to increase productivity during periods with low beluga whale abundance and reduce overall Project duration. At most, two vibratory hammers will be simultaneously active in water at any given time due to the larger ensonified areas associated with simultaneous use of vibratory hammers. See Section 6.1.2 for the discussion of simultaneous hammers.

2.3.1 General Mitigation Measures

2.3.1.1 Pre-activity Monitoring and Startup Procedures

Additional mitigation measures and startup procedures include the following, modeled after the stipulations outlined in the Final IHAs for PCT Phase 1 and Phase 2 construction (85 FR 19294) and SFD construction (86 FR 50057):

- The POA will conduct briefings for construction supervisors and crews, the monitoring team, and POA staff prior to the start of all in-water pile installation and removal, and when new personnel join the work, in order to explain responsibilities, communication procedures, the marine mammal monitoring protocol, and operational procedures.
- Marine mammal monitoring will take place from 30 minutes prior to initiation of in-water pile installation and removal through 30 minutes post-completion of pile installation and removal.

- For beluga whales, the Level B zone for in-water pile installation and removal must be fully visible for 30 minutes before the zone can be considered clear of beluga whales. Pile installation and removal will commence when MMOs have declared the Level B zone clear of beluga whales or the mitigation measures developed specifically for beluga whales (below) are satisfied.
- For species other than beluga whales, in-water pile installation and removal will not commence until the Level A zone is clear of marine mammals for 15 minutes.
- In the event of a delay or shutdown of activity, marine mammal behavior will be monitored and documented until the marine mammals leave the shutdown zones of their own volition, at which time pile installation or removal or the previous activity will commence or recommence.
- All MMO observations will occur between civil dawn and civil dusk.

2.3.1.2 During Activity Monitoring and Shutdown Procedures

The following activity monitoring and shutdown procedures were modeled after the stipulations outlined in the Final IHA for Phases 1 and 2 PCT construction (85 FR 19294) and SFD construction (86 FR 50057):

- For in-water construction involving heavy machinery other than pile installation or removal (e.g., use of barge-mounted excavators or dredging), if a marine mammal comes within 10 meters, the POA will cease operations and reduce vessel speed to the minimum level required to maintain steerage and safe working conditions.
- The POA will use soft start techniques when impact pile driving. A soft start requires contractors to provide an initial set of strikes at reduced energy, followed by a 30-second waiting period, followed by two subsequent reduced-energy strike sets. A soft start must be implemented at the start of each day's impact pile driving, any time impact pile driving has been shut down or delayed due the presence of a marine mammal, or at any time following cessation of impact pile driving for a period of 30 minutes or longer.
- The POA will employ MMOs per the Marine Mammal Monitoring and Mitigation Plan (Appendix B in the CTR LOA/IHA application [POA 2024]).
- On a given day, if marine mammal monitoring ceases but in-water pile installation and removal is scheduled to resume, MMOs will follow the pre-pile driving monitoring protocol as described above, including a 30-minute clearance scan of the Level B zone for beluga whales.
- If a marine mammal is observed entering or within an established Level A zone or shutdown zone, in-water pile installation and removal will be halted or delayed. In-water pile installation and removal will not commence or resume until either the animal has voluntarily left and been visually confirmed beyond the shutdown zone and on a path away from such zone or 15 minutes (species other than beluga whales) or 30 minutes (beluga whales) have passed without subsequent detection.
- 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 Level B zone, in-water pile installation and removal will be shut down immediately. In-water pile installation and removal will not resume until the animal has been confirmed to have left the area or 30 minutes have elapsed.
- In-water pile installation and removal delay and shutdown protocol for Cook Inlet beluga whales (but not other species of marine mammals) include the following:
    - Prior to the onset of in-water pile installation and removal, should a beluga whale(s) be observed within the Level B zone, in-water pile installation or removal will be delayed. In-water pile installation and removal will not commence until the animal has voluntarily traveled beyond the

Level B harassment zone and is on a path away from such zone or has not been re-sighted within 30 minutes.

- If in-water pile installation or removal has commenced and a beluga whale(s) is observed within or likely to enter the Level B harassment zone, in-water pile installation and removal will be delayed. In-water pile installation and removal will not commence until the beluga whale has voluntarily traveled beyond the Level B harassment zone and is on a path away from such zone or has not been re-sighted within 30 minutes.
- If during in-water installation and removal of piles, MMOs can no longer effectively monitor the entirety of the Cook Inlet beluga whale Level B shutdown zone due to environmental conditions (e.g., fog, rain, wind), in-water pile installation and removal will continue only until the current segment of pile is installed or removed; no additional sections of an in-water pile may be installed or removed until conditions improve such that the monitoring zone can be effectively monitored. If the Level B harassment zone cannot be monitored for more than 15 minutes, the entire Level B harassment zone will be cleared again for 30 minutes prior to in-water pile installation and removal.

2.3.2 Monitoring and Reporting

The POA will implement a marine mammal monitoring and mitigation strategy intended to avoid and minimize impacts on marine mammals (see Appendix B in the CTR LOA/IHA application [POA 2024] for more details). Marine mammal monitoring will be conducted at all times when in-water pile installation and removal is taking place.

The marine mammal monitoring and mitigation program that is planned for CTR construction will be the same as for Phase 1 and Phase 2 construction of the PCT. The POA will collect electronic data on marine mammal sightings and any behavioral responses to in-water pile installation or removal for species observed during in-water pile installation and removal associated with the CTR Project. Four MMO teams will work concurrently to provide full coverage for marine mammal monitoring in rotating shifts during in-water pile installation and removal. All MMOs will be trained in marine mammal identification and behaviors. Field experience and/or training may be substituted for a biological degree. NMFS will review submitted MMO curricula vitae and indicate approval as warranted. Approval must be granted by NMFS within 14 days; if no notice is received from NMFS within 15 days, it will be considered tacit approval.

Eleven MMOs for the CTR Project will be stationed at the Anchorage Downtown Viewpoint near Point Woronzof (sometimes called City View), the Anchorage Public Boat Dock at Ship Creek, the CTR Project site, and the north end of POA property (see Figure 2-5). MMOs will have no other construction-related tasks or responsibilities while conducting monitoring for marine mammals. Observations will be carried out using combinations of equipment that include 7-by-50 binoculars, 20x/40x tripod-mounted binoculars, 25-by-150 “big eye” tripod-mounted binoculars (North End, Ship Creek, and Woronzof), and theodolites. Trained MMOs will be responsible for monitoring the 100-meter shutdown zone, the Level A harassment zones, and the Level B harassment zones, as well as effectively documenting Level A and Level B potential exposures (take). They will also (1) report on the frequency at which marine mammals are present in the project area, (2) report on behavior and group composition near the POA, (3) record all construction activities, and (4) report on observed reactions (changes in behavior or movement) of marine mammals during each sighting. Observers will work in collaboration with the POA to immediately communicate the presence of marine mammals prior to or during pile installation or removal. A report that includes electronic data collected and summarized from all monitoring locations will be submitted to NMFS within 90 days of the completion of the marine mammal monitoring program. The marine mammal monitoring approach is described in further detail in the Marine Mammal Monitoring and Mitigation Plan (Appendix B in the CTR LOA/IHA application [POA 2024]).

The POA will receive a daily monitoring summary from its Construction Contractor that will include weekly and cumulative summaries of marine mammal sightings and potential exposures (takes). The POA will provide NMFS with weekly and monthly monitoring reports during the CTR construction season. These reports will include data sheets as well as a summary of marine mammal species and behavioral observations, pile-driving shutdowns or delays, and pile-driving work completed. The POA will provide a final marine mammal monitoring report and copy of the electronic data to USACE and NMFS within 90 days of completion of the marine mammal monitoring. The final report will include information on the monitoring efforts, a summary of environmental conditions, details of marine mammal sightings and behavior, in-water activities before and after each sighting, and a summary of Project shutdowns.

If the POA discovers a stranded, injured, or dead marine mammal, regardless of the cause, the POA will immediately report the incident to the Alaska Marine Mammal Stranding Hotline (877-925-7773). Details regarding the reporting protocol for this scenario can be found in Appendix B of the CTR LOA/IHA application (POA 2024).

Figure 2-5. Potential MMO Station Locations for CTR

2.3.3 Mandatory Shutdowns

Mandatory shutdowns for beluga whales have been established to avoid all take of Cook Inlet beluga whales to the extent possible. These measures are described in detail in the CTR LOA/IHA application (POA 2024) and are modeled after the stipulations outlined in the Final IHAs for Phase 1 and Phase 2 of PCT construction (85 FR 19294), SFD construction (86 FR 50057), and the NES1 Project (89 FR 2832).

Shutdowns will also take place any time a marine mammal is seen approaching the Level A shutdown zone. To ensure that marine mammals do not enter the shutdown zone, MMOs will continuously scan the zone to determine if a marine mammal is approaching. If any ESA-listed species is observed approaching the shutdown zone, pile installation or removal will be halted or delayed. Pile installation or removal may not commence or resume until the animal has voluntarily left and been visually confirmed beyond the shutdown zone. Or, if a marine mammal is not observed leaving the shutdown zone after equipment has been shut down, in-water work may resume 15 minutes after a Steller sea lion was last observed or 30 minutes after a beluga whale or humpback whale was last observed. This approach produces a greater conservation benefit to marine mammals by including a mandatory monitoring and shutdown protocol that avoids and reduces the amount of take.

If a beluga whale is observed within or is likely to enter the Level B harassment zone, in-water pile installation and removal will pause and will not recommence until the beluga whale is out of, and on a path away from, the Level B harassment zone or until no beluga whale has been observed in the Level B harassment zone for 30 minutes immediately prior to resumption of in-water pile installation and removal.

During in-water construction, if an ESA-listed species (e.g., beluga whale, humpback whale, or Steller sea lion) comes within 100 meters of a moving vessel, the POA will reduce vessel speed to the minimum level required to maintain steerage and safe working conditions. The approach to marine mammal monitoring and shutdown protocols is described in further detail in the Marine Mammal Monitoring and Mitigation Plan, Appendix B in the POA's CTR LOA/IHA application (POA 2024).

Section 3. Action Area

The action area is defined as the area to be affected directly or indirectly by a federal action (50 Code of Federal Regulations [CFR] 402.02) and is not merely the immediate area involved in the action. The action area is determined by the geographic extent of the effects of the action on the environment. It extends to a point at which no measurable effects from the Project are expected to occur. For CTR, the basis for defining the action area takes into consideration in-air and underwater construction-related noise associated with in-water pile installation and removal.

3.1 Underwater Portion of Action Area

During CTR, in-water pile installation and removal will result in the greatest geographic extent of potential underwater impacts. The propagation of underwater noise by different methods is discussed in Section 6.1 of this document and the LOA/IHA application for this Project (POA 2024). To define the underwater portion of the action area, the maximum distance at which Project-related underwater noise would be detectable was used. In construction Year 1 through Year 5, impact pile installation of 72-inch piles with a bubble curtain would produce the loudest Project-related underwater noise and would be audible above ambient (background) sound levels up to approximately 2,512 meters (Figure 3-1; see Section 6.1.1.1). In construction Year 6, impact pile installation of 144-inch monopiles for the two mooring dolphins with a bubble curtain would produce the loudest Project-related underwater noise and would be audible above ambient (background) sound levels up to approximately 13,594 meters (Figure 3-2; see Section 6.1.1.1). Landforms located less than 6.0 km away from CTR would block the propagation of noise to some extent and reduce the total area of Knik Arm included in the underwater portion of the action area in all years.

3.2 In-Air Portion of Action Area

The in-air portion of the action area is defined by the acoustic effects related to impact installation of the two 144-inch steel piles. For construction Years 1 through 5, it was assumed that impact installation of 72-inch monopiles would produce the highest in-air sound levels. Because no data could be found on in-air noise estimates from impact installation of 72-inch piles, a proxy sound source based on 96-inch steel piles from the San Francisco-Oakland Bay Bridge East Space Project (Illingworth & Rodkin and Denise Duffy and Associates 2001) was used. In-air noise levels ranging from 90 to 105 A-weighted decibels (dBA) were measured at a distance of 100 meters (328 ft) during impact installation of 96-inch piles, and it was therefore assumed that 105 dBA would be the highest anticipated in-air sound source level for the CTR for construction Years 1 through 5.

For construction Year 6, it was assumed that impact installation of 144-inch monopiles would produce the highest in-air sound levels. Because no data could be found on in-air noise estimates from impact installation of 144-inch piles, a proxy sound source based on 96-inch steel piles from the San Francisco-Oakland Bay Bridge East Space Project (Illingworth & Rodkin and Denise Duffy and Associates 2001) was used. In-air noise levels ranging from 90 to 105 dBA were measured at a distance of 100 meters (328 ft) during impact installation of 96-inch piles. Based on the 50% increase in diameter between 96- and 144-inch piles, we estimate that in-air sound source levels for 144-inch piles would be 2 dB above what was measured for 96-inch piles. Therefore, it is assumed that 107 dBA would be the highest anticipated in-air sound source level for the CTR.

The spherical spreading model with sound transmission loss (TL) of 6.0 dB per doubling distance for a hard surface ($D = D_o \times 10$ [(Construction Noise – Ambient Sound Level in dBA/α]; Washington State Department of Transportation [WSDOT] 2020) was used to estimate sound threshold distances from the mean source levels. In the model:

$$D = D_o \times 10^{((\text{Construction Noise} - \text{Ambient Sound Level})/\alpha)}$$

- D = the distance from the noise source
- D_o = the reference measurement distance (100 meters [328 ft] in this case)
- α = 20 for hard ground or water, which assumes a 6 dBA reduction per doubling distance
- α = 25 for soft ground, which assumes a 7.5 dBA reduction per doubling distance

Based on estimated in-air ambient noise levels of 65 dBA (WSDOT 2020), the spherical spreading loss model indicates that noise from impact pile installation would attenuate to ambient noise levels approximately 10,000 meters (32,808 ft) from the work area in construction Year 1 through Year 5, and 12,589 meters (41,302 ft) from the work area in construction Year 6. Use of 22.5 for transmission loss, to better represent the mixed hard and soft surfaces and scattering that takes place in urban and suburban areas, yields distances of approximately 5,995 meters (19,669 ft) from the work area in construction Year 1 through Year 5, and 7,356 meters (24,134 ft) from the work area in construction Year 6.

This defines the in-air portion of the action area (Figure 3-2). There is no habitat for ESA-listed terrestrial species or haulouts for ESA-listed pinnipeds within the in-air portion of the action area (Section 4). Therefore, the analysis below focuses solely on impacts on the aquatic portion of the action area.

Figure 3-1. CTR In-Water Action Area for Year 1 through Year 5

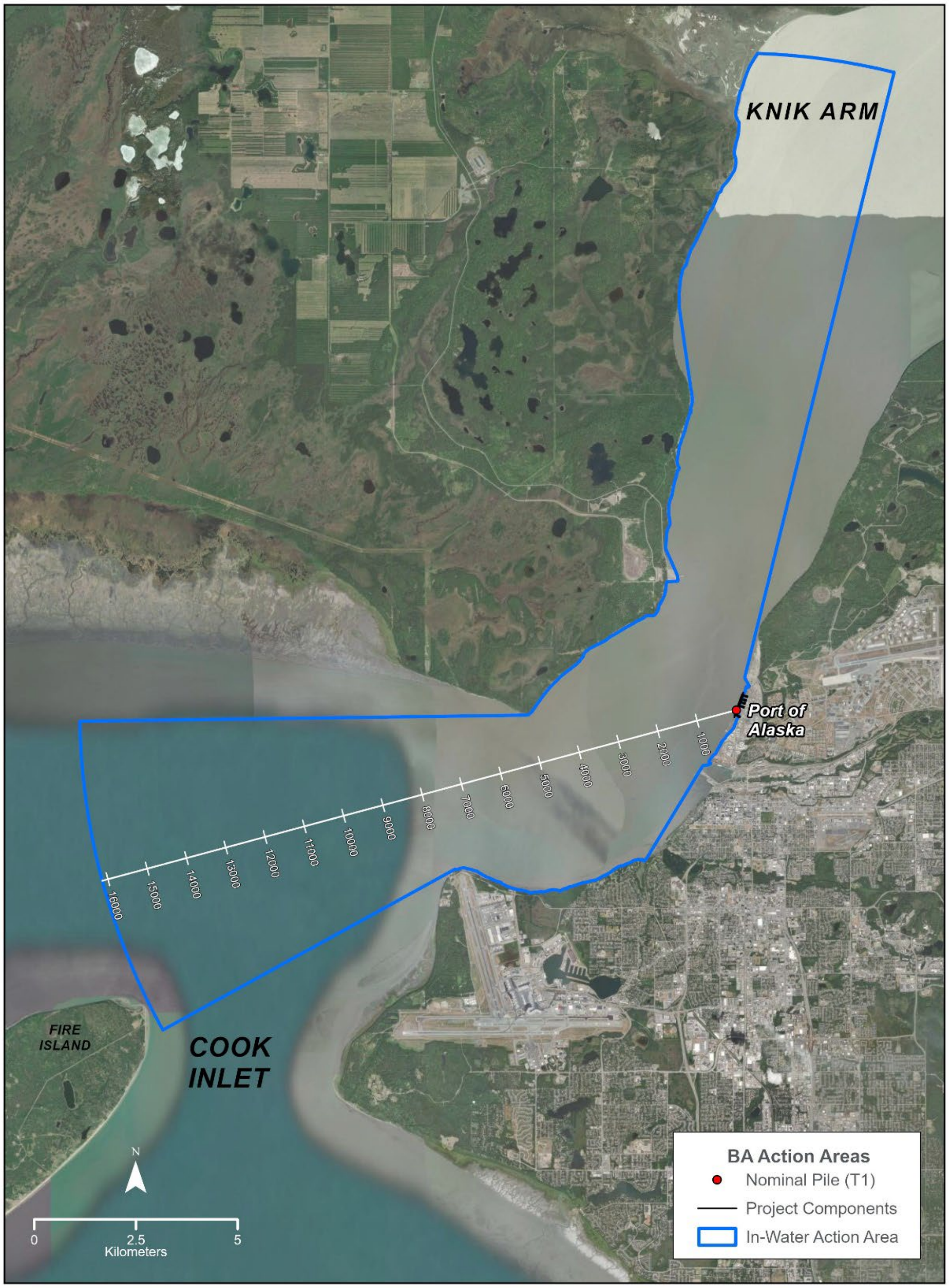

Figure 3-2. CTR In-Water Action Area for Year 6

Section 4. Federally Listed Species and Designated Critical Habitat in Action Area

Federally listed marine mammals that are most likely to be observed in upper Cook Inlet include Steller sea lions, beluga whales, and humpback whales (Table 4-1). Steller sea lions from the federally endangered western DPS are uncommon visitors to upper Cook Inlet but have been documented in and near the POA. The Cook Inlet beluga whale is the most common ESA-listed species in the action area. Humpback whales are rare visitors to upper Cook Inlet but have been documented near the POA. Humpback whales in Cook Inlet could be members of either the Mexico DPS, which is federally listed as threatened; the Hawaii DPS, which is not listed under the ESA; or the Western North Pacific DPS, which is federally listed as endangered (Table 4-1). Gray whales are not discussed in this BA, as gray whales in Cook Inlet are assumed to be members of the Eastern North Pacific DPS and not the Western North Pacific DPS. On 16 March 2023, NMFS proposed listing the sunflower sea star as a threatened species under the ESA (88 FR 16212). Sunflower sea stars are not known to occur in the action area and therefore have a no-effect determination.

Except for the beluga whale, very small proportions of the populations of the two other ESA-listed species occur in upper Cook Inlet near the action area. This BA assesses the potential impacts of the Project on the following three species:

- Steller sea lion;
- Beluga whale; and
- Humpback whale.

The occurrence of the four species of marine mammals that may occur or are expected or likely to occur in or transit near the action area is based on the following criteria:

- Common – occurring consistently in moderate to large numbers;
- Uncommon – occurring in low numbers or on an irregular basis; and
- Rare – records for some years but limited.

Table 4-1. Marine Mammals in or near the Action Area

Species	Abundance (DPS)	MMPA Designation	ESA Listing	Occurrence in Project Area
Steller sea lion	52,932 [a] (Western DPS)	Depleted & Strategic	Endangered	Uncommon
Cook Inlet beluga whale	331 (Cook Inlet DPS)	Depleted & Strategic	Endangered	Common
Humpback whale	11,278 (Hawaii DPS)	None	None	Rare
	Unknown (Mexico DPS)	Depleted & Strategic	Threatened	Rare
	1,084 (Western North Pacific DPS)	Depleted & Strategic	Endangered	Rare

Source: Mexico - North Pacific stock humpback whale population estimate: Martinez-Aguilar 2011. Hawai'i stock humpback whale population estimate: Becker et al. 2022; Carretta et al. 2023. Beluga whale population estimate: Goetz et al. 2023. All other population estimates: Young et al. 2023.
Notes: DPS = Distinct Population Segment; ESA = Endangered Species Act; MMPA = Marine Mammal Protection Act.
[a] N_{min} was used.

4.1 Steller Sea Lion

4.1.1 Status and Distribution

Two DPSs of Steller sea lions occur in Alaska: the western DPS and the eastern DPS. The western DPS includes animals that occur west of Cape Suckling, Alaska, and therefore includes individuals in the Project area. The western DPS was listed under the ESA as threatened in 1990, and its continued population decline resulted in a change in listing status to endangered in 1997. Since 2000, studies indicate that the population east of Samalga Pass (i.e., east of the Aleutian Islands) has increased and is potentially stable (Young et al. 2023). For the region that encompasses Cook Inlet (Central Gulf of Alaska), the annual trend in counts (annual rates of change) of the western DPS of Steller sea lions is 3.78 for non-pups (adults and juveniles) and 3.01 for pups for the period 2006 through 2021 (Sweeney et al. 2022; Young et al. 2023). The most recent abundance estimate for the western DPS is 12,581 pups and 40,351 non-pups, totaling 52,932 individuals (Young et al. 2023).

4.1.2 Foraging Ecology

Steller sea lions feed opportunistically on seasonally abundant prey throughout the year, predominantly on species that aggregate in schools or for spawning. They adjust their distribution based on the availability of prey species but are known to feed primarily on epipelagic and mesopelagic fishes. Principal prey include eulachon, walleye pollock, capelin, mackerel, Pacific salmon, Pacific cod, flatfishes, rockfishes, Pacific herring, sand lance, skates, squid, and octopus (Womble and Sigler 2006; Womble et al. 2009).

During the spring and summer months in Alaska, Steller sea lions feed on a less diverse array of prey, likely due to the increased availability of preferred prey species (Womble et al. 2009; Fritz et al. 2019). Diversity in prey species typically increases during the winter months, but prey species such as capelin, walleye pollock, and Pacific cod remain an integral component of sea lion diet. Capelin are an especially important winter prey species to Steller sea lions due to their high energetic density (Perez 1994; Maniscalco 2023).

Many variables drive the availability of prey species in the Pacific Ocean, including climatic variables such as marine heat waves. The northeast Pacific Marine Heatwave is of notable importance due to its persisting and compounding effects on ecosystem health in the North Pacific. The event lasted approximately 2 years and peaked in 2015 (Di Lorenzo and Mantua 2016). Following the peak of the Pacific Marine Heatwave, winter diets of Steller sea lions located at three different haulout sites in Southcentral Alaska increased in diversity by 12 percent. Their diet contained higher concentrations of benthic and demersal prey species such as polychaetes, Pacific sand lance, sculpins, skates, and snailfishes, and decreased in principal prey species such as capelin, Pacific herring, and walleye pollock (Maniscalco 2023). This shift in foraging behavior suggests that Steller sea lions are having a difficult time finding their preferred prey species and are foraging deeper and more broadly to meet their nutritional needs. Maniscalco (2023) related an increase in diet diversity during winter to a decrease in sea lion numbers on haulout sites.

4.1.3 Presence in Cook Inlet

Steller sea lions have not been documented in upper Cook Inlet during beluga whale aerial surveys conducted annually in June from 1994 through 2012 and in 2014 (Shelden et al. 2013, 2015, 2017; Sheldon and Wade 2019); however, there has been an increase in individual Steller sea lion sightings near the POA in recent years, which is discussed in Section 4.1.4.

4.1.4 Presence in Action Area

Steller sea lions were observed near the POA in 2009, 2016, and 2019–2022 (Integrated Concepts and Research Corporation [ICRC] 2009; Cornick and Seagars 2016; POA 2019a; 61 North Environmental [61N Environmental] 2021, 2022a, 2022b, 2022c; Table 4-2). In 2009, there were three Steller sea lion sightings that were believed to be the same individual (ICRC 2009). In 2016, Steller sea lions were observed on 2 separate days. On 02 May 2016, one individual was sighted. On 25 May 2016, there were five Steller Sea lion sightings within a 50-minute period, and these sightings occurred in areas relatively close to one another (Cornick and Seagars 2016). Given the proximity in time and space, it is believed these five sightings were of the same individual sea lion. In 2019, one Steller sea lion was observed in June at the POA during transitional dredging (POA 2019a). There were six sightings of individual Steller sea lions near the POA in May and June 2020 during PCT Phase 1 construction monitoring that took place from 27 April through 24 November 2020 (61N Environmental 2021). In 2021, there were a total of eight sightings of individual Steller sea lions in May, June, and September near the POA during PCT Phase 2 construction monitoring (61N Environmental 2022a). During NMFS marine mammal monitoring, one Steller sea lion was observed in August 2021 in the middle of the inlet looking and diving (Easley-Appleyard and Leonard 2022). In 2022, there were three Steller sea lion sightings during the transitional dredging monitoring and three during SFD construction monitoring (61N Environmental 2022b, 2022c). All sightings occurred during summer, when the sea lions were likely attracted to ongoing salmon runs. Sea lion observations near the POA may be increasing due to more consistent observation effort or due to increased presence; observations continue to be occasional but are increasing.

Table 4-2. Steller Sea Lions Observed in the POA during Monitoring Programs 2020–2022

Year	Dates of Monitoring Effort	Monitoring Effort		Total Number of Steller Sea Lions	Steller Sea Lions per Hour	Monitoring Type
		# of Days	# of Hours[a]			
2020	April 27–Nov. 24	128	1,238.7	6	0.005	PCT: Construction Monitoring
2021	April 26–Sept. 29	74	734.9	8	0.011	PCT: Construction Monitoring
2021	July 9–Oct. 17	29	231.6	1	0.004	NMFS 2021 unpublished data
2022	May 20–June 11	13	108.2	3	0.028	SFD: Construction Monitoring
2022	May 3–May 15 June 27–Aug. 24	70	727	3	0.004	PCT/SFD: Transitional Dredging Monitoring

Source: 61N Environmental 2021, 2022a, 2022b, 2022c; NMFS 2021 unpublished data

Notes: NMFS = National Marine Fisheries Service; PCT = Petroleum and Cement Terminal; POA = Port of Alaska; SFD = South Floating Dock; TPP = Test Pile Program.

[a] Total observation hours with intermittent in-water pile-driving.

4.1.5 Critical Habitat

Critical habitat for the western DPS of Steller sea lion is defined as all land and air within 3,000 ft and all marine waters within 20 nautical miles of a designated major haulout (58 FR 45269). The haulout closest to the POA is approximately 150 mi away near Homer, Alaska. Therefore, designated critical habitat for the western DPS of Steller sea lion is not part of the action area and would not be affected by the CTR Project.

4.2 Beluga Whale

4.2.1 Status and Distribution

Beluga whales appear seasonally throughout much of Alaska, except in the Southeast region and the Aleutian Islands. Five stocks are recognized in Alaska: the Beaufort Sea stock, eastern Chukchi Sea stock, eastern Bering Sea stock, Bristol Bay stock, and Cook Inlet stock (Young et al. 2023). The Cook Inlet stock is the most isolated of the five stocks, since it is separated from the others by the Alaska Peninsula and resides year-round in Cook Inlet (Laidre et al. 2000; Castellote et al. 2020). Included in the Cook Inlet stock under the MMPA is a small group of beluga whales, fewer than 20 individuals, that is regularly observed in Yakutat Bay (O'Corry-Crowe et al. 2015). This small group of individuals is reproductively separated from individuals in Cook Inlet and is not known to enter Cook Inlet (Lucey et al. 2015; O'Corry-Crowe et al. 2015); therefore, the Yakutat Bay beluga whales are not discussed further in this BA. Only the Cook Inlet population inhabits the Project area.

The Alaska Department of Fish and Game (ADF&G) conducted a survey of beluga whales in August 1979 and estimated 1,293 individuals (Calkins 1989). Although this survey did not include all of upper Cook Inlet, the area where almost all beluga whales are currently found during summer, it is the most complete survey of Cook Inlet prior to 1994 and incorporated a correction factor for beluga whales missed during the survey. Therefore, the ADF&G summary (Calkins 1989) provides the best available estimate for historical beluga whale abundance in Cook Inlet. For management purposes, NMFS has determined that the carrying capacity of Cook Inlet is 1,300 beluga whales (65 FR 34590) based on Calkins (1989).

No systematic population estimates for Cook Inlet beluga whales were conducted prior to 1994. NMFS began comprehensive, systematic aerial surveys of beluga whales in Cook Inlet in 1994. Unlike previous efforts, these surveys included the upper, middle, and lower inlet. These surveys documented a decline in abundance of nearly 50 percent between 1994 and 1998, from an estimate of 653 to 347 whales (Rugh et al. 2000). In response to this decline, NMFS initiated a status review on the Cook Inlet beluga whale stock pursuant to the MMPA and the ESA in 1998 (63 FR 64228). Annual abundance surveys were conducted each June from 1999 through 2012. In 2013, NMFS changed the survey to a biennial schedule because a detailed analysis determined that there would be no decrease in the assessment quality if the number of surveying years was reduced (Hobbs 2013). Analysis of survey data from 1999 to 2016 indicated that the population continued to decline at an annual rate of 0.4 percent (Shelden et al. 2015, 2017). However, Shelden and Wade (2019) analyzed time-series abundance data from 2010 to 2018 using a fully Bayesian method developed by Boyd et al. (2019) that incorporates uncertainty in correction factors. The most recent surveys conducted in 2022 were also analyzed with this new methodology and produced an abundance estimate of 331 beluga whales (Goetz et al. 2023; Table 4-3). The 95 percent probability range is 290 to 386 whales (Goetz et al. 2023). This new analysis indicates that from 2012 to 2022, the Cook Inlet beluga whale population was increasing at an annual rate of 0.9 percent (Goetz et al. 2023).

Abundance surveys were not completed in 2020 due to the Covid-19 pandemic. Consecutive surveys were conducted in 2021 and 2022; however, abundance estimates were not released for 2021. The timing of the 2021 survey, tidal conditions, and inclement weather resulted in overall conditions that were not favorable for estimating abundance nor were they comparable to other survey years. As a result, the median index count of 124 whales was below the normal range of median counts for the project. The 2022 survey conditions were comparable to previous survey years and produced an annual median index count of 224 whales which is within the range of normal for the survey (Shelden et al. 2022).

Table 4-3. Annual Cook Inlet Beluga Whale Abundance Estimates

1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2014	2016	2018	2022
367	435	386	313	357	366	278	302	375	375	321	340	284	312	340	328	279	331

Source: Hobbs et al. 2000, 2011, 2012; Rugh et al. 2003, 2004a, 2004b, 2005a, 2005b, 2005c, 2006a, 2006b, 2007; Hobbs and Shelden 2008; Allen and Angliss 2010, 2011; Shelden et al. 2013, 2015, 2017; Shelden and Wade 2019; Boyd et al. 2019; Goetz et al. 2023.

Note: Abundance surveys were not completed in 2013, 2015, 2017, 2019, and 2020. An abundance estimate was not calculated from the 2021 survey data.

In 1999, NMFS received petitions to list the Cook Inlet beluga whale stock as an endangered species under the ESA (64 FR 17347). However, NMFS determined that the population decline was due to overharvest by Alaska Native subsistence hunters and, because the Native harvest was regulated in 1999, listing this stock under the ESA was not warranted at the time (65 FR 38778). The Cook Inlet beluga whale stock was designated as depleted under the MMPA in 2000, indicating that the size of the stock was below its Optimum Sustainable Population (OSP) level (65 FR 34590). The population has remained below its OSP since the designation but would be considered recovered once the population estimate rises above the OSP.

NMFS announced initiation of another Cook Inlet beluga whale status review under the ESA in 2006 (71 FR 14836) and received another petition to list the Cook Inlet beluga whale under the ESA (71 FR 44614). NMFS issued a decision on the status review on 20 April 2007, concluding that the Cook Inlet beluga whale is a DPS that is in danger of extinction throughout its range. Subsequently, NMFS issued a proposed rule to list the Cook Inlet beluga whale as an endangered species (72 FR 19821). On 17 October 2008, NMFS announced the listing of the population as endangered under the ESA (73 FR 62919). In 2010, a Recovery Team, consisting of a Science Panel and Stakeholder Panel, began meeting to develop a Recovery Plan for the Cook Inlet beluga whale. The Draft Recovery Plan was published in the *Federal Register* on 15 May 2015 (80 FR 27925), and the Final Recovery Plan was published in the *Federal Register* on 05 January 2017 (82 FR 1325). In September 2022, National Oceanic and Atmospheric Administration (NOAA) Fisheries completed the ESA 5-year review for the Cook Inlet beluga whale DPS and determined that the Cook Inlet beluga whale DPS should remain listed as endangered (NOAA and NMFS 2022).

4.2.2 Foraging Ecology

Cook Inlet beluga whales feed on a wide variety of prey species, particularly those that are seasonally abundant. In spring, the preferred prey species are eulachon and Chinook salmon (Burek-Huntington et al. 2022). Other fish and invertebrate species found in the stomachs of beluga whales include porifera, polychaetes, mysids, amphipods, shrimp, crabs, and marine worms. Some of these species may be found in beluga whale stomachs from secondary ingestion because species such as cod feed on polychaetes, shrimp, amphipods, and mysids, as well as other fish (e.g., walleye, pollock, and flatfish) and invertebrates (Quakenbush et al. 2015).

From late spring through summer, most beluga whale stomachs sampled contained Pacific salmon, which corresponded to the timing of fish runs in the area. Anadromous smolt and adult fish aggregate at river mouths and adjacent intertidal mudflats (Calkins 1989). All five Pacific salmon species (i.e., Chinook, pink, coho, sockeye, and chum) spawn in rivers throughout Cook Inlet (Moulton 1997; Moore et al. 2000). Overall, Pacific salmon represent the highest percent frequency of occurrence of prey species in Cook Inlet beluga whale stomachs. This suggests that their spring feeding in upper Cook Inlet, principally on fat-rich fish such as salmon and eulachon, is important to the energetics of these animals (NMFS 2016b).

The nutritional quality of Chinook salmon in particular is unparalleled, with an energy content four times greater than that of a Coho salmon. It is suggested that the decline of the Chinook salmon population has left a nutritional void in the diet of the Cook Inlet beluga whale that no other prey species can fill in terms of quality or quantity (Norman et al. 2020, 2022).

In fall, as anadromous fish runs begin to decline, beluga whales return to consume fish species (cod and bottom fish) found in nearshore bays and estuaries. Stomach samples from Cook Inlet beluga whales are not available for winter (December through March), although dive data from beluga whales tagged with satellite transmitters suggest that they feed in deeper waters during winter (Hobbs et al. 2005), possibly on such prey species as flatfish, cod, sculpin, and pollock.

4.2.3 Distribution in Cook Inlet

Beluga whales are year-round residents in Cook Inlet (Rugh et al. 2000; Castellote et al. 2020), though they display seasonal movements throughout the inlet. Large aggregations of beluga whales occur near the mouths of rivers and streams when anadromous fish are present (Moore et al. 2000; Shelden and Wade 2019; Castellote et al. 2020; McGuire et al. 2020).

4.2.3.1 Spring and Summer

During spring and summer, beluga whales generally aggregate near the warmer waters of river mouths where prey availability is high and predator occurrence is low (Moore et al. 2000; Shelden and Wade 2019; McGuire et al. 2020). In particular, beluga whale groups are seen in the Susitna River Delta, the Beluga River and along the shores of the Little Susitna River, Knik Arm, and Chickaloon Bay. The Susitna River delta is an especially important feeding area to beluga whales due to the quantity of eulachon, Chinook, pink, and coho salmon available (Castellote et al. 2021). Small groups were recorded farther south in Kachemak Bay, Redoubt Bay (Big River), and Trading Bay (McArthur River) prior to 1996, but rarely thereafter. Since the mid-1990s, most beluga whales (96 to 100 percent) aggregate in shallow areas near river mouths in upper Cook Inlet, and they are rarely sighted in the central or southern portions of Cook Inlet during summer (Hobbs et al. 2008). Important calving grounds are located near the river mouths of upper Cook Inlet, and peak calving occurs between July and October (McGuire et al. 2016).

4.2.3.2 Fall and Winter

Data from tagged whales (14 tags between July 2000 through March 2003) show that beluga whales continue to use upper Cook Inlet intensively between summer and late autumn (Hobbs et al. 2005). Beluga whales tagged with satellite transmitters continue to use Knik Arm, Turnagain Arm, and Chickaloon Bay as late as October, but some range into lower Cook Inlet to Chinitna Bay, Tuxedni Bay, and Trading Bay (McArthur River) in fall (Hobbs et al. 2005, 2012). From September through November, beluga whales move between Knik Arm, Turnagain Arm, and Chickaloon Bay (Hobbs et al. 2005; Goetz et al. 2012b). By December, beluga whales are distributed throughout the upper to mid-inlet. From January into March, they move as far south as Kalgin Island and slightly beyond in central offshore waters. Beluga whales make occasional excursions into Knik Arm and Turnagain Arm in February and March in spite of ice cover (Hobbs et al. 2005). Although tagged beluga whales move widely around Cook Inlet throughout the year, there is no indication of seasonal migration in and out of Cook Inlet (Hobbs et al. 2005). Data from NMFS aerial surveys, opportunistic sighting reports, and corrected satellite-tagged beluga whales confirm that they are more widely dispersed throughout Cook Inlet during winter (November–April), with animals found between Kalgin Island and Point Possession. Generally fewer observations of beluga whales are reported from the Anchorage and Knik Arm area from November through April (76 FR 20180; Rugh et al. 2000, 2004a).

4.2.4 Presence in Action Area

Knik Arm is one of three areas in upper Cook Inlet where beluga whales are concentrated during spring, summer, and early fall (Section 4.2.3). Most beluga whales observed in or near the POA are transiting between upper Knik Arm and other portions of Cook Inlet, and the POA itself is not considered high-quality foraging habitat. Beluga whales tend to follow their anadromous prey and travel in and out of Knik Arm with the tides. Use of Knik Arm is concentrated between August and October and may be highest in October (61N Environmental 2021, 2022a, 2022c). Use of Knik Arm is lowest in winter (December through February) and remains low in spring and early summer (March–July; Rugh et al. 2000, 2004a, 2005a, 2006a, 2007; Funk et al. 2005; U.S. Army Garrison Fort Richardson 2009; Hobbs et al. 2011, 2012).

Goetz et al. (2012a) used distribution and group size data collected during annual aerial surveys between 1994 and 2008 to develop a predictive habitat model. This predictive model maps beluga whale density from 0 to 1.12 whales per square kilometer (km^2) in Cook Inlet. The highest predicted densities of beluga whales are in Knik Arm, near the mouth of the Susitna River, and in Chickaloon Bay. The model suggests that the density of beluga whales at the mouth of Knik Arm, near the POA, ranges between approximately 0.013 and 0.062 whales per km^2. The distribution presented by Goetz et al. (2012a) is generally consistent with beluga whale distribution documented in upper Cook Inlet throughout ice-free months (NMFS 2016b).

Several marine mammal monitoring programs and studies have been conducted at or near the POA during the last 18 years. These studies, summarized below, offer some of the best available information on the abundance of beluga whales in the Project area.

4.2.4.1 SFD Construction Monitoring and Transitional Dredging (2022)

In 2022, a marine mammal monitoring program identical to that used during PCT construction was implemented during construction of the SFD. Marine mammal monitoring was conducted during 13 non-consecutive days, with a total of 108.2 hours of monitoring observation from 20 May through 11 June 2022 (61N Environmental 2022c Table 4-4).

Table 4-4. Beluga Whales Observed in the POA Area during PCT and SFD Construction Monitoring 2020–2022

Month	Hours			Whales (Individuals)			Whales (Groups)			Average Group Size		
	2020	2021	2022	2020	2021	2022	2020	2021	2022	2020	2021	2022
April	40.5	47.4	0	33	29	—	11	12	—	3	2.4	—
May	301.4	272.8	40.7	168	49	21	35	11	3	4.8	4.5	7
June	318.1	186	67.5	114	38	20	33	16	6	3.5	2.4	3.3
July	192.5	0	0	25	—	—	12	—	—	2.1	—	—
August	151.2	0	0	274	—	—	56	—	—	4.9	—	—
September	85.6	228.6	0	276	401	—	73	93	—	3.8	4.3	-
October	17.6	0	0	0	—	—	0	—	—	0	—	—
November	132	0	0	97	—	—	25	—	—	3.9	—	—
Totals[a]	**1,238.7**	**734.9**	**108.2**	**987**	**517**	**41**	**245**	**132**	**9**	—	—	—

Source: 61N Environmental 2021, 2022a, 2022b, 2022c.

Notes: PCT = Petroleum and Cement Terminal; POA = Port of Alaska.

[a] Numbers may not sum exactly due to rounding.

During SFD construction, the position of the Ship Creek station at the end of the promontory allowed monitoring of a portion of the shoreline north of Cairn Point that could not be seen by the station at the northern end of the POA (61N Environmental 2022c). Eleven MMOs worked from four monitoring stations located along a 9-km stretch of coastline surrounding the POA. The monitoring effort and data collection were conducted at the following four locations: (1) Point Woronzof approximately 6.5 km southwest of the SFD, (2) the promontory near the boat launch at Ship Creek, (3) the SFD Project site, and (4) the northern end of the POA (61N Environmental 2022c).

During 13 days of SFD construction monitoring in late May and early June, 41 individual beluga whales across nine groups were sighted (61N Environmental 2022c; Table 4-5). Ninety groups comprising 529 beluga whales were sighted during the transitional dredging monitoring that occurred from 03 to 15 May and 27 June to 24 August 2022 (61N Environmental 2022b; Table 4-5). Of the nine groups of beluga whales sighted during SFD construction, traveling was recorded as the primary behavior for each group (61N Environmental 2022c). Beluga whales traveled and milled between the SFD construction area, Ship Creek, and areas to the south of the POA for more than an hour at a time. During vibratory pile driving, beluga whales displayed no observable reactions and sometimes continued their trajectory toward the SFD despite the large Level B zones (61N Environmental 2022c).

Table 4-5. Beluga Whales Observed in the POA Area during Monitoring Programs 2005–2022

Year	Dates of Monitoring Effort	Monitoring Effort # of Days	Monitoring Effort # of Hours[a]	Total Number of Beluga Whale Groups[b] Sighted	Total Number of Beluga Whales	Monitoring Type
2005	Aug. 2–Nov. 28	51	374	21	157	MTRP: Scientific Monitoring
2006	April 26–Nov. 3	95	564	25	82	MTRP: Scientific Monitoring
2007	Oct. 9–Nov. 20	28	139	14	61	MTRP: Scientific Monitoring
2008	June 24–Nov. 14	86	612	74	283	MTRP: Scientific Monitoring
	July 24–Dec. 2	108	607	59	431	MTRP: Construction Monitoring
2009	May 4–Nov. 18	86	783	54	166	MTRP: Scientific Monitoring
	March 28–Dec. 14	214	3,322	NA	1,221	MTRP: Construction Monitoring
2010	June 29–Nov. 19	87	600	42	115	MTRP: Scientific Monitoring
	July 21–Nov. 20	106	862	103	731	MTRP: Construction Monitoring
2011	June 28–Nov. 15	104	1,202	62	290	MTRP: Scientific Monitoring
	July 17–Sept. 27	16	NA	5	48	MTRP: Construction Monitoring
2016	May 3–June 21	19	85.3	9	10	TPP: Construction Monitoring
2019	May 8–Sept. 17	133	NA	66	797	PCT: Transitional Dredging Monitoring
2020	April 27–Nov. 24	128	1,238.7	245	987	PCT: Construction Monitoring
2021	April 26–Sept. 29	74	734.9	132	517	PCT: Construction Monitoring
2021	July 9–Oct. 17	29	231.6	113	578	NMFS 2021 unpublished data
2022	May 20–June 11	13	108.2	9	41	SFD: Construction Monitoring
2022	May 3–May 15 June 27–Aug. 24	70	727	90	529	PCT/SFD: Transitional Dredging Monitoring

Source: Prevel-Ramos et al. 2006; Markowitz and McGuire 2007; Cornick and Saxon-Kendall 2008, 2009; Cornick and Pinney 2011; Cornick et al. 2010, 2011; ICRC 2009, 2010, 2011, 2012; Cornick and Seagars 2016; POA 2019a; 61N Environmental 2021, 2022a, 2022b, 2022c; NMFS 2021 unpublished data.

Notes: MTRP = Marine Terminal Redevelopment Project; NA = not available; the information was not provided in the report. The 2009 construction monitoring report does not indicate the total number of sightings, only the total number of beluga whales observed. NMFS = National Marine Fisheries Service; PCT = Petroleum and Cement Terminal; POA = Port of Alaska; SFD = South Floating Dock; TPP = Test Pile Program.

[a] Intermittent in-water pile-driving hours.

[b] Group can be one or more individuals.

4.2.4.2 PCT Construction Monitoring (2020–2021)

A marine mammal monitoring program was implemented during construction of the PCT in 2020 and 2021. Marine mammal monitoring in 2020 occurred during 128 non-consecutive days, with a total of 1,238.7 hours of monitoring from 27 April to 24 November 2020 (61N Environmental 2021). Marine mammal monitoring in 2021 occurred during 74 non-consecutive days, with a total of 734.9 hours of monitoring from 26 April to 24 June and 07 to 29 September 2021 (61N Environmental 2022a). A total of 1,504 individual beluga whales across 377 groups were sighted during PCT construction monitoring (also summarized by year in Table 4-5).

The monitoring effort and data collection were conducted at four locations: (1) the Anchorage Public Boat Dock by Ship Creek, (2) the Anchorage Downtown Viewpoint near Point Woronzof, (3) the PCT construction site, and (4) the North End (North Extension) at the north end of the POA, near Cairn Point. Marine mammal sighting data from April to September indicate that beluga whales swam into the clearance zone and lingered there for periods of time ranging from a few minutes to a few hours. Beluga whales were most often seen traveling at a slow or moderate pace through the monitoring zone, either from the north near Cairn Point or from the south milling at the mouth of Ship Creek. Groups of beluga whales were also observed swimming north and south in front of the PCT construction site after in-water work was shut down and did not appear to exhibit avoidance behaviors. Beluga whale sightings in June were concentrated on the west side of Knik Arm from the Little Susitna River Delta to Port MacKenzie. From July through September, beluga whales were most often seen milling and traveling on the east side of Knik Arm from Point Woronzof to Cairn Point (61N Environmental 2021, 2022a).

4.2.4.3 2016 Test Pile Program Monitoring

In 2016, a marine mammal monitoring program was implemented during the TPP. Marine mammal monitoring was conducted during 19 non-consecutive days, with a total of 85.3 hours of monitoring observation from 03 May through 21 June 2016 (Cornick and Seagars 2016; Table 4-5). During the TPP, nine groups comprising a total of 10 beluga whales were sighted (Cornick and Seagars 2016).

The monitoring effort and data collection were conducted at three locations: (1) the Anchorage Public Boat Dock by Ship Creek, (2) the North End, which is located just above shore level at the north end of the POA, and (3) a roving observer with primary responsibility for the mandatory 100-meter shutdown zone and areas immediately adjacent to the PAMP 2016 TPP in-water activity that were not observable from other stations under all scenarios (Cornick and Seagars 2016).

4.2.4.4 POA Monitoring 2005 to 2011

The POA conducted NMFS-approved monitoring programs for beluga whales and other marine mammals focused at the POA from 2005 to 2011 (Table 4-5). The resulting data on beluga whale sighting rates, groupings, behavior, and movements indicated that the POA was a relatively low-use area, in that beluga whales did not linger in the area but passed through en route to other locations. They were observed most often in fall, with numbers peaking in late August to early October (Funk et al. 2005). Although groups with calves were observed entering the POA area, data did not suggest that the area was an important nursery.

Although the POA scientific monitoring studies indicated that beluga whales were generally passing through the area, it was also used as foraging habitat by whales traveling between lower and upper Knik Arm. Individuals and groups of beluga whales were observed passing through the area each year during monitoring efforts (Table 4-5). Diving and traveling were common behaviors, with many instances of confirmed feeding. Sighting rates at the POA during this time period ranged from 0.05 to 0.4 whales per hour (Prevel-Ramos et al. 2006; Markowitz and McGuire 2007; Cornick and Saxon-Kendall 2008; Cornick et al. 2011) as compared to 3 to 5 whales per hour at Eklutna, 20 to 30 whales per hour at Birchwood, and 3 to 8 whales per hour at Cairn Point (Funk et al. 2005), indicating that these areas were of higher use than the POA. In 2009, the mean sighting duration for 54 groups of beluga whales was 11.4 minutes (± 1.8 minutes), with a range of 1 to 61 minutes (Cornick et al. 2010). In 2011, the mean sighting duration for 62 groups of beluga whales was 16.4 minutes (± 3.5 minutes), with a range of 1 to 144 minutes. There were two observations that had long sighting durations of 144 minutes and 90 minutes; the remaining 60 observations had sighting durations of less than 64 minutes (Cornick et al. 2011).

Data collected annually during monitoring efforts from 2005 to 2011 demonstrated that few beluga whales were observed in July and early August; numbers of sightings increased in mid-August, with the highest numbers observed in late August to mid-September. In all years, beluga whales were observed entering the Project area while construction activities were taking place, including in-water pile installation and removal, and dredging. No apparent behavioral changes or reactions to in-water construction activities (e.g., displacement or abandonment of feeding behavior) were observed by either the construction workers or the scientific observers (Cornick et al. 2011).

4.2.4.5 Knik Arm Bridge and Toll Authority Baseline Study, 2004–2005

To assist in the evaluation of the potential impact of a proposed bridge crossing of Knik Arm north of Cairn Point, Knik Arm Bridge and Toll Authority (KABATA) initiated a study to collect baseline environmental data on beluga whale activity and the ecology of Knik Arm (Funk et al. 2005). Vessel- and land-based observations were conducted in Knik Arm from July 2004 through July 2005. Land-based observations were conducted from nine stations along the shore of Knik Arm. The three primary stations were located at Cairn Point, Point Woronzof, and Birchwood. The majority of beluga whales were observed north of Cairn Point. Temporal use of Knik Arm by beluga whales was related to tide height, with most whale sightings at Cairn Point occurring at low tide. During the study period, most beluga whales using Knik Arm stayed in the upper portion of Knik Arm north of Cairn Point. Approximately 90 percent of observations occurred during the months of August through November, and only during this time were whales consistently sighted in Knik Arm. The relatively low number of sightings in Knik Arm throughout the rest of the year suggested that the whales were using other portions of Cook Inlet. In addition, relatively few beluga whales were sighted in spring and early to mid-summer. Beluga whales predominantly frequented Eagle Bay (mouth of Eagle River), Eklutna, and the stretch of coastline in between, particularly when they were present in high numbers (Funk et al. 2005).

4.2.4.6 Cook Inlet Beluga Whale Photo-ID Project

Beluga whales have persistent distinct natural markings that can be used to identify individuals. The Cook Inlet Beluga Whale Photo-Identification (Photo-ID) Project has surveyed beluga whales in several areas throughout Cook Inlet. Knik Arm and the Susitna River Delta have been surveyed annually since 2005 (McGuire et al. 2013a). These annual surveys have indicated that beluga whales with calves and newborns use Knik Arm and Eagle Bay seasonally (McGuire et al. 2013b). In 2011, McGuire et al. (2013b) documented that 78 percent of the 307 beluga whales identified in Cook Inlet traveled to the Eagle Bay area. Sixteen field seasons (542 surveys) from 2005 through 2020 have been conducted of the Susitna River Delta, Knik Arm, the Kenai River Delta, and Turnagain Arm (McGuire et al. 2022). The project catalog contains compiled photographs of 487 whales identified by right-side markings, 519 whales identified by left-side markings, and 185 whales identified as “dual” whales (both left- and right-side markings) (McGuire et al. 2022).

These annual vessel- and land-based surveys have indicated that beluga whales with calves and newborns use Knik Arm and Eagle Bay seasonally (McGuire et al. 2013b). In 2011, McGuire et al. (2013b) documented that 78 percent of the 307 beluga whales identified in Cook Inlet traveled to the Eagle Bay area. These data provided evidence that most, if not all, of the population visited this area at least once in their lifetime. Groups containing calves or neonates were more likely to be seen in Knik Arm, Eagle Bay, and the Susitna River Delta than other areas studied in upper Cook Inlet during the Photo-ID Project (McGuire et al. 2011, 2016, 2021).

4.2.5 Critical Habitat

On 11 April 2011, NMFS designated two areas of critical habitat for beluga whales in Cook Inlet (76 FR 20180). The designation includes 7,800 km^2 (3,013 square miles [mi^2]) of marine and estuarine habitat in Cook Inlet, encompassing approximately 1,909 km^2 (738 mi^2) in Area 1 and 5,891 km^2 (2,275 mi^2) in Area 2 (Figure 4-1). From spring through fall, Area 1 critical habitat has the highest concentration of beluga whales due to its important foraging and calving habitat. Area 2 critical habitat has a lower concentration of beluga whales in spring and summer but is used by beluga whales in fall and winter. Critical habitat does not include two areas of military usage: the Eagle River Flats Range on Fort Richardson and military lands of Joint Base Elmendorf-Richardson between Mean Higher High Water and Mean High Water (MHW). Additionally, the POA, adjacent navigation channel, and turning basin were excluded from critical habitat designation due to national security reasons (76 FR 20180).

The designation identified the following Primary Constituent Elements (PCEs), essential features important to the conservation of the Cook Inlet beluga whale:

1. Intertidal and subtidal waters of Cook Inlet with depths of less than 30 ft Mean Lower Low Water (MLLW) and within 5 mi of high- and medium-flow anadromous fish streams.
2. Primary prey species, including four of the five species of Pacific salmon (chum, sockeye, Chinook, and coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole.
3. The absence of toxins or other agents of a type or amount harmful to beluga whales.
4. Unrestricted passage within or between the critical habitat areas.
5. The absence of in-water noise at levels resulting in the abandonment of habitat by Cook Inlet beluga whales.

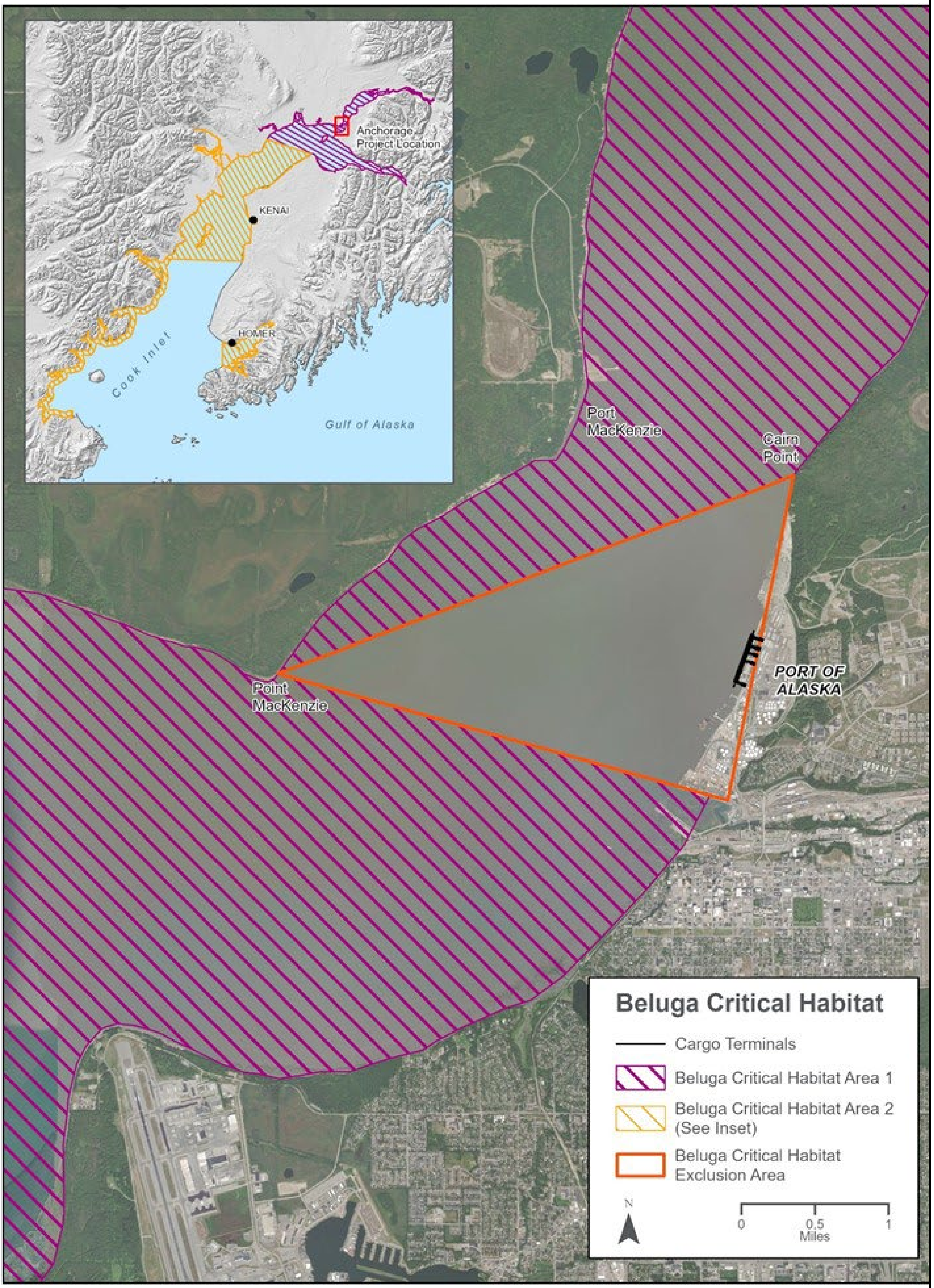

Figure 4-1. Designated Cook Inlet Beluga Whale Critical Habitat and Exclusion Zone at POA

4.3 Humpback Whale

4.3.1 Status and Distribution

Humpback whales, a highly migratory species, are found in all oceans (Young et al. 2023). Commercial whaling operations in the early twentieth century resulted in significantly decreased populations of whales worldwide. Prior to commercial whaling exploitation, humpback whale abundance in the North Pacific was estimated to be 15,000 whales (Rice 1978). Non-subsistence hunting was banned in 1966 when the population of humpback whales was as few as 1,000–1,200 individuals (Rice 1978; Barlow 2003). The population in the North Pacific grew to 6,000–8,000 by the mid-1990s. Current threats to humpback whales include vessel strikes, releases of chemicals or hydrocarbons into the marine environment, climate change, and commercial fishing operations (Young et al. 2023).

Humpback whales worldwide were listed as endangered under the Endangered Species Conservation Act in 1970 (35 FR 18319) and under the ESA at its inception in 1973. However, on 08 September 2016, NMFS published a final decision that changed the status of humpback whales under the ESA (81 FR 62259), effective 11 October 2016. The decision recognized the existence of 14 DPSs based on distinct breeding areas in tropical and temperate waters. Five of the 14 DPSs were classified under the ESA (4 endangered and 1 threatened), while the other 9 DPSs were delisted (81 FR 62260). Three DPSs of humpback whales are found in waters off the coast of Alaska: the Western North Pacific DPS (endangered), the Mexico DPS (threatened), and the Hawaii DPS (recovered; not ESA-listed).

The Structure of Populations, Levels of Abundance, and Status of Humpbacks (SPLASH) Project, conducted from 2004 to 2006, was the largest and most comprehensive study of humpback whales throughout the North Pacific (Young et al. 2023). SPLASH data suggest that the majority of humpback whales in the Gulf of Alaska are from the Hawaii DPS (89 percent), followed by whales from the Mexico DPS (11 percent), and very few from the Western North Pacific DPS (less than 1 percent; Wade 2021; NMFS 2022; Young et al. 2023). Whales of different DPSs intermix at both summer feeding grounds (NMFS AK 2021) and winter breeding grounds (Darling et al. 2022); therefore, all waters off the coast of Alaska should be considered to have ESA-listed humpback whales. Abundance estimates derived from SPLASH data for whales that summer in the Gulf of Alaska are number (N)=2,129, coefficient of variation (CV)=0.081 (multistate model; Wade 2021) and N=3,148, CV=0.062 (Chapman-Peterson summer-summer model; Wade 2021).

The Western North Pacific stock/DPS is described as those humpback whales that breed off Okinawa, Japan, the Philippines, and another unidentified breeding area (inferred from sightings of whales in the Aleutian Islands area feeding grounds) and those whales transiting the Ogasawara area (Oleson et al. 2022). Humpback whales in the Western North Pacific DPS migrate to feeding grounds in the northern Pacific Ocean, primarily off the Russian coast, but also to feeding grounds in the western and central Aleutian Islands (81 FR 62260; Oleson et al. 2022). Abundance estimates for whales that winter in Asia range from N=1,084, CV=0.088 using a multistate model to N=1,907, CV=0.165 using the Chao winter-winter model (Wade 2021).

The Mexico DPS consists of humpback whales that breed along the Pacific coast of Mexico, the Baja California peninsula, and the Revillagigedo Islands (Bettridge 2015) and feed from California to the Kamchatka Peninsula, Russia, with concentrations in the California-Oregon, northern Washington-southern British Columbia, northern and western Gulf of Alaska, and Bering Sea feeding grounds (Martien et al. 2021). The Mexico DPS consists of two stocks: Mainland Mexico – CA-OR-WA stock and Mexico-North Pacific stock. The Mainland Mexico – CA-OR-WA stock winters off the coast of Mainland Mexico states of Nayarit, Jalisco, Colima, and Michoacán and summers along the U.S. West Coast, Southern British Columbia, Alaska, and the Bering Sea (Young et al. 2023). The Mexico-North Pacific stock winters off Mexico and the Revillagigedo Archipelago and summers primarily in Alaska waters (Martien et al. 2021). Abundance estimates for whales that winter in Mexico range from N= 2,352, CV=0.075 using the Chao m(th) model abundance estimate for 2003–2006 (Martinez-Aguilar 2011) to N=2,913, CV=0.066 using a multistate model to N=4,910, CV=0.095 using the Chao winter-winter model (Wade 2021).

The Hawaii stock/DPS consists of humpback whales that breed in the main Hawaiian Islands (Bettridge et al. 2015) and feed in waters off the coast of Northern British Columbia, Southeast Alaska, the Gulf of Alaska, and the Bering Sea/Aleutian Islands (Calambokidis 1997). Abundance estimates for whales that winter in Hawaii range from N=8,097, CV=0.055 using the Chapman-Peterson winter-winter model to N=11,540, CV=0.042 using a multistate model (Wade 2021).

4.3.2 Foraging Ecology

Humpback whales target aggregations of krill (Euphausiidae; Nemoto 1957) and small schooling fish including herring (Krieger and Wing 1984), capelin (Witteveen et al. 2008), sand lance (Hazen et al. 2009), and juvenile salmon (Chenoweth et al. 2017). In Alaska waters, the species composition of prey taken by humpback whales varies, likely due to prey availability and individual preference (Witteveen et al. 2011).

4.3.3 Presence in Cook Inlet

Humpback whales are encountered regularly in lower Cook Inlet and occasionally in mid-Cook Inlet; however, sightings are rare in upper Cook Inlet. During aerial surveys conducted in summers between 2005 and 2012, Shelden et al. (2013) reported dozens of sightings in lower Cook Inlet, a handful of sightings in the vicinity of Anchor Point and in lower Cook Inlet, and no sightings north of 60° North latitude (approximately the latitude of the town of Ninilchik). Biennial surveys began in 2014, although no survey took place in 2020 due to Covid-19. Instead, the planned 2020 survey was postponed to 2021, so consecutive surveys took place in 2021 and 2022 (Shelden et al. 2022). During the 2014–2022 aerial surveys, sightings of humpback whales were recorded in lower Cook Inlet and mid-Cook Inlet, but none were observed in upper Cook Inlet (Shelden et al. 2015, 2017, 2019, 2022). Vessel-based observers participating in the Apache Corporation's 2014 survey operations recorded three humpback whale sightings near Moose Point in upper Cook Inlet and two sightings near Anchor Point, while aerial and land-based observers recorded no humpback whale sightings, including in the upper inlet (Lomac-MacNair et al. 2014). Observers monitoring waters between Point Campbell and Fire Island during summer and fall 2011 and spring and summer 2012 recorded no humpback whale sightings (Brueggeman et al. 2013). Monitoring of Turnagain Arm during ice-free months between 2006 and 2014 yielded one humpback whale sighting (McGuire, unpublished data; cited in LGL Alaska Research Associates, Inc., and DOWL 2015).

4.3.4 Presence in Action Area

There have been few sightings of humpback whales in the vicinity of the Project area (Table 4-6). Humpback whales were not documented during POA construction or scientific monitoring from 2005 to 2011 or during 2016 or 2020 (Prevel-Ramos et al. 2006; Markowitz and McGuire 2007; Cornick and Saxon-Kendall 2008, 2009; ICRC 2009, 2010, 2011, 2012; Cornick et al. 2010, 2011; Cornick and Pinney 2011; Cornick and Seagars 2016; 61N Environmental 2021). Observers monitoring the Ship Creek Small Boat Launch from 23 August to 11 September 2017, recorded two sightings, each of a single humpback whale, which was presumed to be the same individual (POA 2017a). In 2017, an event involved a stranded whale that was sighted near a number of locations in upper Cook Inlet before washing ashore at Kincaid Park; it is unclear as to whether the humpback whale was alive or deceased upon entering Cook Inlet waters. One humpback whale was observed in July during 2022 transitional dredging monitoring (61N Environmental 2022b). No humpback whales were observed during the 2020 to 2021 PCT construction monitoring, the NMFS marine mammal monitoring, or the 2022 SFD construction monitoring from April to June (61N Environmental 2021, 2022a, 2022b, 2022c; NMFS 2021 unpublished data).

Table 4-6. Humpback Whales Observed in the POA during Monitoring Programs 2020–2022

Year	Dates of Monitoring Effort	Monitoring Effort		Total Number of Humpback Whales	Humpback Whales per Hour	Monitoring Type
		# of Days	# of Hours[a]			
2020	April 27–Nov. 24	128	1,238.7	0	0.000	PCT: Construction Monitoring
2021	April 26–Sept. 29	74	734.9	0	0.000	PCT: Construction Monitoring
2021	July 9–Oct. 17	29	231.6	0	0.000	NMFS 2021 unpublished data
2022	May 20–June 11	13	108.2	0	0.000	SFD: Construction Monitoring
2022	May 3–May 15 June 27–Aug. 24	70	727	1	0.001	PCT/SFD: Transitional Dredging Monitoring

Source: 61N Environmental 2021, 2022a, 2022b, 2022c; NMFS 2021 unpublished data.

Notes: NMFS = National Marine Fisheries Service; PCT = Petroleum and Cement Terminal; POA = Port of Alaska; SFD = South Floating Dock.

[a] Total observation hours with intermittent in-water pile-driving.

4.3.5 Critical Habitat

On 09 October 2019, NMFS proposed to designate critical habitat for the Western North Pacific, Mexico, and Central America DPSs of humpback whale (84 FR 54354). NMFS issued a *Federal Register* notice on 21 May 2021, to designate critical habitat for the endangered Western North Pacific DPS, the endangered Central America DPS, and the threatened Mexico DPS of humpback whales pursuant to Section 4 of the ESA (86 FR 21082). Critical habitat for the Western North Pacific and Mexico DPSs includes portions of marine waters in Alaska; however, Unit 6 (Cook Inlet Area) is not included in the final critical habitat designation for the Mexico DPS. Only proposed critical habitat for the Mexico DPS would include Unit 6; the Western North Pacific DPS does not include Cook Inlet (84 FR 54354). Therefore, proposed critical habitat for humpback whales does not include the action area.

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Section 5. Environmental Setting

The environmental setting of the action area includes a discussion of general habitat features used by ESA-listed species in the action area, as well as a description of past and present federal, state, or private actions that have affected the status of listed species and the functional condition of primary constituent elements (PCEs or physical or biological features [PBFs]) in critical habitats. The following discussion considers existing environmental conditions as well as past and present activities that could influence, or have influenced, the action area over time.

The POA is located in the lower reaches of Knik Arm of upper Cook Inlet (Figure 1-1); it sits in the industrial waterfront of Anchorage, just south of Cairn Point and north of Ship Creek (latitude 61° 15’ North, longitude 149° 52’ West; Seward Meridian). Knik Arm and Turnagain Arm are the two branches of upper Cook Inlet, and Anchorage is located where the two arms join. Beluga whales move past the POA to access productive feeding areas in upper Knik Arm during late summer and fall.

5.1 Past and Present Disturbances

The environmental baseline has been thoroughly described in previous BiOps issued by NMFS for past projects at the POA (see Section 1.3). In those BiOps, NMFS describes numerous natural and anthropogenic factors that have affected and may continue to affect the Cook Inlet beluga whale in the action area. These include predation, stranding, environmental change, subsistence hunting, commercial fishing, habitat loss or alteration, reduction of prey, pollution, development, and vessel traffic. Of these, continued development in Knik Arm, including that associated with the POA and nearby Port MacKenzie, is an ongoing concern. Development, including renovation, increased dredging requirements, and increased ship traffic, has the potential to contribute to degradation of the aquatic baseline by reduction of foraging habitat and increased disturbance due to noise and vessel presence. As reported by NMFS (2009), “Even though over 90% of Knik Arm remains undeveloped, several planned or proposed projects have been recently identified in a relatively confined portion of lower Knik Arm. The primary concern for beluga whales is that development may restrict passage along Knik Arm.”

5.2 Physical Environment

Cook Inlet is a large tidal estuary that exchanges waters at its mouth with the Gulf of Alaska. The inlet is roughly 20,000 km^2 (7,700 mi^2) in area, with approximately 1,350 linear km (840 mi) of coastline (Rugh et al. 2000) and an average depth of approximately 100 meters (330 ft). Cook Inlet is generally divided into upper and lower regions by the East and West Forelands. Freshwater input to Cook Inlet comes from snowmelt and rivers, many of which are glacially fed and carry high sediment loads. Currents throughout Cook Inlet are strong and tidally periodic, with average velocities ranging from 3 to 6 knots (Sharma and Burrell 1970). Extensive tidal mudflats occur throughout Cook Inlet, especially in the upper reaches, and are exposed at low tides.

Cook Inlet is a seismically active region and has some of the highest tides in North America (NOAA 2015). The inlet also contains substantial quantities of mineral resources including coal, oil, and natural gas. During winter, sea, beach, and river ice are dominant physical forces in Cook Inlet. In upper Cook Inlet, sea ice generally forms in October to November and continues to develop through February or March (Moore et al. 2000).

Knik Arm comprises narrow channels flanked by large tidal flats composed of sand, mud, or gravel, depending upon location. Approximately 60 percent of Knik Arm is exposed at MLLW. The intertidal (tidally influenced) areas of Knik Arm are mudflats, both vegetated and unvegetated, which consist primarily of fine, silt-size glacial flour. Freshwater sources often are glacially born waters that carry high suspended sediment loads, as well as a variety of metals such as zinc, barium, mercury, and cadmium. Surface waters in Cook Inlet typically carry high silt and sediment loads, particularly during summer, making Knik Arm an extremely silty, turbid waterbody with low visibility through the water column. The Matanuska and Knik rivers contribute the majority of fresh water and suspended sediment into Knik Arm during summer. Smaller rivers and creeks also enter along the sides of Knik Arm (U.S. Department of Transportation and POA 2008).

Due to Knik Arm's predominantly shallow depths and narrow widths, tides near Anchorage are greater than those in the main body of Cook Inlet. The tides at the POA have a mean range of 8 meters (26.2 ft), and the maximum water level has been measured at more than 12.5 meters (41 ft) at the Anchorage station (NOAA 2015). Maximum current speeds in Knik Arm, observed during spring ebb tide, exceed 7 knots (12 ft/second). These tides result in strong currents in alternating directions through Knik Arm and a well-mixed water column. The navigation harbor at the POA is a dredged basin in the natural tidal flat. Sediment loads in upper Cook Inlet can be high; spring thaws occur and accompanying river discharges introduce considerable amounts of sediment to the system (Ebersole and Raad 2004). Natural sedimentation processes act to continuously infill the POAs dredged basin each spring and summer.

Other commercial and industrial activities related to maritime operations are located near the POA on Alaska Railroad Corporation property immediately south of the POA on approximately 111 acres at a similar elevation. Ship Creek, stocked with fish twice each summer, serves as an important recreational fishing resource. Ship Creek flows into Knik Arm through the POA industrial area; the mouth of the creek is just south of the proposed CTR Project location.

5.3 Acoustic Environment

In Knik Arm, marine mammals are exposed to natural and anthropogenic sounds. Though much of upper Cook Inlet is a poor acoustic environment characterized by shallow depth, sand and mud bottoms, and high background noise from currents and glacial silt (Blackwell and Greene 2002), vessel use and in-water construction have degraded baseline acoustic conditions for marine mammals, particularly beluga whales that frequent the area.

Ambient sound is background sound comprising many sources from multiple locations (Richardson et al. 1995). Background sound levels measured in 2008 at the MTRP site ranged from 120 to 150 dB rms (Scientific Fishery Systems, Inc. 2009). These measurements included industrial sounds from maritime operations, but ongoing USACE maintenance dredging and pile installation and removal from construction were not underway at the time of the study. Background sound levels measured at the POA during an underwater survey conducted for the POA in 2007 (URS Corporation 2007) recorded highly variable sound pressure levels (SPLs) ranging from 105 to 135 dB referenced to a pressure of 1 microPascal (re 1 µPa rms). Most SPL recordings exceeded 120 dB rms. During periods of strong currents, water flow and strumming resulted in noise levels in excess of 135 dB rms (KABATA 2011). These levels are consistent with other measurements conducted in Cook Inlet by Blackwell (2005). The lower range of broadband (10 to 10,000 Hertz [Hz]) background sound levels obtained during underwater measurements at Port MacKenzie, located across Knik Arm from the POA, ranged from 115 to 133 dB re 1 µPa rms (Blackwell 2005).

Ambient sound levels were measured at the POA during the PAMP 2016 TPP, when ambient sound recordings were measured at two locations during a 3-day break in pile installation. Median ambient noise levels, measured at a location just offshore of the POA SFD and at a second location about 1 km offshore, were 117.0 and 122.2 dB, respectively (POA 2016). The two IHAs for Phase 1 and Phase 2 of PCT construction that were issued by NMFS in April 2020 (85 FR 19294) used 122.2 dB as ambient noise. A recent sound source verification study conducted in 2020 at the PCT did not directly measure ambient noise but did record small durations of background measurements before and after pile installation events, which indicated background levels of between 120 dB and 130 dB near the Port and 115 dB to 125 dB beyond 500 meters from the Port (I&R 2021a). In 2021, ambient noise levels were not measured as part of the PCT Phase 2 acoustic monitoring program, but, again, small durations of background noise levels were captured before and after pile installation events and ranged from 115 to 140 dB, with background levels of 120 to 135 dB within 500 meters of the Port (I&R 2021b). An ambient sound level of 122.2 dB was used to calculate isopleths for vibratory pile installation and removal in the CTR LOA/IHA application.

5.4 Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act defines Essential Fish Habitat (EFH) as "waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The Act notes that:

> *…for the purpose of interpreting the definition of EFH, "waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities, "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species full life cycle.*

EFH is defined by textual and spatial descriptions in the Fishery Management Plans developed by Fishery Management Councils. In Alaska, marine EFH for salmon includes all estuarine and marine areas utilized by salmon of Alaska origin, extending from the influence of tidewater and tidally submerged habitats to the limits of the U.S. Exclusive Economic Zone; marine habitat extends from the MHW line to the 200-nautical-mile limit offshore; the estuarine component includes the area within the MHW line and the salinity transition zone within nearshore waters (NMFS 2005). The North Pacific Fishery Management Council (NPFMC) identifies habitat in Cook Inlet as essential for Pacific salmon and several groundfish species (NPFMC 2020, 2021). Estuarine and marine waters in the vicinity of the Port provide EFH for all stages of Chinook (*Oncorhynchus tshawytscha*), chum (*O. keta*), coho (*O. kisutch*), Sockeye (*O. nerka*), and pink salmon (*O. gorbuscha*) (NPFMC 2021). Freshwater streams, lakes, ponds, wetlands, and other water bodies that support Pacific salmon, as identified by the ADF&G *Anadromous Waters Catalog*, are also considered EFH. Habitat areas of particular concern are areas of special importance that may require additional protection from adverse effects. There are no designated habitat areas of particular concern in the vicinity of the POA.

Researchers have captured salmon, low numbers of Pacific cod (*Gadus macrocephalus*), walleye pollock (*Theragra chalcogramma*), eulachon (*Thaleichthys pacificus*), and saffron cod (*Eleginus gracilis*) in upper Cook Inlet, all of which are primary prey species for the Cook Inlet beluga whale (Houghton et al. 2005; NMFS 2016b). Based on available general distribution data, estuarine and marine waters in the Port's vicinity are designated as EFH for Pacific cod, walleye pollock, sablefish (*Anoplopoma fimbria*), yellowfin sole (*Limanda aspera*), northern rock sole (*Lepidopsetta polyxystra*), southern rock sole (*L. billineta*), Alaska plaice (*Pleuronectes quadrituberculatus*), rex sole (*Glyptocephalus zachirus*), and flathead sole (*Hippoglossoides elassodon*) larvae, and Alaska plaice and dover sole (*Microstomus pacificus*) eggs, all of which may occur in summer; and adult Kamchatka flounder (*Atheresthes evermanni*), which may occur in spring (NPFMC 2020; NOAA 2022). Available data are insufficient to identify EFH for species in the forage fish complex (e.g., eulachon) (Matt Eagleton, personal communication, 01 September 2016; NPFMC 2020).

Details of EFH and the life stages of Fishery Management Plan-managed fish species can be found in the *Port of Alaska Modernization Program Essential Fish Habitat Technical Report – Cargo Terminals Replacement (CTR) Project* (POA 2022).

5.5 Prey Fish

All fish species in Knik Arm are important to the diets of marine mammals, and many are important to recreational sport fishing as catch or prey. The seasonal fish resources in upper Cook Inlet are generally characterized by the spring to fall availability of migratory eulachon, out-migrating salmon smolt, and returning adult salmon, with variable species abundance and distribution throughout summer (Moore et al. 2000). Survey data indicate that Knik Arm, including in the vicinity of the POA, provides migration, rearing, and foraging habitat to a wide diversity of marine and anadromous fish (Federal Highway Administration and Alaska Department of Transportation and Public Facilities 1983; Houghton et al. 2005). NMFS determined that Chinook, sockeye, chum, and coho salmon; Pacific eulachon; Pacific cod; walleye pollock; saffron cod; and yellowfin sole are primary prey species that are essential to the conservation of the Cook Inlet beluga whale (NMFS 2016b).

Biologists captured a total of 19 fish species in Knik Arm during nearshore beach seine and mid-channel surface tow net surveys in 2004 and 2005 (Houghton et al. 2005). Juvenile salmon (five species combined), three-spine stickleback (*Gasterosteus aculeatus*), saffron cod, and eulachon were among the most abundant species captured (Houghton et al. 2005).

Coho salmon was the most abundant juvenile salmon species in April; abundance increased to a peak in July before declining, with smaller numbers present in the nearshore Knik Arm through November (Houghton et al. 2005). Coho, and to a lesser degree sockeye salmon, had the largest and longest presence in Knik Arm of the juvenile salmonids. Juvenile pink and chum salmon had the shortest residency time in Knik Arm compared to other salmon species. Relatively small numbers of juvenile pink and chum salmon were captured in April; numbers peaked in May and June before declining sharply (Houghton et al. 2005). Juvenile Chinook salmon were captured in April; numbers increased to a peak in June and declined in August, with few present through October 2004. Juvenile Chinook salmon captured from between Cairn Point and Point Woronzof were primarily of William Jack Hernandez Sport Fish Hatchery origin (Houghton et al. 2005). Few sockeye were observed in Knik Arm before May, but sockeye were abundant from June through August before declining in September and October (Houghton et al. 2005).

Tow net surveys confirmed the presence of substantial numbers of juvenile salmon throughout the open waters of Knik Arm (Houghton et al. 2005). Juvenile pink and chum salmon were more abundant in mid-channel tow net sampling than nearshore beach seining, which suggests that they may not have a strong association with shorelines in Knik Arm. Higher catches of juvenile coho and Chinook salmon in beach seines, as compared to tow net survey catches, suggest a closer association with shoreline habitat in Knik Arm. The numbers of juvenile sockeye salmon captured during tow net surveys as compared to beach seine hauls did not differ substantially (Houghton et al. 2005).

Based on the spring 1983 and 2004–2005 sampling efforts, Houghton et al. (2005) suggested that the species most likely to contribute to beluga whale diets in Knik Arm include:

- April: Eulachon, saffron cod
- May: Eulachon, Chinook salmon, saffron cod
- June: Chinook salmon, saffron cod (questionable)
- July: Pink, chum, sockeye, and coho salmon
- August: Coho salmon, saffron cod
- September: Saffron cod, longfin smelt
- October: Saffron cod, longfin smelt
- November: Saffron cod

Section 6. Effects of the Action

“Effects of the action” are all consequences to ESA-listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 CFR 402.02).

The potential consequences of the proposed action include:

- Behavioral disturbance due to underwater noise;
- Vessel activity;
- Habitat loss or modification; and
- Effects on prey species.

This section also discusses the potential effects on Cook Inlet beluga whale critical habitat and cumulative effects of the proposed action in combination with ongoing or reasonably foreseeable actions.

6.1 Underwater Noise

The CTR Project will introduce noise into the action area during in-water pile installation and removal and from the operation of vessels during construction. Responses to anthropogenic noise can vary depending on the received SPL, duration of exposure, activity of the animal during exposure, and several other factors (Richardson et al. 1995). Severe effects from noise such as permanent hearing impairment and other physical impacts are not discussed here, as they are not expected as a result of the CTR Project.

The POA anticipates that the most common reaction to project-related underwater noise will be behavioral disturbance. Behavioral disturbance may include subtle changes in behavior or more conspicuous responses such as displacement. Behavioral responses are highly variable and species-specific, depending on numerous aspects of the species and the environment (Richardson et al. 1995). To assess the significance of displacement, it is necessary to characterize the quality of habitats to which the animals relocate and the duration of the displacement. For example, short-term displacement may not be of concern unless the disturbance happens repeatedly.

Increased stress is a type of disturbance that may not be outwardly visible in the behavior of a marine mammal but can have adverse effects on individual health. The level of stress a mammal exhibits varies based on age, sex, season, and health status (Romero et al. 2008). Stress responses generally include displacement to lessen the influence of the stressor. Because most ESA-listed marine mammals that occur in the action area are passing through, underwater noise is not expected to manifest in lasting stress responses.

Underwater noise may also mask marine mammal communication. Vocal changes in response to anthropogenic noise can occur across sounds produced by marine mammals. Changes to vocal behavior and call structure may result from a need to compensate for an increase in background noise. In cetaceans, vocalization changes have been reported from exposure to anthropogenic noise sources such as sonar, vessel noise, and seismic surveying. Vocalizations may increase in amplitude to become more audible or cease altogether (Dunlop et al. 2014).

Temporary threshold shift, or temporary hearing loss, can occur from impulsive noise or sustained exposure to high-intensity noise. In most cases, hearing sensitivity returns rapidly following exposure. Increased vigilance or diversion of focus may result from anthropogenic noise. While these may seem subtle, they can have cascading impacts on foraging, predator avoidance, or reproduction. Such physiological effects are not expected as a result of the CTR Project.

6.1.1 Underwater Noise Criteria for Marine Mammals

Under the ESA, **take** is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct." The ESA further defines **harass** as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." **Harm** is defined "as an act which actually kills or injures wildlife … by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering" (50 CFR 17.3). Under the ESA, there are no acoustic thresholds at which harm or harassment may occur.

In contrast, the MMPA categorizes take as **Level A** or **Level B**. Level A harassment is defined as "any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild." The MMPA defines Level B harassment as "any act of pursuit, torment, or annoyance which has the potential to disturb [but not injure] a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering." NMFS continues to use its Interim Criteria to assess Level B harassment levels. Under the interim guidance, Level B harassment by impulsive sounds, such as impact pile installation, occurs with exposure to an SPL value of 160 dB rms for all marine mammals. Level B harassment by non-impulsive sounds, such as vibratory pile installation and removal, occurs with exposure to an SPL value of 120 dB rms for all marine mammals.

NMFS published updated Technical Guidance (NMFS 2018c) that is currently being used by NMFS to assess effects of exposure to underwater anthropogenic sound on the hearing of marine mammals. The Technical Guidance identifies the received levels, or thresholds, above which individual marine mammals are predicted to experience permanent changes (e.g., a permanent threshold shift [PTS]) in their hearing sensitivity from cumulative incidental exposure to underwater anthropogenic sound sources (NMFS 2018c). Additional information on the Technical Guidance and thresholds for Level A take are provided in the LOA/IHA application submitted to NMFS for CTR (POA 2024).

Although the definition for take under the ESA requires a higher degree of impact on marine mammals than the definition of take under the MMPA, for consistency with the MMPA CTR LOA/IHA application, this BA adopts the MMPA Level B thresholds to define the thresholds for take under the ESA. Potential exposure, or take, estimates are detailed in Section 7 for each ESA-listed species.

6.1.1.1 Description of Noise Sources

For the purposes of this BA, the sound field in Knik Arm is the existing ambient sound plus additional construction noise from the CTR Project. Pile installation and removal are anticipated to produce the highest in-water sound pressure levels. A number of Project activities will take place above marine waters (including welding, cutting, wiring, concrete work, and setting of a prefabricated gangway and ramp), and no in-water noise is anticipated in association with their installation. Some pile installation and removal will take place out of water (in the dry), in areas that are de-watered, and this is not expected to produce elevated in-water sound pressure levels. Vessel noise will be generated by tugs and barges; however, noise from Project vessels is not anticipated to have more than a negligible effect on beluga whales, sea lions, and humpback whales.

Ambient Noise

Ambient noise is background noise that is comprised of many sources from multiple locations (Richardson et al. 1995). Ambient noise can vary with location, time of day, tide, weather, season, and frequency on scales ranging from 1 second to 1 year (Richardson et al. 1995). Ambient underwater noise levels in the Project area are both variable and relatively high, primarily because of extreme tidal activity, elevated sediment loads in the water column, periodic high winds, the seasonal presence of ice, and anthropogenic activities. Sources of anthropogenic noise in the Project area consist of dredging operations, boats, ships, oil and gas operations, construction noise, and aircraft overflights from Joint Base Elmendorf-Richardson, all of which contribute to the high underwater noise levels in upper Cook Inlet (e.g., Blackwell and Greene 2002; KABATA 2011). These levels are consistent with other measurements conducted in Cook Inlet by Blackwell (2005).

Ambient levels were measured near the POA in 2016 at two locations, one within the POA and one about 1 km offshore of the POA, during a 3-day break in pile installation during the POA TPP (Austin et al. 2016). The median values of the background sound pressure levels from continuous 60-second sample averages were 117.0 dB at the nearshore location within the POA and 122.2 dB at the offshore location (POA 2016). During the measurements, some typical sound signals were noted, such as noise from current flow and the passage of vessels. Throughout the data set, the offshore levels were consistently higher than those closer to the POA by 3 to 5 dB. Although different sound metrics were measured, the median levels are thought to be the most appropriate characterization of the nominal ambient conditions. A diurnal pattern to the ambient sound data was not apparent. The two IHAs for PCT Phase 1 and Phase 2 issued by NMFS in April 2020 (85 FR 19294) and the IHA for the SFD issued by NMFS in August 2021 (86 FR 50057) used 122.2 dB as ambient noise. A recent sound source verification study conducted in 2020 at the PCT did not directly measure ambient noise but did not indicate that ambient noise levels were significantly different from 122.2 dB (James Reyff, personal communication, 26 August 2020). Based on these measurements and the application of 122.2 dB for other POA projects, the ambient noise level of 122.2 dB will be used for the Project.

Sound Source Levels

The primary sound-generating activities associated with construction of the Project will be impact hammer installation and vibratory hammer installation and removal of steel pipe piles. Impact hammer pile installation produces impulsive sounds that typically have differing potential to cause physical effects to marine mammals, particularly with regard to hearing. Such sounds have the potential to result in physical injury because they are characterized by a relatively rapid rise in ambient pressure, followed by a period of diminishing, oscillating maximal and minimal pressures. Vibratory hammer installation and removal of steel pipe piles that will primarily be used to build temporary construction components will also take place during construction of the Project.

The most accurate sound source levels (SSLs) were determined for the Project based on site- and Project-specific data when available (Appendix A of the CTR LOA/IHA application [POA 2024]; Table 6-1). Data to verify SSLs were collected at the POA during 3 different years and for a number of pile sizes, hammer types, and sound attenuation types and configurations (Austin et al. 2016; I&R 2021a, 2021b). Unfortunately, the POA was not allowed to collect data on unattenuated pile installation, and measurements were obtained from only a small number of unattenuated piles with authorization from NMFS when extenuating circumstances prevented use of the bubble curtain (Table 6-1).

Vibratory Hammer

U.S. Navy (2015) data were selected as proxies for unattenuated vibratory installation of 24- and 36-inch piles in the POA environment because piles were installed at similar depths (for a more detailed discussion, see Appendix A of the CTR LOA/IHA application [POA 2024]). The source level for unattenuated vibratory installation of 72-inch piles was determined from existing unpublished data (Appendix A of the CTR LOA/IHA application [POA 2024]), and the source level for unattenuated vibratory installation of 144-inch piles was based on an assumed 7-dB reduction with a bubble curtain from the measured value during PCT 2021 construction (I&R 2021b; Table 6-1).

Source levels for unattenuated vibratory removal of 24- and 36-inch piles were determined for POA projects by NMFS as part of the IHA process for the NES1 Project, slated for earlier construction at a neighboring location at the POA. For NES1, the POA proposed to use project- and site-specific SSLs for unattenuated vibratory removal of 24- and 36-inch temporary piles as collected during PCT 2020 construction and reported in I&R (2021a). However, NMFS did not accept those values and chose to evaluate all available data related to unattenuated vibratory removal of 24- and 36-inch steel pipe piles, including data submitted by the POA and measured during the PCT Project. NMFS gathered available data from publicly available reports that reported driving conditions and specified vibratory removal for certain piles. If vibratory removal was not specifically noted for a given pile, it was excluded from the analysis. Mean rms SPLs were converted into pressure values, and pressure values for piles from each project were averaged to give a single value for each project. The calculated project means were then averaged and converted back into units of decibels to give a single recommended SPL for each pile type. The guidance document from NMFS is dated 18 May 2023 and was provided to the POA in an email on the same day.

For 24-inch pile removal, NMFS included 10 pile measurements: 3 from Columbia Crossing in Oregon; 5 from Joint Expeditionary Base Little Creek in Norfolk, Virginia; and 2 from the PCT Project at the POA. NMFS calculated an average SPL for vibratory removal of 24-inch steel pipe piles of 168 dB rms, whereas POA data indicate a value of 167 dB rms (I&R 2021a).

For 36-inch pile removal, NMFS included 40 pile measurements: 38 from the U.S. Navy Test Pile Program at Naval Base Kitsap in Bangor, Washington, and 2 from the PCT Project at the POA. NMFS calculated an average SPL for vibratory removal of 36-inch steel pipe piles of 159 dB rms, whereas POA data indicate a value of 155 dB rms (I&R 2021a; Table 6-1).

Source levels for attenuated vibratory installation and removal of 24-, 36-, and 144-inch piles were measured during PCT construction (I&R 2021a, 2021b). The source level for attenuated vibratory installation of 72-inch piles was based on an assumed 7 dB reduction with a bubble curtain (Table 6-1).

Impact Hammer

U.S. Navy (2015) data were selected as proxies for unattenuated impact installation of 24- and 36-inch piles. Source levels for unattenuated impact installation of 72- and 144-inch piles were estimated by I&R (see Appendix A of the CTR LOA/IHA application [POA 2024]). Source levels for attenuated impact installation of 24-, 36-, and 72-inch piles were was based on an assumed 7 dB reduction with a bubble curtain (Table 6-1). The source level for unattenuated impact installation of 144-inch piles was extrapolated from existing data (see Appendix A of the CTR LOA/IHA application [POA 2024]), and the attenuated value for impact installation of 144-inch piles was measured during PCT construction (I&R 2021b).

Transmission Loss for Pile Installation and Removal

In the PCT Final IHA for Phase 2 of that project (85 FR 19294), the POA proposed and NMFS applied a TL coefficient of 16.5 for assessing potential for Level A and B harassment from unattenuated vibratory pile installation and removal, and 16.5 will be used for the CTR Project. This TL value is supported by site-specific data collected during unattenuated vibratory pile installation (Austin et al. 2016; see Appendix A of the CTR LOA/IHA application [POA 2024]). The POA has applied a practical spreading loss model (15log) for attenuated vibratory pile installation and removal, and for sound exposure level (SEL) and rms for both unattenuated and attenuated impact pile installation (Table 6-1). The 15 TL coefficient falls within the range of TL coefficients reported in I&R (2021a, 2021b) for PCT Phase 1 and also serves as the NMFS default transmission loss value.

Table 6-1. Estimates of Unweighted Underwater Sound Levels Generated during Vibratory and Impact Pile Installation With and Without a Bubble Curtain

Method and Pile Type	Unweighted Sound Level at 10 Meters									
Vibratory Hammer	Unattenuated (Without Bubble Curtain)					Attenuated (With Bubble Curtain)				
	dB rms			TL Coefficient	Data Source for Source Levels	dB rms			TL Coefficient	Data Source for Source Levels
24-inch steel installation	161			16.5[a]	U.S. Navy 2015	158.5			15.0[c] (rms)	I&R 2021a
24-inch steel removal	168				NMFS average 2023[b]	157				I&R 2021a
36-inch steel installation	166				U.S. Navy 2015	160.5				I&R 2021a, 2021b
36-inch steel removal	159				NMFS average 2023[b]	154				I&R 2021a
72-inch steel	171				I&R 2003, unpublished data for Castrol Oil berthing dolphin in Richmond, CA	164				Assumed 7-dB reduction supported by I&R 2021a
144-inch steel	160				Added 7 dB to measured result of 153 dB from attenuated 144-inch piles as reported in I&R 2021b	153				I&R 2021b
Impact Hammer	Unattenuated (Without Bubble Curtain)					Attenuated (With Bubble Curtain)				
	dB rms	dB SEL	dB peak	TL Coefficient	Data Source for Source Levels	dB rms	dB SEL	dB peak	TL Coefficient	Data Source for Source Levels
24-inch steel	193	181	210	15.0[c] (rms) 15.0[c] (SEL)	U.S. Navy 2015	186	174	203	15.0[c] (rms) 15.0[c] (SEL)	Assumed 7-dB reduction supported by I&R 2021a
36-inch steel	193	184	211		U.S. Navy 2015	186	177	204		Assumed 7-dB reduction supported by I&R 2021a
72-inch steel	203	191	217		I&R model; estimate based on interpolation of data for piles 24 to 144 inches in diameter	196	184	210		Assumed 7-dB reduction supported by Caltrans Compendium (Caltrans 2020)
144-inch steel	209	198	221		I&R model; estimate based on interpolation of data for 24-, 36-, 48-, and 96-inch piles	207	193	219		I&R 2021b

Note: dB = decibels; I&R = Illingworth & Rodkin, LLC; rms = root mean square; SEL = sound exposure level; TL = transmission loss.

[a] Austin et al. 2016

[b] NMFS-developed values (see text for details)

[c] NMFS default value (Practical Spreading Loss)

6.1.1.2 Distances to Harassment Isopleths

Sound propagation and the distances to the sound isopleths at which a marine mammal exposed to those values would potentially experience a PTS (Level A harassment) based on the Technical Guidance were estimated using the User Spreadsheet developed by NMFS (NMFS 2018c). The NMFS User Spreadsheet computes the distances to isopleths for the different functional hearing groups based on an unweighted sound level with corresponding distance. The model applies simple Weighting Factor Adjustments for the five functional hearing groups and incorporates a duty cycle to account for the number of pile strikes (NMFS 2018c).

The simple spreading loss to account for sound propagation and the distances to the sound isopleths defined by NMFS for onset of PTS (Level A harassment) and Level B harassment of marine mammals were estimated based on the following formula for transmission loss (TL):

$$TL = TL_c * \log10^{(R/D)}$$

Where

- TL_c is the transmission loss coefficient, typically the NMFS default of 15 and for this Project, 16.5 for unattenuated vibratory pile installation and removal;
- R is the estimated distance to where the sound level is equal to the Level B harassment threshold (122.2 dB for continuous sound and 160 dB for impulsive sound); and
- D is the distance at which the SSL was measured.

The estimated distance to the onset of Level B harassment isopleths can be calculated by rearranging the terms in the above equation to the following:

$$R = D * 10^{(TL/TL_c)}$$

Where

- TL is the difference between the reference SSL in dB rms and the Level B threshold in dB rms (122.2 dB rms for continuous sound or 160 dB rms for impulsive sound); and
- TL_c is the transmission loss coefficient, typically the NMFS default of 15 and for this Project, 16.5 for unattenuated vibratory pile installation and removal.

For estimated distances to the onset of PTS, the SSL is based on the cumulative sound exposure level (SEL_{cum}) over time, which is computed based on the following for continuous sound such as vibratory pile driving:

$$SEL_{cum} = SEL + 10Log_{10}(\text{seconds})$$

And the following for impulsive sound such as impact pile driving:

$$SEL_{cum} = \text{Single-Strike SEL} + 10\ Log_{10}(\text{number of events})$$

Where number of events is expressed as seconds for vibratory pile driving or pile strikes for impact pile driving.

These models were used to predict distances to underwater Level A (PTS) and Level B isopleths generated by pile installation and removal as part of the Project (Table 6-2). Isopleths were calculated for each combination of pile size, hammer, and use of a bubble curtain; and for the number of piles and duration that could be installed each day as identified in Table 2-3 through Table 2-9.

Isopleths were calculated for some pile combinations that are not expected to be used but that could become necessary if an unexpected or high-risk situation arises. For example, it is anticipated that all temporary piles will be installed with a vibratory hammer; however, if an obstruction is encountered that prevents advancement of a temporary pile, use of an impact hammer on that temporary pile may become necessary. Similarly, it is anticipated that a bubble curtain will be used with an impact hammer for all pile sizes when water depths exceed 3 meters, but if a human safety risk materializes, it may be necessary to stabilize the pile by partially installing it. It may not be possible to lift and lay down these large, heavy piles on a barge once they have been stabbed and the impact hammer has been attached. The POA will coordinate with NMFS as soon as possible if construction methods differ significantly from what is proposed here.

The pile combinations that are planned construction methods are indicated in **bold font** in Table 6-. Pile combinations that are not planned construction methods are not in bold font in Table 6-. Level A and Level B isopleths for planned construction methods are shown in Figure 6-1 through Figure 6-10.

Calculated Level A zones for all combinations of functional hearing group, pile size, number of piles per day, and vibratory hammer are smaller than the 100-meter shutdown zone that will be implemented by the POA during pile installation and removal (Table 6-).

Table 6-. Distances to Calculated Level A and B Harassment Isopleths for Pile Installation and Removal

Pile Size	Bubble Curtain	Number of Piles (Duration in Minutes or Strikes per Pile) Per Day	Calculated Level A Zone (m)					Calculated Level B Zone
			LF	MF	HF	PW	OW	
			Humpback and Gray Whale	Beluga and Killer Whale	Harbor Porpoise	Harbor Seal	Steller Sea Lion	
Vibratory Hammer								
24-inch installation	Unattenuated	**4 (30 minutes)**	**11**	**2**	**16**	**7**	**1**	**2,247**
	Attenuated		**8**	**1**	**11**	**5**	**1**	**2,630**
24-inch removal	Unattenuated	**4 (45 minutes)**	**37**	**5**	**53**	**24**	**3**	**5,967**
	Attenuated		**8**	**1**	**12**	**5**	**1**	**2,089**
36-inch installation	Unattenuated	**4 (30 minutes)**	**22**	**3**	**31**	**14**	**2**	**4,514**
	Attenuated		**11**	**1**	**15**	**7**	**1**	**3,575**
36-inch removal	Unattenuated	**4 (45 minutes)**	**11**	**2**	**15**	**7**	**1**	**1,699**
	Attenuated		**5**	**1**	**8**	**3**	**1**	**1,318**
72-inch installation	Unattenuated	**3 (10 minutes)**	**19**	**3**	**27**	**12**	**2**	**9,069**
	Attenuated		**7**	**1**	**11**	**5**	**1**	**6,119**
144-inch installation	Unattenuated	**1 (15 minutes)**	**3**	**1**	**4**	**2**	**1**	**1,954**
	Attenuated		**1**	**1**	**2**	**1**	**1**	**1,131**
Impact Hammer								
24-inch installation	Unattenuated	1 (1,000 strikes)	735	27	876	394	29	1,585
	Attenuated	1 (1,000 strikes)	251	9	299	135	10	541
36-inch installation	Unattenuated	1 (1,000 strikes)	1,165	42	1,387	624	46	1,585
	Attenuated	1 (1,000 strikes)	398	15	474	213	16	541
72-inch installation	Unattenuated	1 (5,743 strikes)	10,936	389	13,026	5,853	427	7,356
	Attenuated	**1 (5,743 strikes)**	**3,734**	**133**	**4,448**	**1,999**	**146**	**2,512**
		2 (5,743 strikes)	**5,928**	**211**	**7,061**	**3,173**	**231**	

<table>
<tr><th rowspan="3">Pile Size</th><th rowspan="3">Bubble Curtain</th><th rowspan="3">Number of Piles (Duration in Minutes or Strikes per Pile) Per Day</th><th colspan="5">Calculated Level A Zone (m)</th><th rowspan="3">Calculated Level B Zone</th></tr>
<tr><th>LF</th><th>MF</th><th>HF</th><th>PW</th><th>OW</th></tr>
<tr><th>Humpback and Gray Whale</th><th>Beluga and Killer Whale</th><th>Harbor Porpoise</th><th>Harbor Seal</th><th>Steller Sea Lion</th></tr>
<tr><td></td><td></td><td>3 (5,743 strikes)</td><td>7,767</td><td>277</td><td>9,252</td><td>4,157</td><td>303</td><td></td></tr>
<tr><td rowspan="3">144-inch installation</td><td>Unattenuated</td><td>1 (5,000 strikes)</td><td>29,201</td><td>1,039</td><td>34,782</td><td>15,627</td><td>1,138</td><td>18,478</td></tr>
<tr><td rowspan="2">Attenuated</td><td>0.5 (2,500 strikes)</td><td>8,539</td><td>304</td><td>10,171</td><td>4,570</td><td>333</td><td rowspan="2">13,594</td></tr>
<tr><td>1 (5,000 strikes)</td><td>13,554</td><td>483</td><td>16,145</td><td>7,254</td><td>529</td></tr>
</table>

Notes: HF = high-frequency; LF = low-frequency; m = meters; MF = mid-frequency; OW = otariid in water; PW = phocid in water.

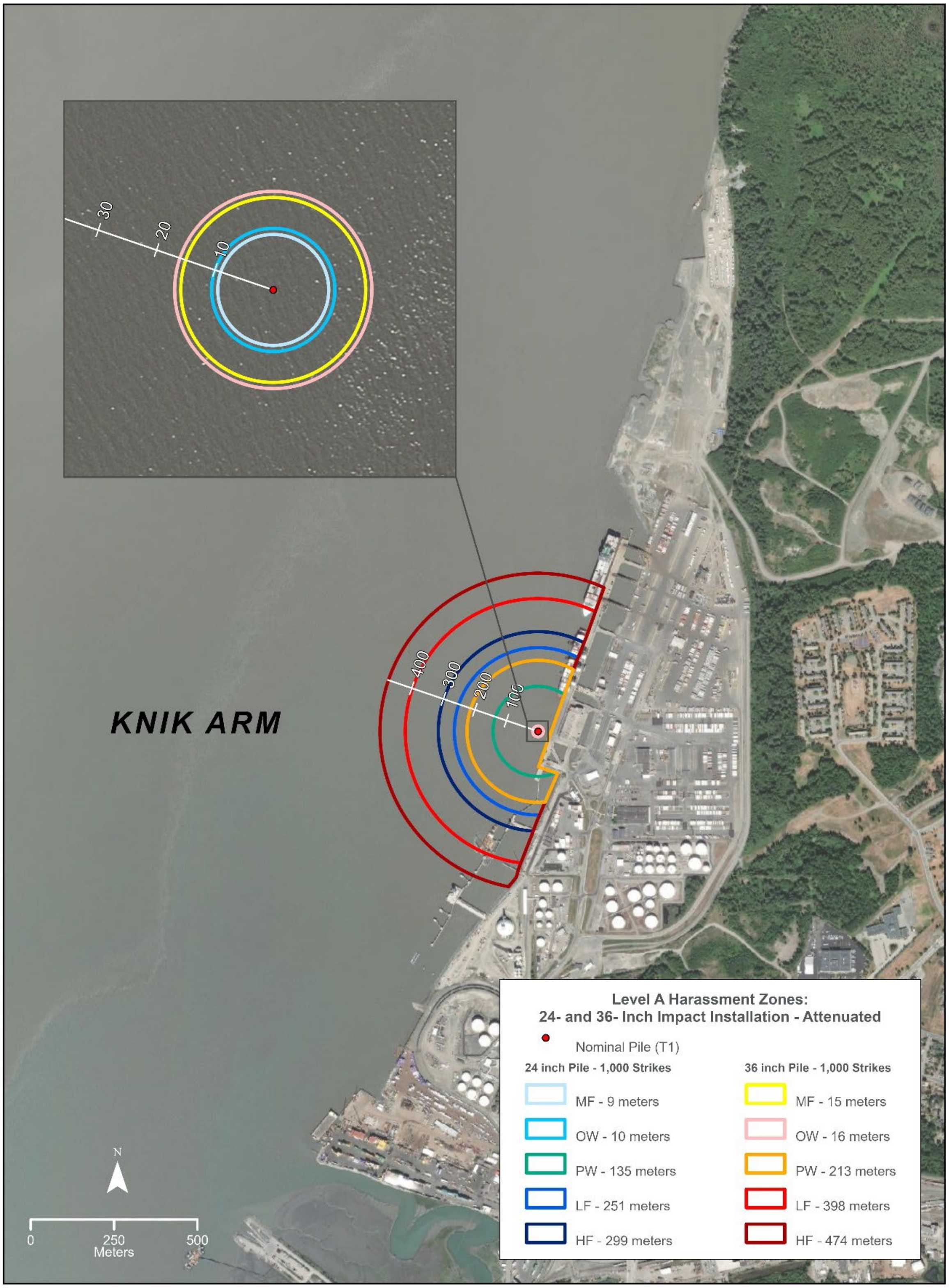

Figure 6-1. Level A Harassment Isopleths for Impact Installation of 24- and 36-Inch Piles (Attenuated) for Production Rate of One Pile per Day

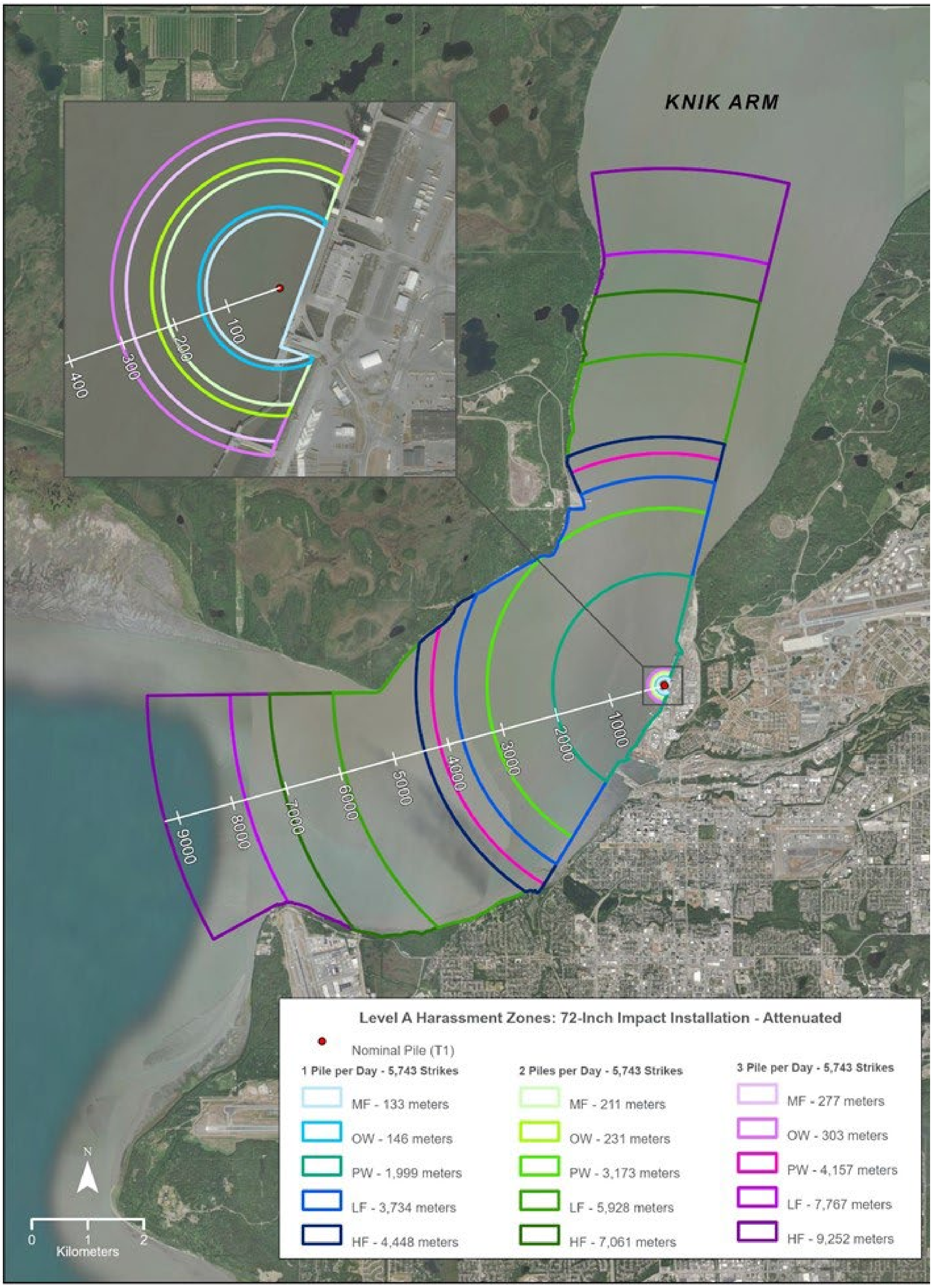

Figure 6-2. Level A Harassment Isopleths for Impact Installation of 72-Inch Piles (Attenuated) for Production Rate of One to Three Piles per Day

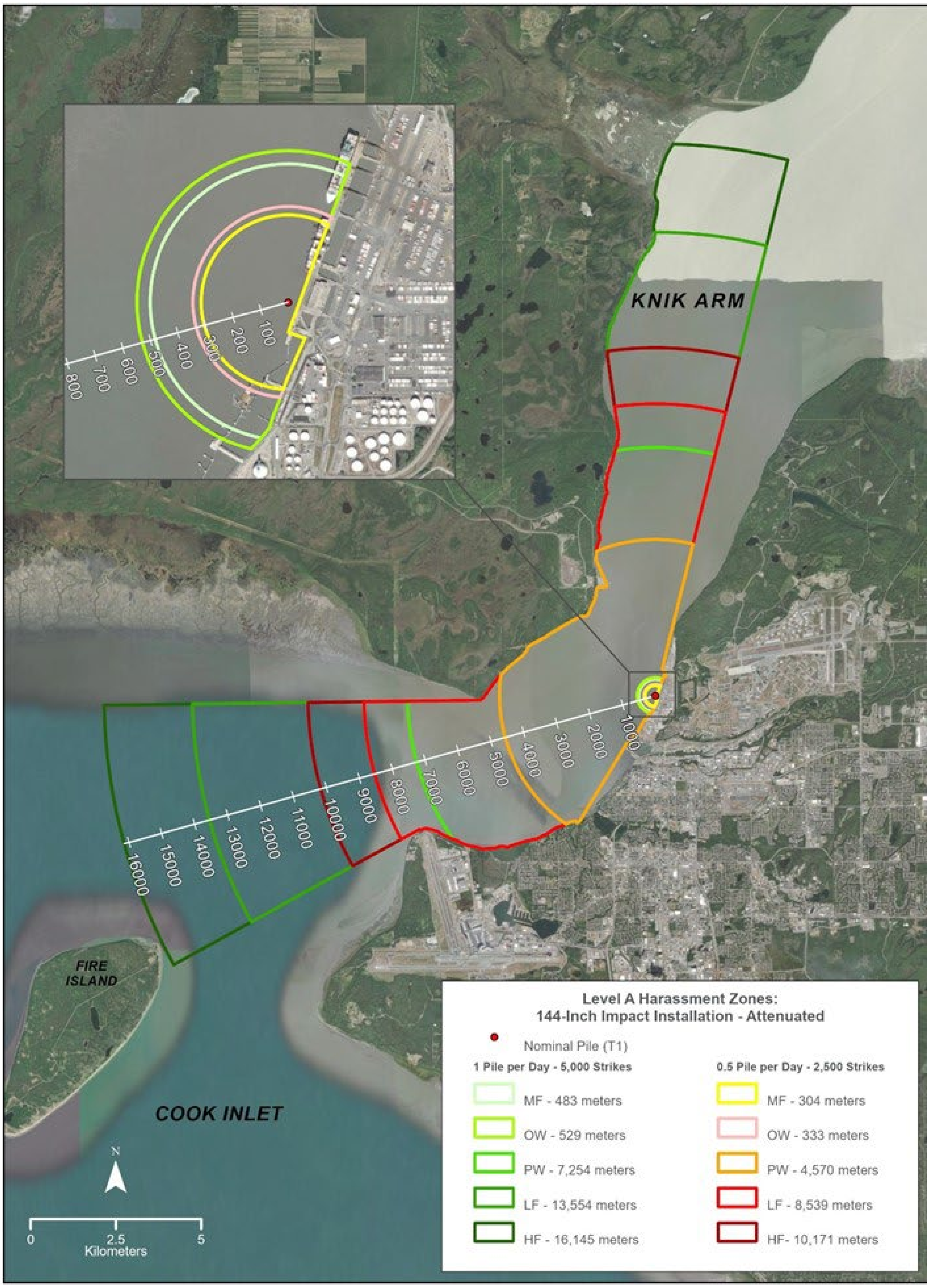

Figure 6-3. Level A Harassment Isopleths for Impact Installation of 144-Inch Piles (Attenuated) for Production Rate of 0.5 or 1 Pile per Day

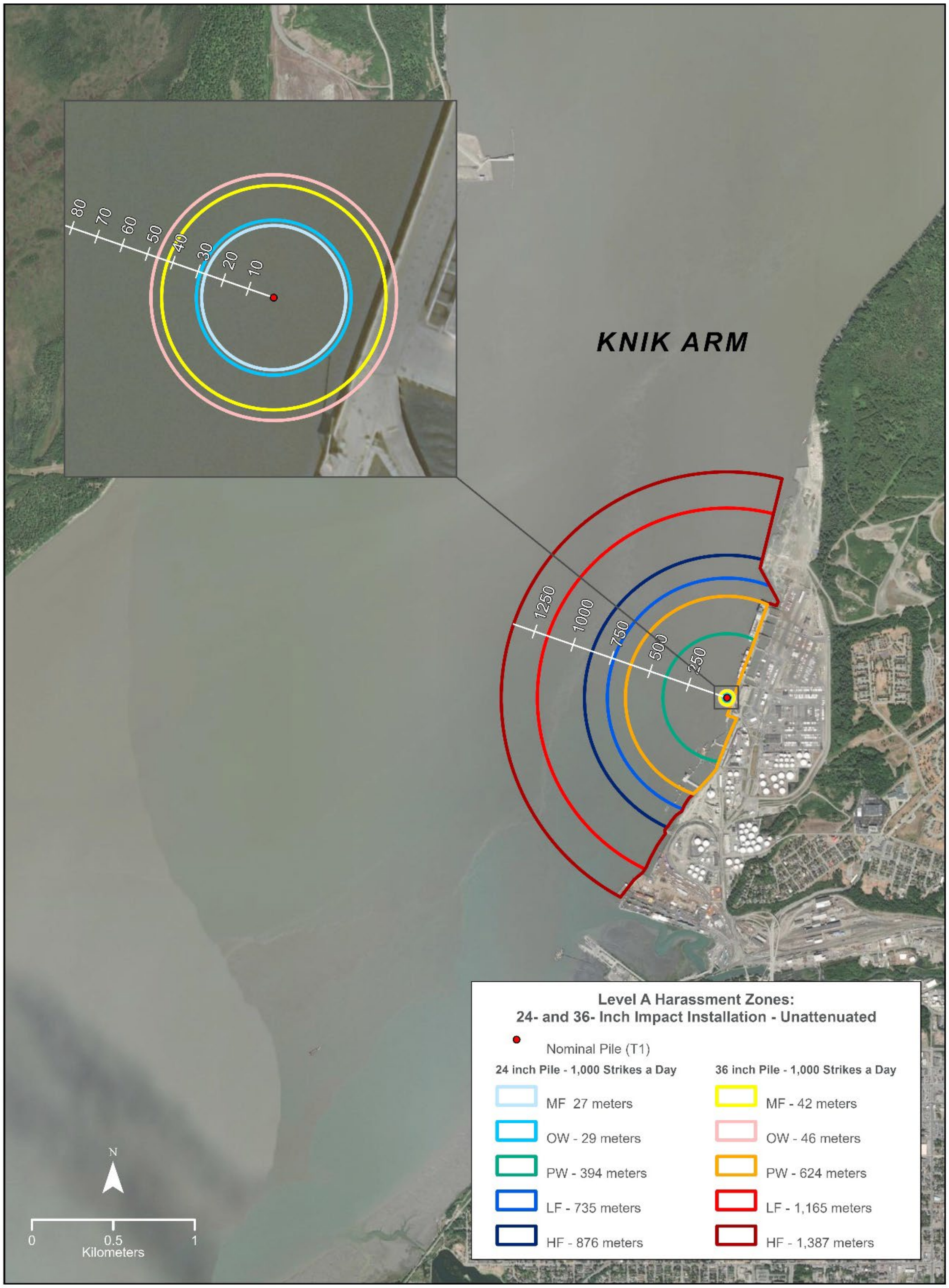

Figure 6-4. Level A Harassment Isopleths for Impact Installation of 24- and 36-Inch Piles (Unattenuated) for Production Rate of One Pile per Day

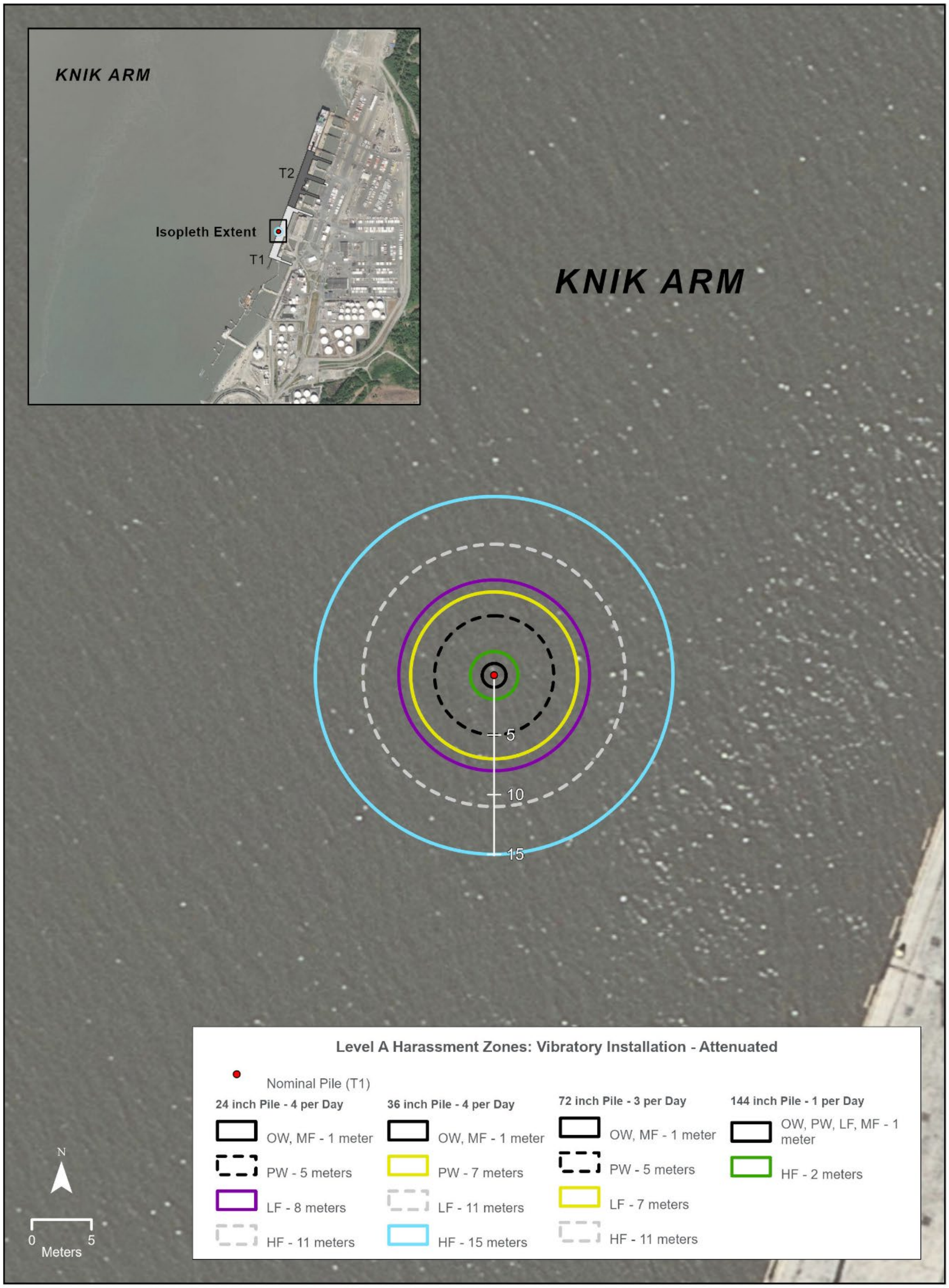

Figure 6-5. Level A Harassment Isopleths for Vibratory Pile Installation (Attenuated)

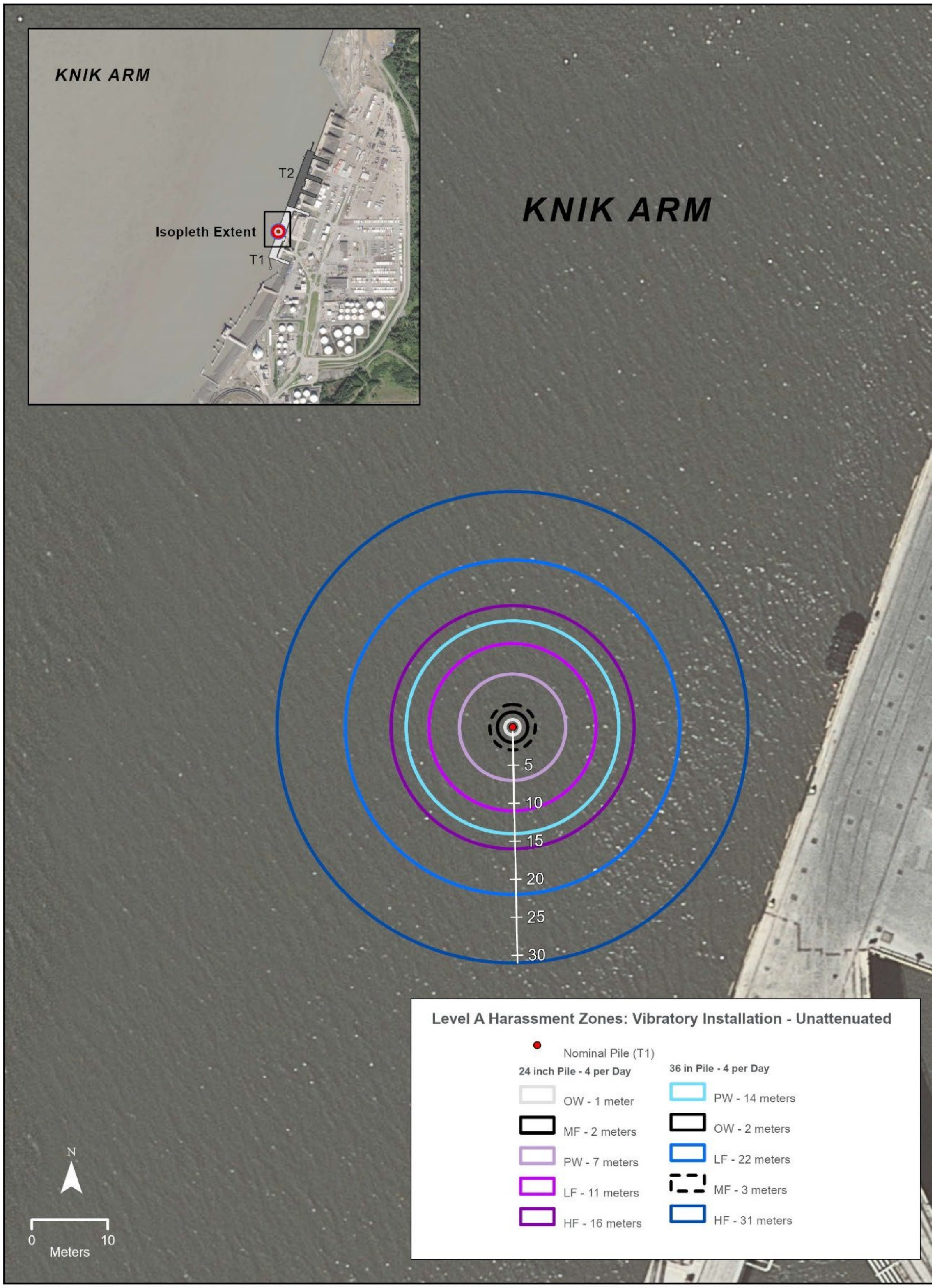

Figure 6-6. Level A Harassment Isopleths for Vibratory Pile Installation (Unattenuated)

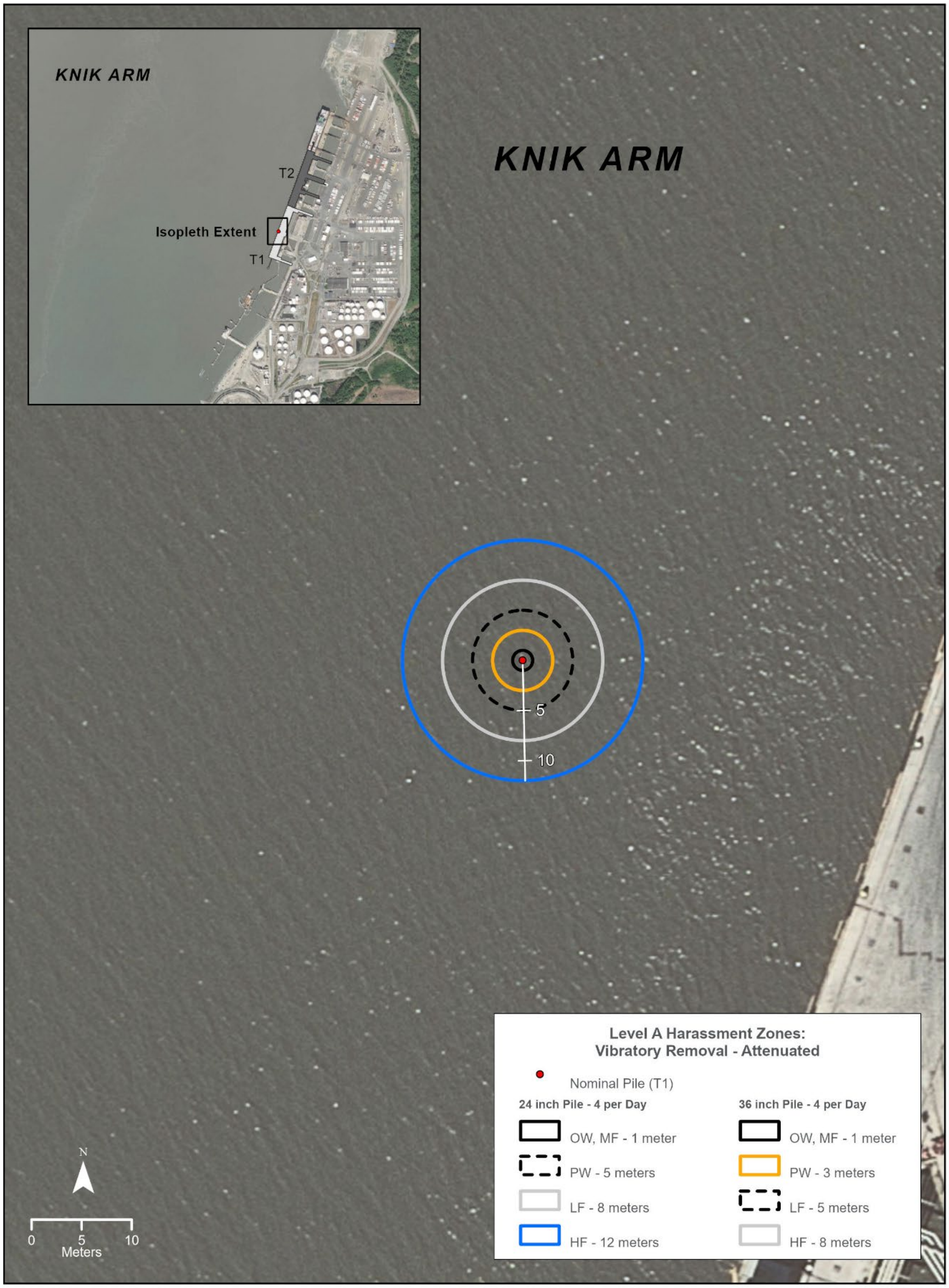

Figure 6-7. Level A Harassment Isopleths for Vibratory Pile Removal (Attenuated)

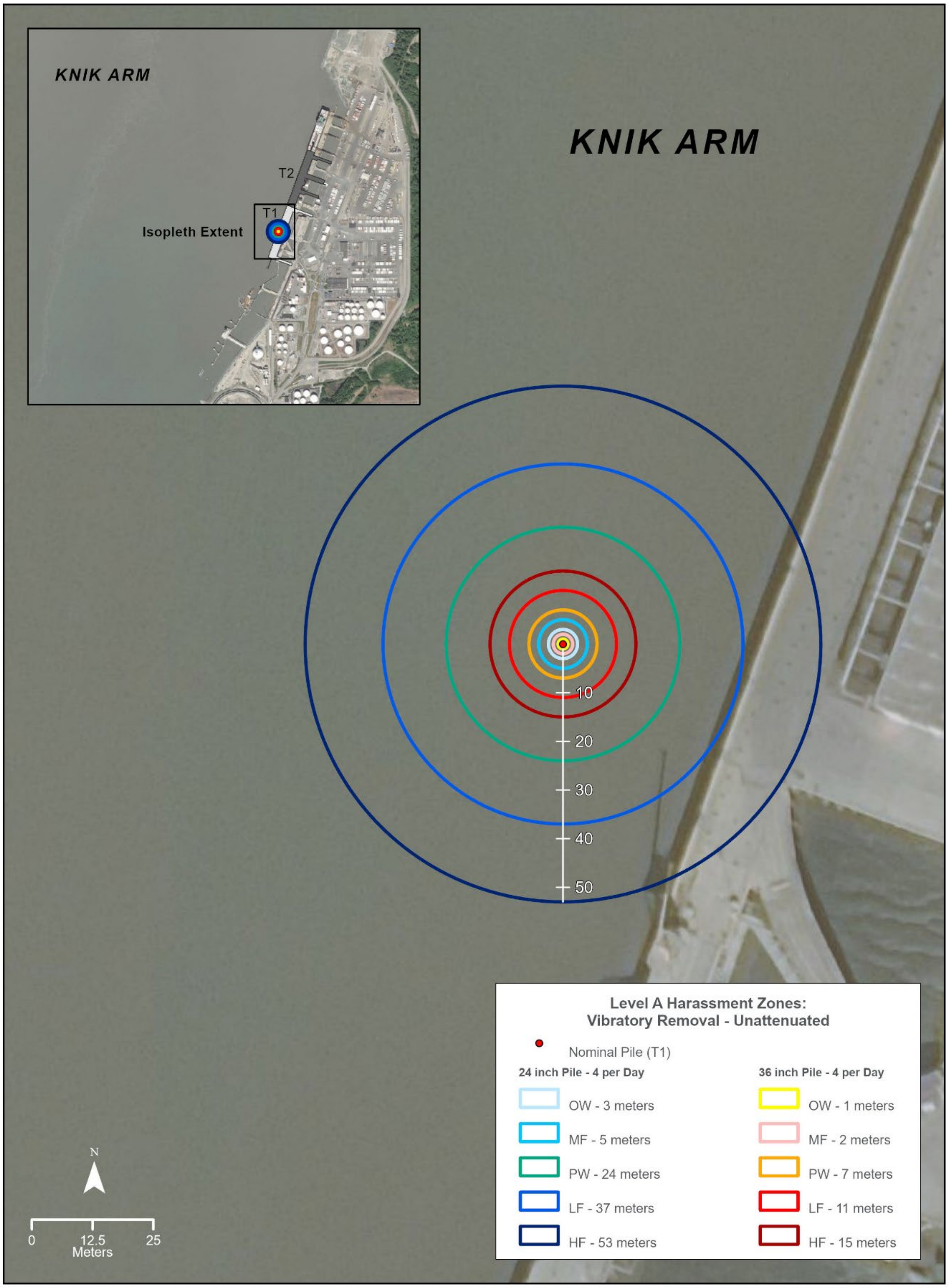

Figure 6-8. Level A Harassment Isopleths for Vibratory Pile Removal (Unattenuated)

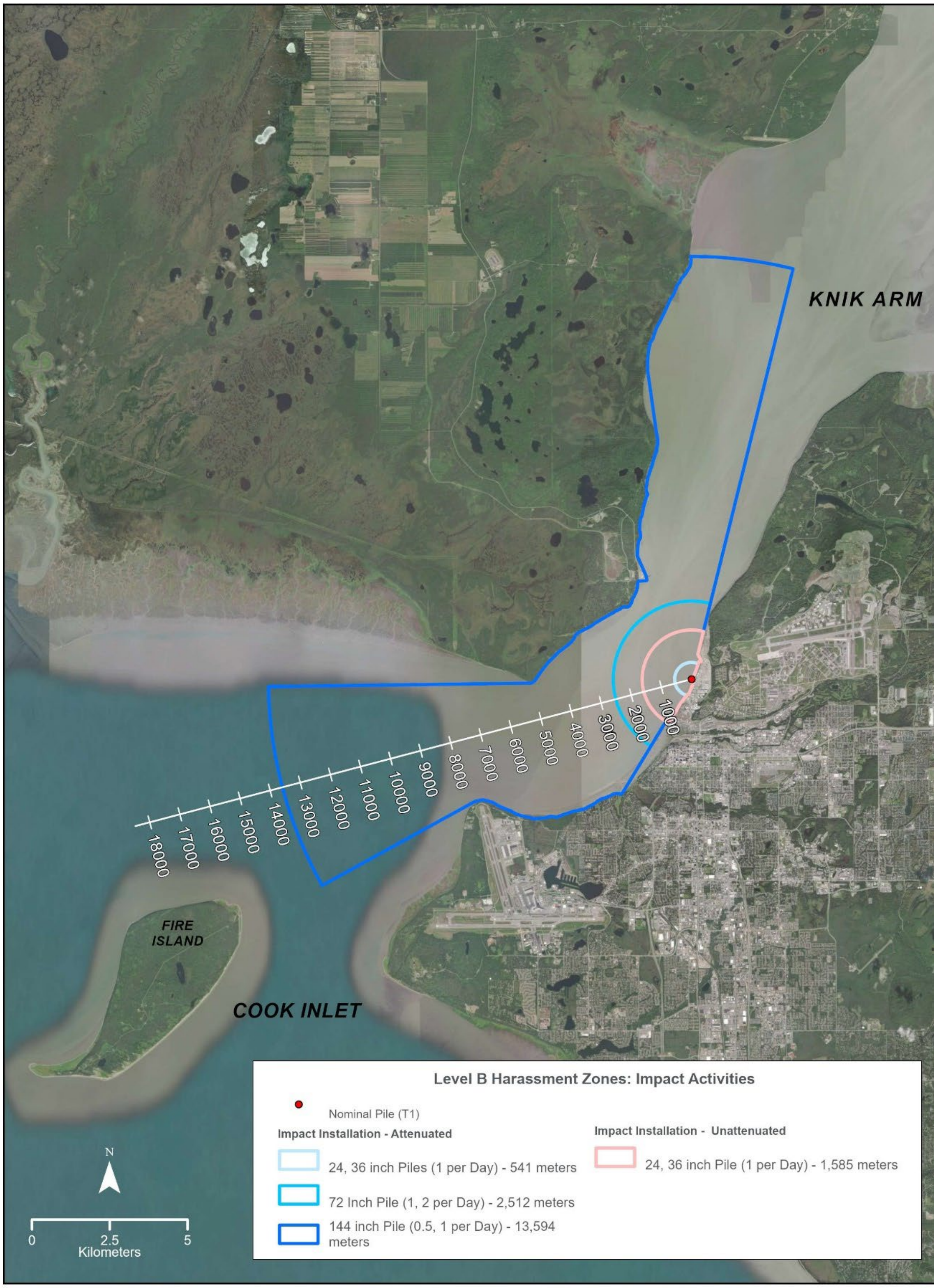

Figure 6-9. Level B Harassment Isopleths for All Pile Sizes for Impact Installation (Attenuated and Unattenuated)

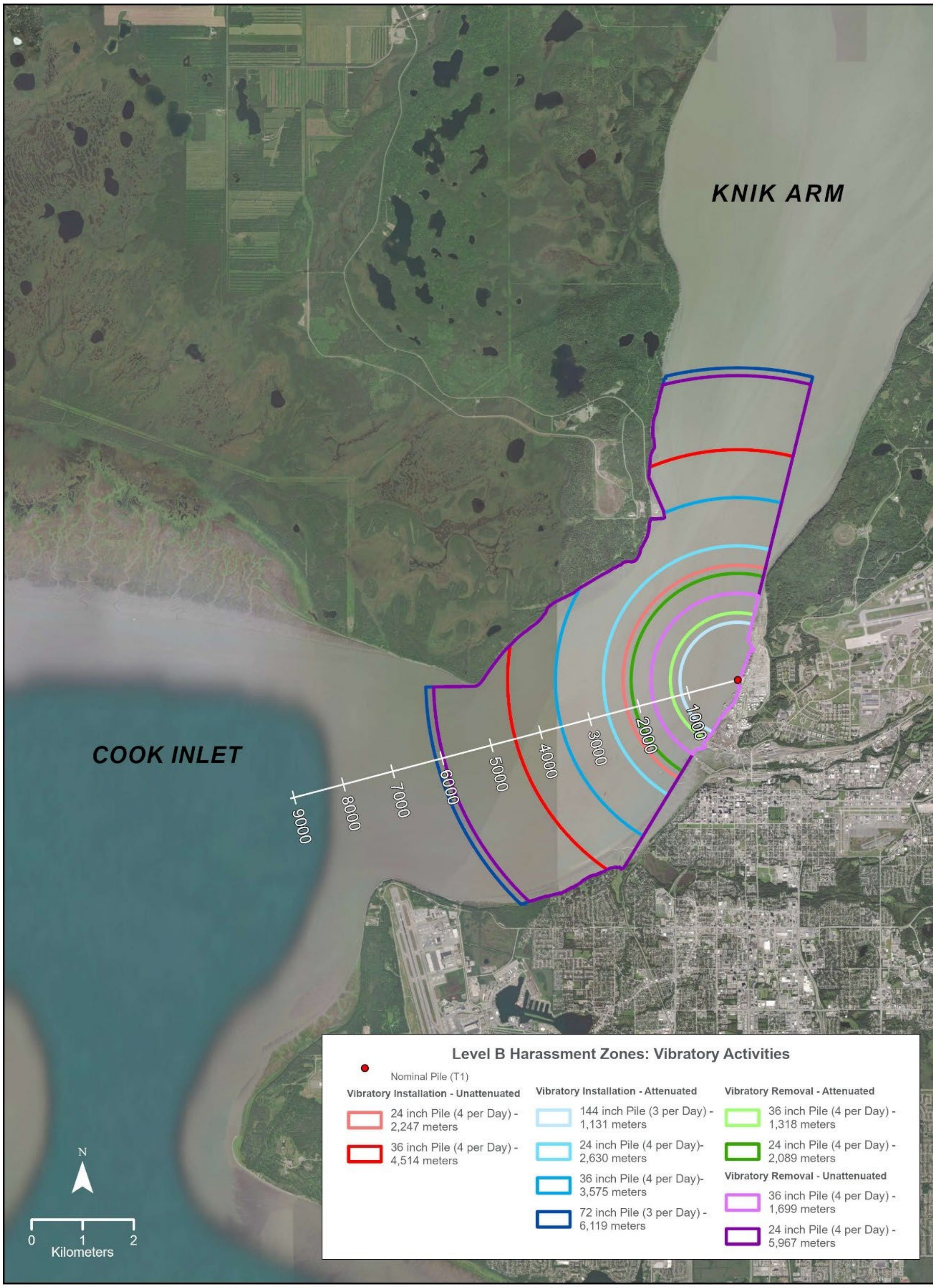

Figure 6-10. Level B Harassment Isopleths for All Pile Sizes for Vibratory Installation and Removal (Attenuated and Unattenuated)

6.1.1.3 Two Hammers

As described in Section 1.3, two or more construction crews may operate two or more hammers to increase productivity during periods with low beluga whale abundance and reduce overall Project duration. At most, two vibratory hammers will be simultaneously active in water at any given time due to the larger ensonified areas associated with simultaneous use of vibratory hammers. No pile removal or installation will occur simultaneously with installation of the two 144-inch piles. Only one vibratory hammer will likely be available for installation of the 72-inch piles, and therefore the only combinations of vibratory hammers that could be used simultaneously would be for installation of an attenuated 72-inch pile and an attenuated temporary pile, an attenuated 72-inch pile and an unattenuated temporary pile, or two temporary piles. To simplify and represent temporary pile installation and removal as well as attenuated and unattenuated conditions, 160.5 dB rms was selected as the attenuated value and 168.0 dB rms was selected as the unattenuated value from Table 6-1.

Simultaneous use of two continuous noise sources such as vibratory hammers can create overlapping sound fields that result in additive effects of sound from the different hammers under certain conditions (Table 6-2; WSDOT 2020). Although the sound from two sources near the same location results in louder sound levels than from a single source, the sound levels cannot be added by standard addition because the decibel is measured on a logarithmic scale. For example, two sounds of equal level (plus or minus 1 dB) combine to raise the sound level by 3 dB. However, if two sounds differ by more than 10 dB, there is no combined increase in the sound level; the higher output covers any other sound. This approach builds on work by the U.S. Department of Transportation (USDOT 1995) and Kinsler (2000). For marine mammal monitoring purposes, if the isopleth from one sound source encompasses a second sound source over a free sound field (i.e., no landmass separating the sound sources), then the sources are considered close enough to be a "combined sound source" and their sound levels are added (WSDOT 2020) to determine the sound isopleth. The resulting isopleth is centered on the "combined source," which is the geometric centroid of the polygon formed by the sound sources.

Table 6-2. Rules for Combining Sound Levels Generated during Pile Installation and Removal

Hammer Types	Difference in SSL	Level A Zones	Level B Zone
Vibratory, Impact	Any	Use impact zones	Use vibratory zone
Impact, Impact	Any	Use zones for each pile size and number of strikes	Use zone for each pile size
Vibratory, Vibratory	0 or 1 dB	Add 3 dB to the higher source level	Add 3 dB to the higher source level
	2 or 3 dB	Add 2 dB to the higher source level	Add 2 dB to the higher source level
	4 to 9 dB	Add 1 dB to the higher source level	Add 1 dB to the higher source level
	10 dB or more	Add 0 dB to the higher source level	Add 0 dB to the higher source level

Source: Modified from USDOT 1995, NMFS 2018c, and WSDOT 2020.

Note: SSL = sound source level; dB = decibels.

At this stage in Project planning, it is impossible to predict when or where each of the two construction crews may be working and which combinations of hammers and pile sizes might occur simultaneously and for how long. Therefore, sound source levels and their resultant Level B zone sizes were calculated for the possible combinations of pile sizes for two vibratory hammers (Table 6-3). For calculations, a transmission loss coefficient of 15 was used for combinations when both piles would be attenuated with a bubble curtain; 16.5 was used when both piles would be unattenuated; and the mean TL of 15.75 was used when one pile would be attenuated with a bubble curtain and one would not (Table 6-3).

Level A zones for all combinations of vibratory hammers, including use of the highest combined SSL of 171 dB rms, TL of 15, and 45 minutes of installation per pile for four pile installations (eight piles total with complete overlap for four 45-minute durations with the largest possible combined SSL, a scenario that would be impossible to realize), remain below 100 meters for all functional hearing groups. Therefore, to simplify management of Level A zones for use of two vibratory hammers simultaneously, the 100-meter shutdown zone will continue to be implemented.

Based on the WSDOT (2020) guidance for use of two impact hammers simultaneously, it is unlikely that the two hammers would operate in synchrony, and therefore, the sound pressure levels are not adjusted, regardless of the distance between the hammers. In this case, each impact hammer is considered to have its own independent harassment zones (Table 6-3). During simultaneous use of an impact hammer and a vibratory hammer, the Level A zones for the impact hammer (Figure 6-11) and the Level B zone for the vibratory hammer are implemented (Table 6-3; WSDOT 2020).

Based on the impossibility of predicting how much overlap in hammer use, if any, could occur over each construction season of the 6 years of planned in-water construction, no adjustments to marine mammal take estimates were made for simultaneous use of two hammers.

Table 6-3. Combined Sound Levels Generated During Pile Installation and Removal for Combinations of Two Hammers; Transmission Loss (TL); and Level B Zone Sizes in Meters

Method			Vibratory			Impact
	Pile Diameter		24- or 36-inch temporary attenuated	24- or 36-inch temporary unattenuated	72-inch attenuated	All
		SSL	160.5	168	164	
Vibratory	24- or 36-inch temporary attenuated	160.5	Added: 163.5 dB TL: 15 5,667 meters	Added: 169 dB TL: 15.75 9,363 meters	Added: 166 dB TL: 15 8,318 meters	No Addition (Level B = Vibratory, Level A = Impact)
	24- or 36-inch temporary unattenuated	168	Added: 169 dB TL: 15.75 9,363 meters	Added: 171 TL: 16.5 9,069 meters	Added: 169 dB TL: 15.75 9,363 meters	
	72-inch attenuated	164	Added: 166 dB TL: 15 8,318 meters	Added: 169 dB TL: 15.75 9,363 meters	NA	
Impact	All		No Addition (Level B = Vibratory, Level A = Impact)			No Addition

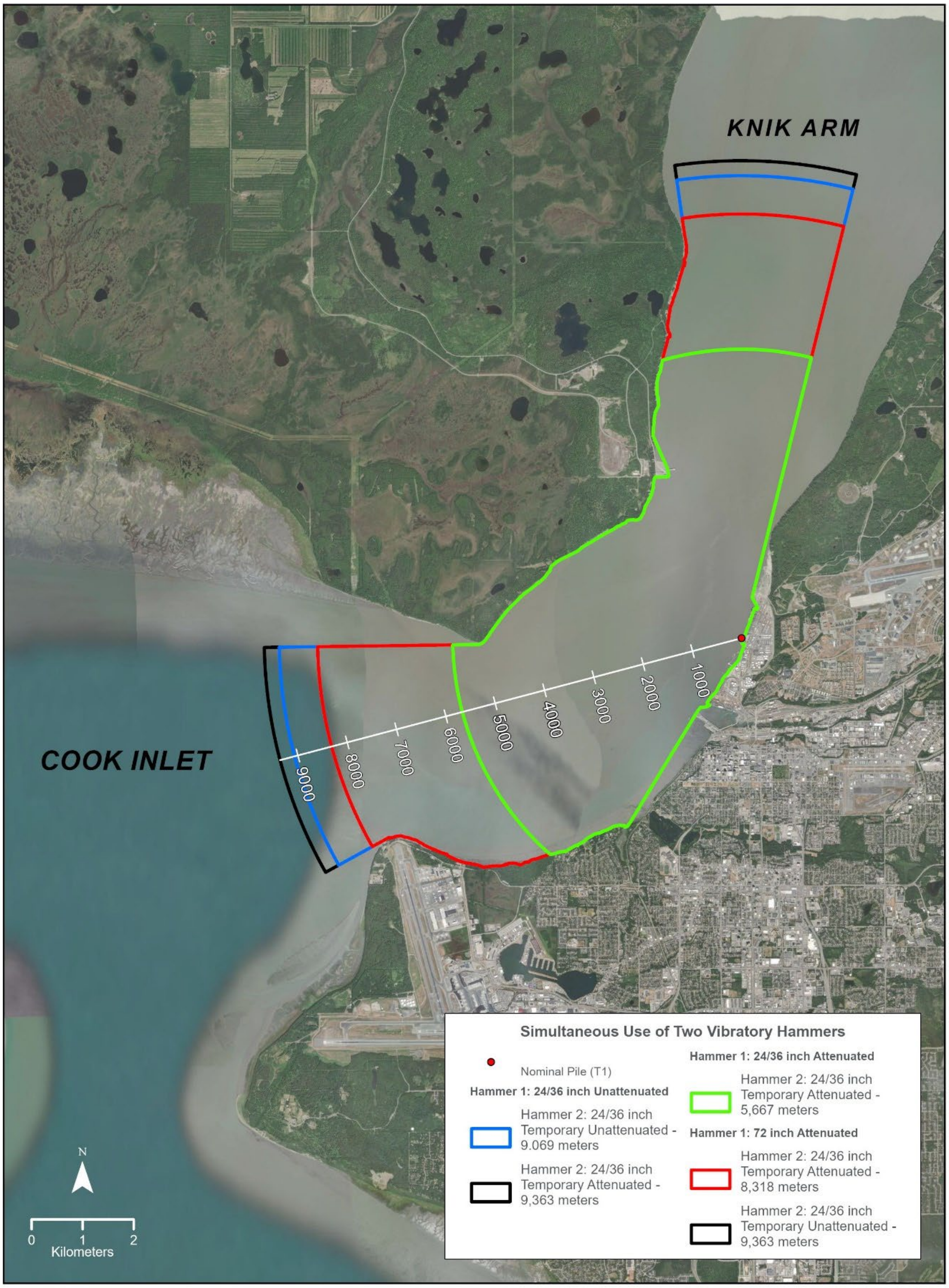

Figure 6-11. Harassment Isopleths for Simultaneous Use of Two Vibratory Hammers (Attenuated and Unattenuated)

6.1.1.4 Marine Mammal Exposure Estimates

Beluga Whale Exposure Estimates

Background

In the past few years of marine construction at the POA, a sighting rate methodology was used by NMFS to calculate potential exposure (take) of beluga whales to elevated sound levels for the PCT (85 FR 19294) and SFD (86 FR 50057) projects. The NMFS sighting rate methodology used data collected during marine mammal observations from 2005 to 2009 (84 FR 72154; Kendall and Cornick 2016; Table 6-4) to calculate hourly sighting rates per calendar month by dividing the total number of beluga whales observed by the total number of observation hours for each given month. For the SFD Project in 2022, observation data from 2020 PCT construction were also incorporated (86 FR 50057; 61N Environmental 2021; Table 6-4).

Table 6-4. Marine Mammal Monitoring Data Used for Beluga Whale Sighting Rate Calculations

Year	Dates of Monitoring Effort	Monitoring Effort			Total Number of Beluga Whale Groups Sighted	Total Number of Beluga Whales	Monitoring Type and Data Source
		# of Days	# of Hours	# of Observers			
2005	Aug. 2–Nov. 28	51	374.4	2	23	156	Pre-Construction Monitoring Kendall and Cornick 2016
2006	April 26–Nov. 3	95	563.8	1	26	82	Pre-Construction Monitoring Kendall and Cornick 2016
2008	June 24–Nov. 14	91	611.5	2	74	283	MTRP: Construction Monitoring Kendall and Cornick 2016
2009	May 4–Nov. 18	112	779.4	2	54	166	MTRP: Construction Monitoring Kendall and Cornick 2016
2020	April 27–Nov. 24	128	1,238.7	11	245	987	PCT: Construction Monitoring 61N Environmental 2021
2021	July 9–Oct. 17	29	231.6	4	113	575	NMFS 2021 unpublished data
	April 26–June 24	74	734.9	11	132	517	PCT: Construction Monitoring 61N Environmental 2022a
	Sept. 7–Sept. 29						
2022	May 20–June 11	13	108.2	11	9	41	SFD: Construction Monitoring 61N Environmental 2022c

Source: Kendall and Cornick 2016; 61N Environmental 2021, 2022a, 2022c.

Notes: 61N Environmental = 61 North Environmental; MTRP = Marine Terminals Redevelopment Project; NMFS = National Marine Fisheries Service; PCT = Petroleum and Cement Terminal; POA = Port of Alaska; SFD = South Floating Dock.

The original sighting rate methodology used by NMFS combined all beluga whale observations from the monitoring efforts between 2005 and 2009 into a monthly sighting rate of beluga whales per hour per calendar month, regardless of the whales' distance from the Project site. At the time, this was an acceptable way to estimate exposure of beluga whales to elevated sound levels using data collected from 2005 to 2009, when one to two MMOs worked simultaneously to locate and track marine mammals from a single location near the POA terminals, sighting distances were limited, and observations were assigned to 1-km^2 grid cells on paper maps. NMFS also found the 2005–2009 monitoring data (Kendall and Cornick 2016) to be the best available data on beluga whale occurrence in upper Cook Inlet at that time and selected this data set for POA use over the data used by Goetz et al. (2012b), which was used for TPP take calculations in 2015 (80 FR 78176).

During 3 successful years of marine construction at the POA (PCT 2020–2021 and SFD 2022), the marine mammal monitoring programs were expanded from previous programs to include 11 MMOs working from four elevated, specially designed monitoring stations located along a 9-km stretch of coastline surrounding the POA. The number of days of data collected varied among years and project (Table 6-4). MMOs used 25-power “big-eye” and handheld binoculars to detect and identify marine mammals, and theodolites to track movements of beluga whale groups over time and collect location data while they remained in view. Distances from beluga whale sightings to the project site from 2020 to 2022 ranged from less than 10 meters up to nearly 15 km. This robust marine mammal monitoring program in place from 2020 through 2022 undoubtedly located, identified, and tracked beluga whales at greater distances from the Project site than previous data collection programs and has contributed to a better understanding of beluga whale movements in upper Cook Inlet.

The expanded marine mammal monitoring programs for the PCT and SFD projects produced a unique and comprehensive data set of beluga whale locations and movements (61N Environmental 2021, 2022a, 2022c) that is the most current data set available for Knik Arm. This data set also includes observations collected over a larger area than the area monitored between 2005 and 2009. Given the evolution of the best available data of beluga whale presence in upper Cook Inlet, particularly regarding the distances at which beluga whales were being observed and documented in more recent monitoring efforts, the original sighting rate methodology was no longer an appropriate approach in calculating take estimates due to its lack of inclusion of a spatial component.

Lack of a geographic or spatial component to the previous methodology means that every observation of beluga whales in Knik Arm was used to produce a single sighting rate that was then used to calculate potential beluga whale take for all activities, regardless of the size of the ensonified area. This method can overestimate potential beluga whale exposures when harassment zones are small because distant whales that never approached the project site are included in the sighting rate. This method also results in exposure estimates that are identical for installation and removal of all pile sizes, with or without a bubble curtain, for all hammer types and areas of ensonification, assuming equal hours of installation.

The new sighting rate methodology allows for more accurate estimation of potential take of beluga whales and therefore allows differentiation of potential effects from these different activities.

The recent and comprehensive data set of beluga whale locations and movements (61N Environmental 2021, 2022a, 2022c) provided the opportunity for refinement of the original sighting rate methodology with the introduction of a new, spatially explicit component using ArcGIS. A spatially modified sighting rate methodology reflects the increased ability of the MMOs implementing the POA’s marine mammal monitoring programs to detect, identify, and track beluga whale groups at greater distances from the Project work site when compared with previous years. Collection of multiple locations of beluga whale groups enabled the creation of tracklines for many groups and the determination of a closest point of approach (CPOA) for each group based on the tracklines or a single recorded location. With the new method, accuracy of the sighting rates is increased because beluga whale groups that did not approach, and were not likely to have approached, the project site close enough to become a Level B exposure were excluded.

Data Source Considerations

Data for 2020, 2021, and 2022 were selected for the updated sighting rate analysis for the CTR Project because they are the most current data available and are therefore more likely to accurately represent future beluga whale attendance at the Project site, which may be affected by beluga whale population size, beluga whale movement patterns through Knik Arm, environmental change including climate change, differences in salmon and other prey abundance among years, and other factors.

To provide information about beluga attendance near the POA during periods when construction monitoring was not occurring, data collected by NMFS on days when PCT Phase 2 construction was not occurring were used to augment the PCT construction data set. The NMFS dataset included 231.6 hours of observation over 47 non-consecutive days from 09 July to 17 October 2021 (NMFS 2021 unpublished data). Effort associated with the NMFS-collected data differed from the POA programs, as the NMFS-funded program utilized only four MMOs and two observation stations along with shorter (4- to 8-hour) observation periods compared to PCT or SFD data collection, which included 11 MMOs, four observation stations, and most observation days lasting close to 10 hours. Despite the differences in effort, the NMFS dataset fills in gaps during the 2021 season when beluga whale presence began to increase from low presence in July and is thus valuable in this analysis.

The older data from 2005 to 2009 published in Kendall and Cornick (2016) (and used by NMFS for sighting rate analyses for the PCT and SFD) were not included in this analysis due to the changes in observation programs and age of the data collected. Monitoring data from the 2016 TPP (Cornick and Seagars 2016) were not included in the analysis because of limited hours observed, limited seasonal coverage, and differences in the observation programs.

CPOA Methodology for Calculating Sighting Rates

The POA, under guidance from and in collaboration with NMFS, has developed a sighting rate methodology for the CTR Project that includes a spatial component to more accurately estimate the number of potential beluga whale exposures based on the sound levels of specific in-water activities and the time of year the activity is expected to occur. Instead of including all beluga whale sightings regardless of distance from the Project site, data from the marine mammal observation programs associated with each year of construction (61N Environmental 2021, 2022a, 2022c) and data collected during PCT 2021 construction by a NMFS-funded non-construction observation effort (NMFS 2021 unpublished data) were used to create hourly sighting rates. The revised hourly sightings rates were calculated per calendar month (beluga whales per hour per month) for each Project activity based on the CPOA to the Project site of each beluga whale group observed. This same methodology was used for the POA's NES1 Project.

The CPOA for each beluga whale group was calculated in ArcGIS software using the GPS coordinates provided for documented sightings of each group (for details on data collection methods, see 61N Environmental 2021, 2022a, 2022c) and the CTR location midpoint, centered on the Project site between T1 and T2. A group was defined as a sighting of one or more beluga whales as determined during data collection. When more than one documented sighting for a given beluga whale group was available, a trackline was produced that connected each sighting for each group with straight lines. The nearest distance of either the trackline or single point to the midpoint of CTR was then calculated. If a group had only one documented sighting, that single sighting location was used as the CPOA. The most distant CPOA to the Project was 11,138 meters, and the closest CPOA was 6 meters.

During the NES1 permitting process, the POA initially proposed to calculate beluga whale sighting rates based on the CPOA and the radius of the calculated acoustic Level B harassment zone. For example, with the NES1 Project, the Level B harassment zone for sheet pile removal is 1,954 meters, and the sighting rate proposed by the POA included all beluga whale groups with a CPOA within that radius of the NES1 Project site plus a 500-meter buffer. However, NMFS preferred an alternative analysis that they believed would align more closely with beluga whale behavior. The POA proposed, and NMFS accepted, a piecewise regression model that detected breakpoints in the cumulative density distribution of the CPOA locations that related to known beluga whale distribution and behavior. This methodology, refined during the NES1 process, has been continued here.

To determine the distance thresholds at which the sighting rate (beluga whales per linear distance from the Project site) statistically changed, a piecewise regression model was run in R version 4.2 (R Core Team 2022). Using the "Segmented" package (Muggeo 2020), the breakpoint value of each two segments was identified following this equation:

$$y_i = \begin{cases} \beta_0 + \beta_i + e_i, x_i \leq \alpha \\ \beta_0 + \beta_i x_i + \beta_{i+1}(x_i - \alpha) + e_i,\ x_i > \alpha \end{cases}$$

where y is cumulative density, x is the distance from the shoreline to the CPOA of each beluga group, α is the breakpoint between two segments (the threshold), *e* is the error, β_0 is the slope intercept, β_i is the slope of the line, and β_{i+1} is the difference in slopes between lines (Toms and Lesperance 2003). This analysis identified breakpoints at 195.7 meters, 2,337.0 meters, 3,154.7 meters, and 6,973.9 meters (Figure 6-12).

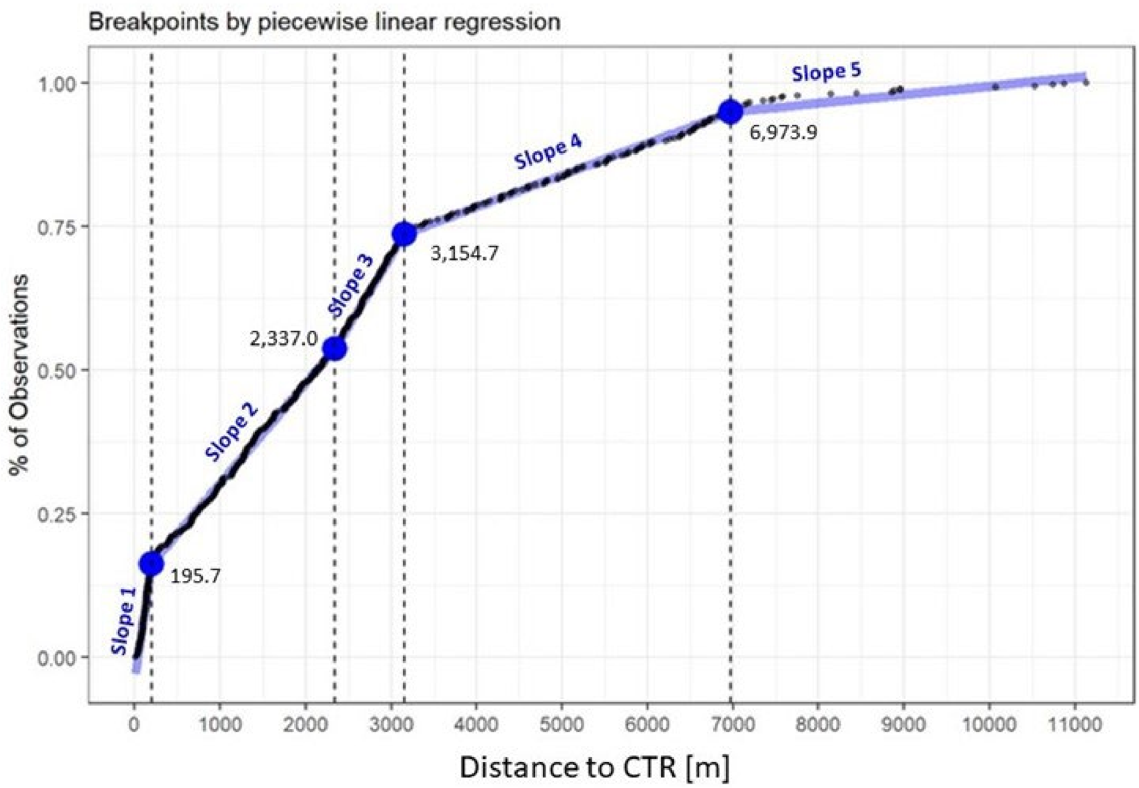

Figure 6-12. CPOA Observations Sorted Using the Empirical Cumulative Distribution Function and Associated Breakpoints Determined by Piecewise Linear Regression

Piecewise regression is a common tool for modeling ecological thresholds (Atwood et al. 2016; Whitehead 2016; Lopez et al. 2020). In a scenario similar to the one outlined above, Mayette et al. (2022) used piecewise regression to model the distances between two individual beluga whales in a group in a nearshore and a far shore environment. For the POA's analysis, the breakpoints detect a change in the frequency of beluga whale groups sighted, and the slope of the line between two points indicates the magnitude of change. A greater positive slope indicates a greater accumulation of sightings over the linear distance (x-axis) between the defining breakpoints, whereas a more level slope (i.e., closer to zero) indicates a lower accumulation of sightings over that linear distance (x-axis) between those defining breakpoints (Figure 6-12; Table 6-5).

Table 6-5. Slope Estimates for Empirical Cumulative Distribution Function

Slope	Estimate	Standard Error	Upper CI (95%)	Lower CI (95%)
Slope 1	0.0010131	1.30E-05	0.0009876	0.0010387
Slope 2	0.0001747	7.00E-07	0.0001734	0.0001760
Slope 3	0.0002455	2.40E-06	0.0002407	0.0002502
Slope 4	0.0000557	4.00E-07	0.0000548	0.0000566
Slope 5	0.0000148	8.00E-07	0.0000132	0.0000164

Note: CI = Confidence Interval.

The breakpoints identified by the piecewise regression analysis match what is known about beluga whale behavior in Knik Arm. Observation location data collected during POA monitoring programs indicate that beluga whales were consistently found in higher numbers in the nearshore areas along both shorelines, and were found in lower numbers in the open waters in the center of the Arm. Tracklines of beluga whale group movements collected from 2020 to 2022 show that detected beluga groups displayed a variety of movement patterns that included swimming close to shore past the POA on the east side of Knik Arm (defined by breakpoint 1 at 195.7 meters), with fewer beluga whales swimming in the center of Knik Arm (breakpoints 1 to 2, 195.7 to 2,337.0 meters). Beluga whales commonly swam past the POA close to shore on the west side of Knik Arm, with no beluga whales able to swim farther from the POA in that area than the far shore (breakpoints 2 to 3, 2,337.0 to 3,154.7 meters). Behaviors and locations beyond breakpoint 4 (6,973.9 meters) include swimming past the mouth of Knik Arm between the Susitna River area and Turnagain Arm; milling at the mouth of Knik Arm but not entering the Arm; and milling to the northwest of the POA without exiting Knik Arm. The shallowness of slope 5, at distances greater than 6,973.9 meters, could be due to detection falloff from a proximity (distance) bias, which would occur when MMOs are less likely to detect beluga whale groups that are farther away than groups that are closer.

The distances from the CTR Project site detected by the breakpoint analysis were used to define five sighting rate distance bins for calculation of beluga whale exposure (take). Each breakpoint (195.7 meters, 2,337.0 meters, 3,154.7 meters, and 6,973.9 meters, and the complete data set of observations [greater than 6,973.9 meters]) was rounded up to the nearest meter and considered the outermost limit of each sighting rate bin, resulting in five identified bins (Table 6-6).

To determine the number of marine mammal Level B takes required for the Project, Level B harassment isopleths were calculated for each pile size and hammer expected to create elevated noise levels (Table 6-). For beluga whales, the sighting rate for each Level B isopleth was determined by identifying the sighting rate distance bin with the distance closest to and not exceeding the corresponding Level B harassment isopleth (i.e., the sighting rate distance bin that the Level B isopleth falls within was selected). All beluga whale sightings within that sighting rate distance bin for all years were summed and divided by the number of hours of observation for all years, giving the number of beluga whales per hour per month for each sighting rate distance bin (Table 6-6). The number of hours expected from each activity was then multiplied by the sighting rate to determine the number of beluga whales expected to be seen that could potentially be exposed to elevated sound levels during the specified activity.

Table 6-6. Beluga Whale Monthly Sighting Rates for Different Bin Sizes

Bin Number	Distance (meters)	Beluga Whales/Hour							
		April	May	June	July	August	Sept.	Oct.	Nov.
1	196	0.05	0.06	0.10	0.04	0.82	0.59	0.51	0.10
2	2,338	0.34	0.16	0.15	0.09	1.55	1.42	1.09	0.65
3	3,155	0.36	0.22	0.21	0.09	2.02	1.89	1.98	0.72
4	6,974	0.67	0.33	0.29	0.13	2.24	2.18	2.42	0.73
5	>6,974	0.71	0.39	0.30	0.13	2.29	2.23	2.56	0.73

Beluga Whale Exposure Estimates

Take estimates for Cook Inlet beluga whales were calculated by multiplying the total number of vibratory and impact installation or removal hours per month for each activity based on the anticipated construction schedule (Table 2-10) with the corresponding sighting rate (beluga whales per hour per month) and sighting rate distance bin (Table 6-7). Calculations were based on using a bubble curtain system during impact and vibratory pile installation of permanent 72- and 144-inch piles in all months and when water depth is greater than 3 meters; and using a bubble curtain system on all piles during months with historically higher beluga whale abundance (August through October) when water depth is greater than 3 meters. Only temporary piles will be installed (and removed) without a bubble curtain during months with low beluga whale abundance (April through July and November).

Table 6-7. Allocation of Each Level B Isopleth to a Sighting Rate Bin and Beluga Whale Monthly Sighting Rates for Different Pile Sizes and Hammer Types

Activity	Level B Isopleth Distance (m)	Sighting Rate Bin Number and Distance	Beluga Whales/Hour							
			April	May	June	July	Aug.	Sept.	Oct.	Nov.
Unattenuated Values (without the use of a bubble curtain)										
36-Inch Vibratory Installation	4,514	4 (6,974 m)	0.67	0.33	0.29	0.13	2.24	2.18	2.42	0.73
36-Inch Vibratory Removal	1,699	2 (2,338 m)	0.34	0.16	0.15	0.09	1.55	1.42	1.09	0.65
Attenuated Values (with the use of a bubble curtain)										
36-Inch Vibratory Installation	3,575	4 (6,974 m)	0.67	0.33	0.29	0.13	2.24	2.18	2.42	0.73
36-Inch Vibratory Removal	1,318	2 (2,338 m)	0.34	0.16	0.15	0.09	1.55	1.42	1.09	0.65
36-Inch Impact Installation	541	2 (2,338 m)	0.34	0.16	0.15	0.09	1.55	1.42	1.09	0.65
72-Inch Vibratory Installation	6,119	4 (6,974 m)	0.67	0.33	0.29	0.13	2.24	2.18	2.42	0.73
72-Inch Impact Installation	2,512	3 (3,155 m)	0.36	0.22	0.21	0.09	2.02	1.89	1.98	0.72
144-Inch Vibratory Installation	1,131	2 (2,338 m)	0.34	0.16	0.15	0.09	1.55	1.42	1.09	0.65
144-Inch Impact Installation	13,594	5 (>6,974 m)	0.71	0.39	0.30	0.13	2.29	2.23	2.56	0.73
Observation Hours/Month[a]			87.9	615.1	571.6	246.9	224.5	326.2	109.5	132.0

Note: m = meters.

[a] Observation hours have been totaled from the PCT 2020 and 2021 programs, the NMFS 2021 data collection effort, and the SFD 2022 construction (61N Environmental 2021, 2022a, 2022c, and NMFS 2021 unpublished data). November sighting rates were not used in calculations but are included here for completeness.

As described in Section 2, CTR construction is anticipated to take place from April through November, 2025–2031. Although the allocation of work effort among months is not known with certainty, the hours for installation and removal of piles have been approximately evenly distributed between construction months (Table 2-10). The total hours of impact pile installation and vibratory pile installation or removal for each month were then multiplied by the sighting rate for that month and bin, and the resulting estimated beluga whale exposures were totaled for all activities in each month (Table 6-8). Using the monthly activity estimates in hours and monthly beluga whales/hour calculated rate, it is estimated that up to 801.09 (rounded up to 802) beluga whales potentially may be exposed to Level B harassment over the 6 years of in-water construction (Table 6-8).

Table 6-8. Beluga Whale Monthly and Total Estimated Level B Take

Beluga Whale Monthly and Total Estimated Level B Take									
Year 1	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Total**
36-Inch Vibratory Installation and Removal	1.93	2.13	1.88	0.85	14.63	14.16	8.08	1.96	43.66
72-Inch Vibratory and Impact Installation	3.17	4.13	3.88	1.71	29.45	27.67	29.19	4.62	99.20
								Year 1 Total	**142.86**
Year 2	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Total**
36-Inch Vibratory Installation and Removal	2.27	1.80	1.58	0.72	12.39	11.98	6.87	1.47	37.60
72-Inch Vibratory and Impact Installation	3.17	3.38	3.17	1.40	29.45	24.60	25.95	4.62	91.12
								Year 2 Total	**128.71**
Year 3	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Total**
36-Inch Vibratory Installation and Removal	4.62	4.72	4.16	1.89	31.51	30.50	16.55	1.96	93.95
72-Inch Vibratory and Impact Installation	2.53	1.50	1.41	0.47	9.82	9.22	9.73	3.46	34.68
								Year 3 Total	**128.64**
Year 4	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Total**
36-Inch Vibratory Installation and Removal	1.93	1.97	1.73	0.85	13.51	13.07	6.87	1.47	39.92
72-Inch Vibratory and Impact Installation	3.17	3.38	3.17	1.40	29.45	24.60	25.95	4.62	91.12
								Year 4 Total	**131.03**
Year 5	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Total**
36-Inch Vibratory Installation and Removal	1.93	2.13	1.88	0.85	14.63	13.07	14.13	2.33	48.62
72-Inch Vibratory and Impact Installation	1.90	3.38	3.17	1.40	26.18	24.60	25.95	3.46	86.58
								Year 5 Total	**135.19**
Year 6	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Total**
36-Inch Vibratory Installation and Removal	1.93	1.80	1.58	0.72	12.39	15.16	12.99	6.36	46.57
72-Inch Vibratory and Impact Installation	1.90	3.38	3.17	1.40	26.18	24.60	25.95	3.46	86.58
144-Inch Vibratory and Impact Installation[a]	0.00	1.51	1.19	0.53	0.00	0.00	0.00	0.00	1.51
								Year 6 Total	**134.66**

Note: Numbers may not sum exactly due to rounding.

[a] It is unknown in which month the 144-inch monopile dolphins will be installed, and therefore, the highest value for two piles driven in the highest density month (May) of the low-density months (May–July) was used for the total for Year 6**.** POA has committed to not installing 144-inch piles in the highest beluga density months.

For the PCT and SFD projects, NMFS accounted for the implementation of mitigation measures by applying an adjustment factor to beluga whale take estimates since some Level B harassment takes would likely be avoided based on required shutdowns for beluga whales at the Level B harassment zones. For the PCT Project, NMFS compared the number of realized takes at the POA to the number of authorized takes for previous projects from 2008 to 2017 and found that the percentage of realized takes ranged from 12 to 59 percent with an average of 36 percent (84 FR 72154; Table 6-9). NMFS then applied the highest percentage of previous realized takes (59 percent during the 2009–2010 season) to ensure that potential impacts on beluga whales were fully evaluated and to provide the POA with an adequate number of authorized beluga whale takes. In doing so, NMFS assumed that approximately 59 percent of the takes calculated would be realized during PCT and SFD construction (84 FR 72154 and 86 FR 50057, respectively). It was also assumed that 41 percent of the expected beluga whale Level B harassment takes would be avoided by successful implementation of required mitigation measures.

The adjustment for successful implementation of mitigation measures for the CTR Project was calculated using the percentage of realized takes for the PCT Project (Table 6-9). The recent data from PCT Phase 1 and PCT Phase 2 most accurately reflect the current marine mammal monitoring program, the current program's effectiveness, and beluga whale attendance in the Project area. Between the two phases of the PCT Project, 90 total Level B takes were authorized and 53 were potentially realized, equating to an overall percentage realized of 59 percent. The SFD Project, during which only 7 percent of authorized take occurred, represents installation of only 12 piles during a limited time period and does not represent the much higher number of piles and longer construction season anticipated for this Project (Table 2-10).

Table 6-9. Comparison of Reported and Authorized Takes for Cook Inlet Beluga Whales

Project	Valid Dates of Incidental Harassment Authorization	Reported Takes	Authorized Takes	Percentage of Takes That Occurred
MTRP	July 15, 2008 – July 14, 2009	12	34	35
MTRP	July 15, 2009 – July 14, 2010	20	34	59
MTRP	July 15, 2010 – July 14, 2011	13	34	38
MTRP	July 15, 2011 – July 14, 2012	4	34	12
TPP	April 1, 2016 – March 31, 2017	1	15	7
PCT Phase 1	April 1, 2020 – March 31, 2021	26	55	47
PCT Phase 2	April 1, 2021 – March 31, 2022	27	35	77
SFD	August 8, 2021 – August 7, 2022	2	24	8

Notes: MTRP = Marine Terminal Redevelopment Project; PCT = Petroleum and Cement Terminal; SFD = South Floating Dock; TPP = Test Pile Program.

NMFS and the POA agree that the 59 percent adjustment accurately accounts for the efficacy of the POA's marine mammal monitoring program and shutdown protocol. It was therefore assumed that approximately 59 percent of the takes calculated for this Project will actually be realized. This adjusts the calculated potential exposures of beluga whales from 801.09 to 472.65, which is rounded up for each year to 475 total Level B beluga whale takes for the 6 years of in-water construction (beluga whale take estimates are rounded up annually and then summed; Table 6-10).

Table 6-10. Summary Table of Annual Beluga Potential Take Exposures

Year	Beluga Whale Take Estimate			Percent of Cook Inlet Beluga Whale Population
	Without AF	With 59% AF	With 59% AF (rounded up)	
Year 1	142.86	84.29	85	25.68
Year 2	128.71	75.94	76	22.96
Year 3	128.64	75.90	76	22.96
Year 4	131.03	77.31	78	23.56
Year 5	135.19	79.76	80	24.17
Year 6	134.66	79.45	80	24.17
Total	**801.09**	**472.65**	**475[a]**	-

Notes: AF = adjustment factor. Numbers may not sum exactly due to rounding.

[a] Beluga whale take estimates are rounded up annually and then summed.

No Level A take of beluga whales is anticipated or requested. This small number of potential beluga whale exposures to Level B harassment is anticipated to have no measurable effect on individuals or the population as a whole.

The POA is committed to implementing the same robust marine mammal monitoring program for the CTR Project to maintain consistency moving forward in both data collection and analysis, including estimation of potential exposure to elevated sound levels.

Steller Sea Lion Exposure Estimate

Steller sea lions from the Western DPS are anticipated to occur in low numbers within the Project area as summarized in Section 4.1. However, no known Steller sea lion haulout or pupping sites occur in the vicinity of the POA; therefore, exposure of Steller sea lions to in-air noise is not considered in this BA, and no take for in-air exposure is requested.

The in-water sighting rate for Steller sea lions was about 0.028 individuals sighted for each hour of observations during SFD construction in 2022 (see Table 4-2). Sighting rates for this species appear to be increasing near the POA. Additionally, POA data indicate that a single individual may linger near the POA and be counted as many as five times per day as it moves around and resurfaces in different locations. To account for increasing sighting rates, the risk of each individual being counted multiple times, and interannual variability in attendance patterns, it is estimated that potential exposures of Steller sea lions could be as much as five times greater than previously realized (e.g., 0.028 * 5 = 0.14 Steller sea lions/hour). This value was therefore used to calculate potential exposure of Steller sea lions for each year (Table 6-11). The number of individual Steller sea lions actually taken will likely be smaller than the number of potential exposures that is reported.

Steller sea lions often are curious of onshore activities and may choose to approach closely. Additionally, given the potential difficulty of tracking individual Steller sea lions, Level A take for a small number of Steller sea lions is requested. It is assumed that all Level A takes of Steller sea lions would occur during impact pile installation when the Level A zones are larger than the 100-meter minimum shutdown zone. The proportion of active hammer time each year that is anticipated to involve use of an impact hammer was used to estimate the number of Steller sea lions that could potentially be exposed to Level A harassment levels.

Table 6-11. Estimated Number of Potential Exposures (Takes) of Steller Sea Lions for Each Construction Year

Year	Total Hammer Duration (hrs)	Proportion of Hammer Use That is Impact	Estimated Potential Exposures			Population Size	% of Population
			Total	Level A	Level B		
Year 1	153.9	0.64	22	15	7	52,932	0.04
Year 2	135.4	0.65	19	13	6		0.04
Year 3	135.2	0.29	19	6	13		0.04
Year 4	137.9	0.63	20	13	7		0.04
Year 5	137.2	0.60	20	12	8		0.04
Year 6	149.0	0.58	21	13	8		0.04

Note: Population estimates used in calculations are presented in Section 4. hrs = hours.

Humpback Whale Exposure Estimate

Sightings of humpback whales in the Project area are rare, and the potential risk of exposure of a humpback whale to sounds exceeding the Level B harassment threshold is low. Few, if any, humpback whales are expected to approach the Project area. However, based on two sightings in 2017 of what was likely a single individual at the Anchorage Public Boat Dock at Ship Creek (ABR Inc. 2017) south of the Project area, it is anticipated that exposure of up to six individuals could occur during each construction year of pile installation and removal for the Project (Table 6-12). This could include three sightings of a cow-calf pair or six sightings of single humpback whales.

It is assumed that all Level A takes of humpback whales would occur during impact pile installation when the Level A zones are large. The proportion of active hammer time each year that is anticipated to involve use of an impact hammer was used to estimate the number of humpback whales that could potentially be exposed to Level A harassment levels (Table 6-12).

Table 6-12. Estimated Number of Potential Exposures (Takes) of Humpback Whales for Each Construction Year

Year	Total Hammer Duration (hrs)	Proportion of Hammer Use That is Impact	Estimated Potential Exposures			Population Size	% of Population
			Total	Level A	Level B		
Year 1	153.9	0.64	6	4	2	*Unknown* (Mexico - North Pacific Stock) or 11,278 (Hawaiʻi Stock)	*NA* or 0.05
Year 2	135.4	0.65	6	4	2		
Year 3	135.2	0.29	6	2	4		
Year 4	137.9	0.63	6	4	2		
Year 5	137.2	0.60	6	4	2		
Year 6	149.0	0.58	6	3	3		

Notes: Population estimates used in calculations are presented in Section 4. Percentages assume that all potential exposures come from each stock; thus, each percentage should be adjusted down if multiple stocks are actually affected. hrs = hours; NA = not applicable.

6.1.2 Vessel Noise

Tugboats and floating barges, which are used regularly as part of standard POA operations, will also be used in support of the CTR Project. Vessel traffic to and from the POA is not expected to measurably increase as a result of the CTR Project. Behavioral reactions to vessel noise can vary depending on vessel type, speed, and proximity to the individual animals. If animals are exposed to vessel noise and presence, they may exhibit deflection from the noise source, engage in low-level avoidance behavior, exhibit short-term vigilance behavior, or experience and respond to short-term acoustic masking behavior, but these behaviors are not likely to result in significant disruption of normal behavioral patterns (NMFS 2020a). All Project-related vessels will be moving at slow speeds, and their presence is expected to be tolerated by marine mammal species.

In areas with heavy vessel traffic, beluga whales appear to habituate to vessel noise. At the POA, beluga whales appear to be relatively tolerant of intense vessel traffic, as they are commonly seen during summer and early fall and have been sighted consistently near active dredging. Blackwell and Greene (2002) reported that beluga whales were observed “within a few meters” of a large cargo ship, suggesting that they were not strongly affected by the sounds produced by the ship. More recent reports of marine mammal observations near the POA indicate that beluga whales may be habituated to regular activities in the area (61N Environmental 2020, 2021; 87 FR 62364), including dredging (61N Environmental 2021). These observations of beluga whales at the POA suggest that they are not harassed by vessel noise to the point of abandonment, although the whales may tolerate noise that would otherwise disturb them in order to reach feeding areas or to conduct other biologically significant behaviors (NMFS 2008).

Similarly, although Steller sea lions and humpback whales may be exposed to dredging and vessel noise, it is unlikely that any individual will be displaced from the area. Any disturbance to an individual will be limited in space and time, and effects are anticipated to be insignificant.

Port activities, including vessel traffic and dredging, contribute to existing ambient noise levels in the Project area and have not resulted in abandonment from the area by beluga whales or other marine mammals. Although sound levels can sometimes be used as a proxy for disturbance, there is no evidence of disturbance to marine mammals at the POA from the ongoing dredging program. It is unlikely that marine mammals will exhibit significant behavioral modification due to underwater noise and vessel activity associated with dredging and disposal for CTR.

6.2 Vessel Strikes

The presence of vessels in the action area increases the potential for collisions with marine mammals, which can be fatal to individuals. Vessel strikes of Cook Inlet beluga whales are thought to be rare. In 2007 and again in 2012, dead beluga whales were found with trauma indicative of a ship strike (NMFS 2008, 2020; McGuire et al. 2022). McGuire et al. (2022) has reported scarring on beluga whales consistent with propeller injuries. Collisions with smaller, faster vessels likely account for the majority of strikes and occur where fishing vessels and beluga whales are pursuing the same fishery resource. Project-related vessels would be large and travel slowly in direct routes and therefore are not likely to strike beluga whales. Steller sea lions are highly agile swimmers and therefore unlikely to be struck by Project-related vessels. In Alaska, humpback whales account for the most known ship strikes, but these are mostly in southeast Alaska (Neilson et al. 2012). Project-related vessels will slow to minimum velocity in order to maintain safe steerage if approached by a marine mammal. This, along with the rarity of ESA-listed species and the active monitoring program, should effectively avoid all vessel strikes of marine mammals. Therefore, the potential for a vessel strike with an ESA-listed marine mammal is highly unlikely and discountable.

6.3 Habitat Loss and Modification

The effects of the proposed CTR Project on ESA-listed marine mammal habitat are expected to be temporary and insignificant. The CTR Project is in an area that has been highly modified by industrial activity. The action area experiences high levels of vessel traffic and relatively high levels of underwater noise. The majority of the action area currently is not considered high-quality foraging habitat for marine mammals or marine mammal prey such as fish.

Any displacement of marine mammals by sound from in-water pile installation and removal would be short-term and temporary. In-water pile installation and removal will occur only for a relatively small portion of each day, allowing ample time for recovery should displacement or modification of behavior occur. The CTR Project is not expected to result in any new habitat-related effects that could cause significant or long-term negative consequences for individual marine mammals or their populations, since installation or removal of in-water piles will be temporary and intermittent.

6.3.1 Turbidity

During installation of permanent piles (and during installation and removal of temporary piles), a minor increase in turbidity is expected to occur in proximity to each pile. However, turbidity from this activity would not be expected to extend beyond an approximately 25-foot radius of the pile (Everitt et al. 1980). Due to the implementation of the 100-meter shutdown zone, the high silt loads in the action area, and the unlikely drift of suspended sediments beyond the shutdown zone, such turbidity is unlikely to measurably affect ESA-listed species during passage through or while foraging in the action area.

The substrate removed from installed piles will be immediately discharged and allowed to fall around the pile and be distributed by currents. The deposition of sediments back into the water column is expected to result in a minimal increase in turbidity relative to normal conditions in lower Cook Inlet. Marine waters at the POA are currently highly turbid due to ongoing dredging and high levels of suspended silt. Therefore, turbidity produced from substrate deposition is anticipated to result in insignificant effects to ESA-listed marine mammals in the action area.

6.3.2 Changes in Substrate

The extreme tidal currents, turbulence, and heavy silt content of Upper Cook Inlet support a relatively limited habitat for benthic organisms and other intertidal species, such as clams and mussels (Fall 1981; USACE 2023), that are typically found along Alaska's coastlines. Installation and removal of in-water piles will occur in an area already heavily industrialized, and changes to the substrate are not expected to be new or result in significant effects to ESA-listed marine mammals in the action area.

6.3.3 Pollution and Water Quality

The CTR Project could increase the potential for hazardous material spills and offshore disposal has the potential to release pollutants into the water column. Contaminants and hazardous materials could affect PCE 3 (Section 6.5) and be harmful to the Cook Inlet beluga whale. Little is known about the effects an oil spill could have on the Cook Inlet beluga whale population. If beluga whales swim through oil, they could experience injury or mortality by respiratory distress from hydrocarbon vapors, ingestion of oil, or skin irritation from oil. Additionally, beluga whales could be affected by the contamination of prey species or displacement from foraging areas (NMFS 2008).

Accidental spills are possible but unlikely to occur from construction equipment associated with the CTR Project. Spills are extremely unlikely because the selected Contractor would be required to provide spill cleanup protocols to prevent the introduction of hazardous materials into the waters surrounding the POA during in-water pile installation and removal and over-water construction operations.

The CTR Project will be designed to accommodate fuel transfer operations and will meet the containment criteria of 33 CFR 154, Facilities Transferring Oil or Hazardous Material in Bulk; 154.530, Small Discharge Containment; and 154.550, Emergency Shutdown. Adherence to these standards is intended to prevent and minimize potential hazardous material and oil spills during operation of CTR.

6.4 Effects on Prey Species

Fish species in Knik Arm that are prey for Cook Inlet beluga whales, Steller sea lions, and humpback whales could be affected by noise from in-water pile installation and removal. Although data on fish populations in upper Cook Inlet are limited, studies indicate that a wide variety of fish species, including five species of Pacific salmon, saffron cod, and forage fish, including eulachon and longfin smelt, are present in the vicinity of the POA. Marine waters surrounding the POA provide habitat for migrating, rearing, and foraging (Moulton 1997; Houghton et al. 2005; Cornick et al. 2011; McGuire et al. 2020).

Especially strong or intermittent sounds may elicit changes in fish behavior and local distribution and could potentially harm fish. High underwater SPLs (such as those occurring during impact hammer pile installation) are documented to alter behavior, cause hearing loss, and injure or kill individual fish by causing serious internal injury (Hastings and Popper 2005). Vibratory installation and removal produce lower SPLs that are not known to cause harm. Effects on fish have not been observed in association with vibratory hammers (WSDOT 2020), and fish injury criteria do not exist for vibratory pile installation. NMFS (2017) states that a vibratory hammer "does not produce sound levels high enough to injure fish." Although it has not been reported in the literature, behavioral avoidance during vibratory pile installation and removal is possible but would be temporary and localized in the immediate vicinity of the pile. Displaced fish would be expected to move into and use adjacent available areas.

Adults and juveniles of five Pacific salmon species, eulachon, longfin smelt, saffron cod, and other species use habitat throughout Knik Arm during the timeframe in which in-water pile installation and removal is anticipated to occur.

Currently, there are no criteria to evaluate underwater noise impacts on fish from a vibratory hammer. However, since vibratory hammers do not produce impulsive noise, and SSLs are lower than those produced from an impact hammer, it is not expected that in-water pile installation and removal for CTR will have an impact on local fish species. Additionally, in-water pile installation and removal will be intermittent and temporary, further reducing the potential for impacts on fish.

During the MTRP, the effects of impact and vibratory installation of 30-inch steel sheet piles at the POA on 133 caged juvenile coho salmon in Knik Arm were studied (Hart Crowser et al. 2009; Houghton et al.

2010). Acute or delayed mortalities or behavioral abnormalities were not observed in any of the coho salmon. Furthermore, results indicated that the pile driving had no adverse effect on feeding ability or the ability of the fish to respond normally to threatening stimuli (Hart Crowser et al. 2009; Houghton et al. 2010).

As described in Section 4, Cook Inlet beluga whales, Steller sea lions, and humpback whales can be found in or may use the area around the POA. The diets of Cook Inlet beluga whales in Knik Arm can be generalized based on a comparison of fishes found in stomach analyses of beluga whales and fish species observed in Knik Arm (Houghton et al. 2005). Common prey species in Knik Arm include Pacific salmon, eulachon, and Pacific cod (Houghton et al. 2005; Rodrigues et al. 2006, 2007; Quakenbush et al. 2015). Occasional occurrences of killer whales in Knik Arm are typically of the transient ecotype (Shelden et al. 2003); transients feed on beluga whales and other marine mammals such as harbor seals and harbor porpoises.

Descriptions of the potential impacts on habitat resulting from CTR are discussed in Section 6.3. Any displacement of marine mammals by sound from pile installation and removal would be short-term and temporary. Pile installation and removal will occur only for a relatively small portion of each day, allowing time each day for recovery should displacement or modification of behavior occur.

The CTR Project is not anticipated to substantially impede migration of adult or juvenile salmon or adversely affect the health and survival of the affected species at the population level. Affected fish would represent only a portion of the food available to marine mammals in the area. The CTR Project is not expected to result in any habitat-related effects that could cause significant or long-term negative consequences for individual prey species or their populations, since removal of in-water piles will be temporary and intermittent.

6.5 Effects on Cook Inlet Beluga Whale Critical Habitat

The CTR Project will not result in permanent impacts on designated critical habitat for beluga whales. CTR will take place in the critical habitat exclusion zone surrounding the POA. However, the proposed action will result in temporary changes in the acoustic environment for a minor amount of designated critical habitat outside the exclusion zone that is exposed to in-water pile installation and removal noise.

Habitat is the locality or environment that is essential for an animal’s survival—where it feeds, rests, travels, socializes, breeds, and raises its young. For cetaceans, these are in-water areas, whereas for pinnipeds, habitat also includes haulout sites or rookeries. In addition to physical locations, habitat also includes the prey upon which a marine mammal feeds.

There are no known pinniped haulouts near the POA. The Cook Inlet beluga whale is the only marine mammal species in the action area with critical habitat designated in Cook Inlet. The area around the POA was excluded from the critical habitat designation for national security reasons (76 FR 20180). Beluga whales swim past the POA to access feeding areas to the north, and their use of Knik Arm and the POA is described in detail in Sections 4.1.3 and 4.1.4. In summary, although the POA is a highly industrialized area supporting ship traffic and industrial activities including construction, beluga whales are present almost year-round. Despite increased shipping traffic and maintenance operations such as dredging, beluga whales continue to utilize waters in and surrounding the POA area. Additionally, an interim population consequences-of-disturbance modeling effort indicated that under all scenarios, the effect of anthropogenic noise disturbance on vital rates was so small that it was considered unlikely to result in population-level effects (Tollit et al. 2016).

Habitat degradation or loss is a threat of medium concern for Cook Inlet beluga whales (NMFS 2016b), and habitat restoration would improve one of the current threats. Degradation or loss of habitat in areas known to be important to Cook Inlet beluga whales for foraging and reproduction is of concern. Degradation or loss of habitat could result in the reduction in the carrying capacity of Cook Inlet for beluga whales and limit areas important for foraging or reproduction (NMFS 2016b). Although anthropogenic activities tend to be localized in coastal areas, seasonal, and increasing in frequency, most of the beluga whale habitat in Cook Inlet is not degraded to the point that adverse effects on Cook Inlet beluga whales are apparent (NMFS 2016b). Nearshore marine and freshwater habitat restoration, such as the improved fish passage in the tidal reach of Lower Ship Creek (NOAA 2022), can refine and create access to miles of upstream, subtidal, and intertidal habitat for the Cook Inlet beluga whales and their prey.

Although beluga whales may be temporarily exposed to elevated underwater sound levels in a small portion of designated critical habitat, such exposure will not affect the conservation value of critical habitat near the POA exclusion zone. Similarly, effects on prey fish near the action area will be negligible from in-water pile installation and removal and short-term in nature and are not expected to affect the overall fitness of the Cook Inlet beluga whale population or its recovery. Anticipated in-water pile installation and removal effects to PCEs (or PBFs) for Cook Inlet beluga whale critical habitat include the following:

- **PCE 1. Intertidal and subtidal waters of Cook Inlet with depths of less than 30 ft (MLLW) and within 5 miles of high- and medium-flow anadromous fish streams.**
  - **Effect:** During CTR, the presence of in-water machinery, Project-related noises, and increased sediment suspension has the potential to impact PCE 1. These impacts will be short-term, intermittent, and insignificant. A very small area of designated critical habitat will be included in the action area and will be affected by increased noise levels for only a short duration. Increased sediment suspension is unlikely to affect designated critical habitat at a significant level.
- **PCE 2. Primary prey species, including four of the five species of Pacific salmon (chum, sockeye, Chinook, and coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole.**
  - **Effect:** In-water pile installation and removal will result in an increase in localized turbidity, which could affect the foraging behavior of prey species or increase the susceptibility of prey species to predation. However, given the distance of designated critical habitat to proposed in-water pile installation and removal locations, Project-related turbidity is unlikely to extend to critical habitat.
  - Underwater noise during impact pile installation could result in harm to prey fish if they are located in proximity to the pile being driven. Juvenile salmonids will be the most susceptible to injury or mortality resulting from pile driving because of their small body size (WSDOT 2018). Injury to fish is not expected to occur at distances greater than 1,600 meters from the sound source and would overlap with a very small area of designated critical habitat (POA 2017b). During the MTRP, the effects of impact and vibratory driving of 30-inch-diameter steel sheet piles at the POA on 133 caged juvenile coho salmon in Knik Arm were studied (Hart Crowser et al. 2009; Houghton et al. 2010). Maximum peak SPLs observed ranged from 177 to 195 dB re 1 µPa rms, and accumulated sound exposure levels ranged from 174.8 to 190.6 dB re 1 µPa rms. Acute or delayed mortalities, or behavioral abnormalities, were not observed in any of the coho salmon. Furthermore, results indicated that the pile installation had no adverse effect on feeding ability or the ability of the fish to respond normally to threatening stimuli (Hart Crowser et al. 2009; Houghton et al. 2010). Considering this information and the relatively small number of piles being installed, potential adverse effects to beluga whale prey species would be insignificant.
- **PCE 3. The absence of toxins or other agents of a type or amount harmful to beluga whales.**
  - **Effect:** Considering the distance of proposed CTR activity from the nearest critical habitat outside the exclusion zone, it is highly unlikely that PCE 3 will be affected by in-water pile installation and removal. A temporary increase in suspended sediments and turbidity could occur during in-water pile installation and removal; however, such Project-related turbidity is unlikely to be measurable within designated critical habitat outside the POA exclusion zone. In the event that Project-related sediments do enter critical habitat, the naturally high turbidity of Knik Arm suggests that any

minor increase in turbidity will result in insignificant impacts on beluga whales that pass through the action area. The selected Contractor will be required to provide spill cleanup protocols to prevent the introduction of hazardous materials into the waters surrounding the POA during in-water pile installation and removal.

- **PCE 4. Unrestricted passage within or between the critical habitat areas.**
  - **Effect:** The action area for the most impactful project component (installation of 144-inch piles) extends no more than 13.5 km (8.4 mi) from the east shore of lower Knik Arm (Figure 4-1), and in-water pile installation and removal would ensonify an area that reaches the west shore of Knik Arm; however if beluga whales are seen approaching the area of ensonification, the CTR Project would shut down so that ensonification will not extend across the Knik Arm. Passage for Cook Inlet beluga whales will not be blocked. In-water pile installation and removal will be intermittent during this time period and will occur for 1 to 4 hours per day. Because in-water pile installation and removal will occur for a short duration and be intermittent over a long period of time, blockage of Knik Arm due to elevated underwater noise levels will be minimal, and PCE 4 will be only minimally affected.
- **PCE 5. The absence of in-water noise at levels resulting in the abandonment of habitat by Cook Inlet beluga whales.**
  - **Effect:** As discussed in Section 6.1, beluga whales have not been observed to abandon Knik Arm during in-water construction at the POA (Prevel-Ramos et al. 2006; Markowitz and McGuire 2007; Cornick and Saxon-Kendall 2008, 2009; Kendall 2010; Cornick and Pinney 2011; Cornick et al. 2011; Cornick and Seagars 2016; 61N Environmental 2021, 2022b, 2022c); however, localized and temporary avoidance of the action area is possible during CTR. Less than 1 percent of designated critical habitat could be affected by in-water pile installation and removal for the duration of the CTR Project.

6.6 Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as: "...those effects of future State or private activities not involving Federal activities that are reasonably certain to occur within the action area of the Federal action subject to consultation." Reasonably certain activities and their related effects to ESA-listed species in the action area would presumably involve activities within and adjacent to Knik Arm.

Federal projects that require consultation under the ESA will do so independently of this project. As such, federal projects are not included in the cumulative impacts. Any projects involving the placement of fill, dredging, or structures in Knik Arm would be subject to federal authorization from USACE. Some of the same or other projects could be subject to federal authorization from NMFS pursuant to the MMPA. Such authorizations from USACE and/or NMFS would require consultation under the ESA on their effects to ESA-listed species and are therefore not addressed here as cumulative impacts. Also excluded from this section is USACE's maintenance dredging at the POA conducted by its Civil Works Program (USACE 2023).

As described in Section 2, the POA will use two or more hammers simultaneously during CTR; however, no more than two vibratory hammers will be used at one time. The simultaneous in-water installation or removal of piles with other ongoing POA activities such as vessel maneuvering, dredging, and other activities may result in increased underwater noise levels or expanded harassment zones.

6.6.1 Coastal Zone Development Projects

Coastal zone development in this area of Knik Arm may result in the loss of habitat, increased vessel traffic, increased pollutants, and increased noise associated with project construction and operation. Potential projects in the area include mining projects, renewable energy projects (Fire Island Wind Project Phase 2 and tidal energy development), and coastal construction (e.g., port expansions and maintenance, roadway construction; Figure 6-13). These activities are discussed below.

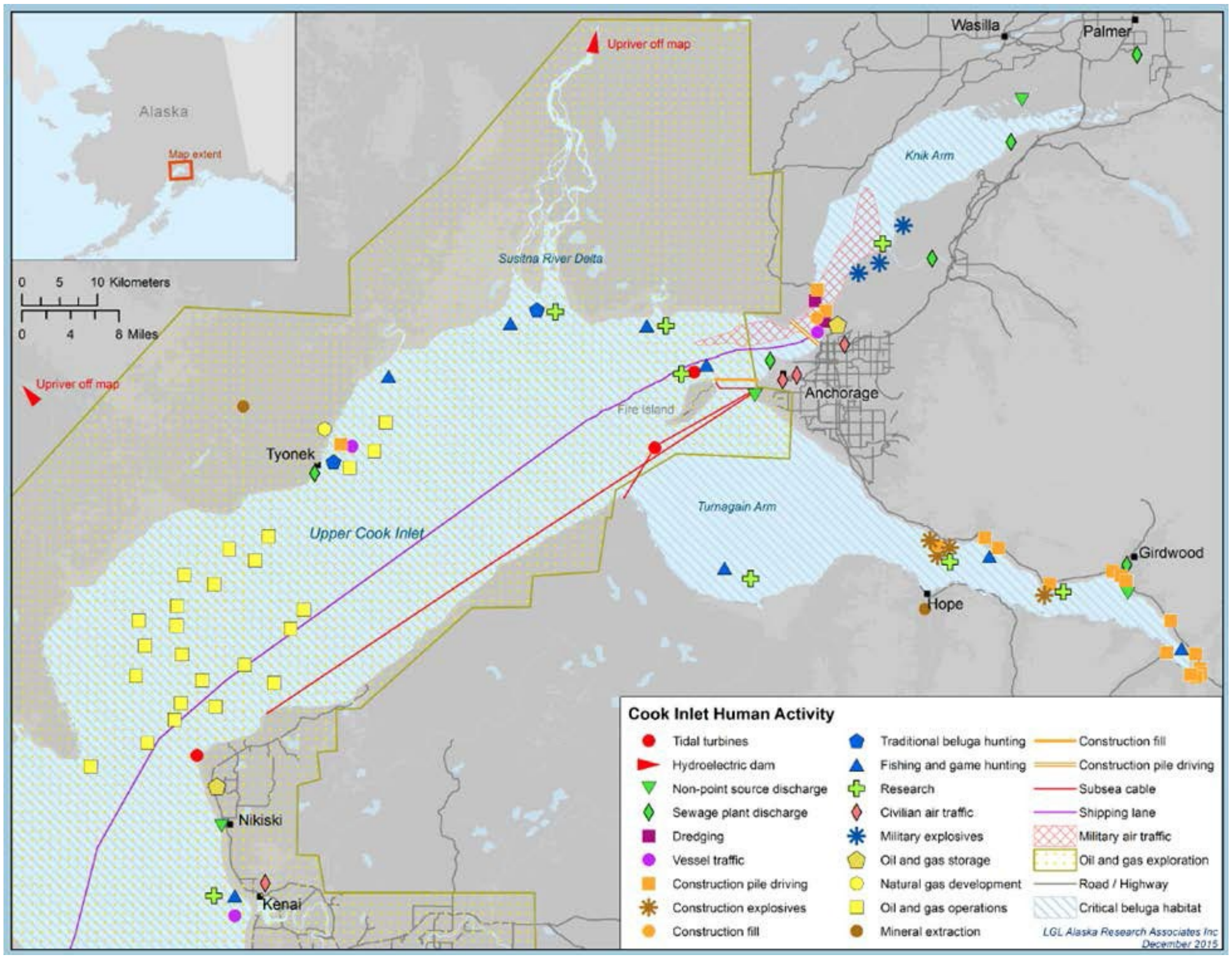

Figure 6-13. Cook Inlet Human Activity

6.6.1.1 Project-Related Cumulative Impacts

The POA plans to continue to modernize POA facilities as part of the PAMP. In 2019, the POA completed construction of the South Backlands Stabilization Project, and construction of the PCT and SFD was completed in 2022. The next phase of the PAMP includes construction of NES1 and replacement of General Cargo Terminal 1 and Terminal 2. Other phases of the PAMP include replacing POL2, NES1 and NES2, and demolition of Terminal 3. It should be noted that the NES1 and NES2 Projects will remove existing filled areas and convert them to open marine waters, resulting in beneficial impacts on the marine environment, fish, and marine mammals.

The POA is Alaska's largest seaport and provides 90 percent of the consumer goods for about 85 percent of Alaska. It currently includes three cargo terminals, two petroleum terminals, one dry barge berth, two railway spurs, a small craft floating dock, and 220 acres of land facility. It is located in the Municipality of Anchorage, and approximately 450 ships or tugs/barges call at the POA each year.

Operations began at the POA in 1961 with a single berth. Since then, the POA has expanded to a terminal with five berths that moves more than 4 million tons of material across its docks each year (McDowell Group 2020). The POA plans to continue to modernize its facilities as part of the PAMP, which includes multiple construction projects to enable continued port operations, update facilities for operational efficiency, accommodate modern shipping operations, and improve seismic resiliency. In 2019, the POA completed construction of the South Backlands Stabilization Project; in 2022, the POA completed construction of the PCT and SFD. Construction of NES1 began on land in 2023 and in-water work is scheduled to begin in 2024. The next phase of the PAMP is replacement of General Cargo Terminals 1 and 2. Other phases of the PAMP include replacing POL2, completing NES2, and demolishing Terminal 3. It should be noted that the NES1 and NES2 Projects will remove existing filled areas and convert them to open marine waters, resulting in beneficial impacts on the marine environment, fish, and marine mammals. NES1 will include the conversion of approximately 13 acres of developed land back to intertidal and subtidal habitat in Knik Arm. Future phases of the PAMP will depend upon funding that is not yet secured. The PAMP website describes the funding requests to the State of Alaska and alternative sources of funding such as taxes or cargo tariffs. Additional information is provided below.

The POA (i.e., Port of Anchorage at that time) Expansion Project (74 FR 35136) included pile installation (including sheet and 36-inch round piles) and dredging between 2008 and 2011. The Cook Inlet beluga whale was listed under the ESA in October 2008; therefore, ESA Section 7 consultation covered work from 2009 through 2011. The number of beluga whales potentially harassed, as defined under the MMPA, was fewer than the number of takes authorized. NMFS Permits Division authorized 34 takes of beluga whales per year of the project (there was no take issued for humpback whales or Steller sea lions). Takes of other marine mammal species were also limited. Scientific monitoring during that period showed that beluga whales continued to transit past the POA, and their passage to critical foraging grounds in upper Knik Arm was not blocked or impeded.

In 2016, NMFS issued a BiOp for the POA's TPP (NMFS 2016a) to evaluate sound attenuation devices for potential use during port expansion projects. The NMFS Permits Division authorized Level B harassment takes for 26 Cook Inlet beluga whales and six western DPS Steller sea lions. During the TPP, beluga whales entered the Level B harassment exclusion zone on nine occasions. Only one 4-minute delay of start of operations was necessitated to avoid prohibited takes of beluga whales, and one authorized instance of potential Level B harassment occurred, affecting a single beluga whale (Cornick and Seagars 2016).

In 2018, NMFS issued an LOC for ESA Section 7 consultation for the POA Fender Pile and Replacement Repair Project (NMFS 2018a). This project included pile installation of forty-four 22-inch round piles. Mitigation measures were implemented to avoid take of marine mammals; therefore, no take was authorized. No sightings of protected species occurred during pile installation activities. However, on 30 May 2019, a small group of beluga whales was observed by the construction crew before in-water work began. When the MMO arrived, they observed three adult beluga whales traveling northward and milling.

An IHA was issued in August 2021 for construction of the SFD. Take by Level B harassment of six marine mammal species and take by Level A harassment of two of those six species was authorized in the IHA. Construction of the SFD was completed in 2022.

On 23 March 2020, NMFS issued a BiOp and ITS (NMFS 2020a) that consulted on the effects of the POA PCT Project (Phases 1 and 2) on the western DPS of Steller sea lions, humpback whales, and Cook Inlet beluga whales and their designated or proposed critical habitat. On 31 March 2020, NMFS issued two successive IHAs (85 FR 19294; NMFS 2020b, 2020c) to the POA for construction of the PCT. Construction of the PCT was planned and permitted as two distinct construction seasons, with PCT Phase 1 permitted under an IHA valid from 01 April 2020, through 31 March 2021 (NMFS 2020b), and work on PCT Phase 2 permitted under the successive IHA valid from 01 April 2021, through 31 March 2022 (NMFS 2020c). The PCT requested two modifications to the PCT Phase 2 IHA, and NMFS approved that process. The modifications to construction methods were necessary to ensure safe, accurate, and efficient construction of the PCT facility and led to other changes that reduced potential impacts to marine mammals, including a reduction in temporary pile numbers, avoidance of battered piles, and a reduction in overall installation and removal times, which together achieved the least practicable adverse impact on marine mammals. PCT in-water construction was completed in 2021, and the terminal was completed in 2022.

In 2020, the POA applied for concurrence from USACE that the POA Fender Pile Replacement and Repair Project qualifies under Nationwide Permit 3, Maintenance. Informal Section 7 consultation for this work was initiated on 25 September 2020 (POA 2020). The purpose of the project was to replace 180 corroding and failing 22-inch pin piles in the POA's existing fendering system. Pre- and post-earthquake (2018) inspections have shown that these pin piles were in a state of imminent failure and require emergency repair. It was determined through engineering evaluation that these piles were providing only 10 percent of the required resistance for safely berthing ships at the POA, presenting a substantial safety hazard and potential threat to commerce in Alaska. The fendering system comprises 107 fender assemblies, each supported by two pin piles. A total of 23 fender assemblies were replaced in 2015 and 2019. The POA has repaired the remaining fender assemblies except for one fender, which was completed in 2023.

To reinforce each fender assembly, a 22-inch pile was installed inside each existing 24-inch pile up to a 45-foot embedment depth using an impact and/or vibratory hammer. Installing the new pile within the existing pile reduced noise impacts and the potential for incidental dock damage during maintenance. For piles that were determined to be in extremely poor condition or that had already failed, a diving contractor cut the pile off at the mudline and removed the non-embedded portion of the pile. In-water work included pile installation and fender repair in previously disturbed areas; no excavation or fill was associated with this project. The POA implemented mitigation and monitoring measures (shutdown zones and MMO monitoring). This project did not result in the harassment of marine mammals; therefore, no MMPA authorization was necessary.

The POA began landside work on the NES1 Project in 2023 and in-water work in 2024. The POA is currently working on design and permitting for replacement of Terminals 1 and 2 as part of Phase 2 of the PAMP, the CTR Project. Terminals 1 and 2 are the existing container and general cargo terminals and are the only deep-water marine cargo terminals in Anchorage. The POA cargo services supply goods for 90 percent of Alaska's population (POA 2019b).

Other proposed future phases of the PAMP include replacing POL Terminal 2 as part of Phase 3, and further stabilization of NES2 and demolition of Terminal 3 as part of Phases 4 and 5. It should be noted that the NES1 and NES2 Projects will remove existing filled areas and convert them to open marine waters, resulting in beneficial impacts on the marine environment. The construction schedules for Phases 3 through 5 have not been developed.

USACE has been conducting maintenance dredging annually at the POA since 1965 and continues to do so throughout each year. The POA is dredged to the depth of minus 35 ft MLLW. Dredged materials are dumped 3,000 ft abeam of the POA dock face at the Anchorage Harbor Open Water Disposal Site. NMFS issued an LOC under the ESA for their current USACE permit in 2017. In 2023, USACE issued a Finding of No Significant Impact for the POA to conduct transitional dredging at the terminal facility and dredged material disposal offshore. These activities will provide the needed depths for berthing vessels at the new terminal facility (referenced above). Once the POA's dredging is complete, USACE will maintain dredging at this location.

Dredging operations also occur annually at the Ship Creek Boat Ramp, located approximately 1.5 km (0.9 mi) southwest of the POA CTR Project location. The POA dredging at this site is accomplished in early May during minus 3-foot tides and is usually accomplished in 3 to 4 days using heavy machinery. Dredging at the POA does not seem to be a source of re-suspended contaminants (USACE 2023), and beluga whales often pass near the dredge (USACE 2008, 2023; ICRC 2012).

6.6.1.2 Road Development

The Alaska Department of Transportation and Public Facilities (DOT&PF) Seward Highway Milepost 75 to 90 (along Turnagain Arm) Project included geophysical and geotechnical (G&G) testing, onshore blasting, pile removal and installation at stream crossings, and fill placed into Turnagain Arm to facilitate roadway straightening. The project also included resurfacing 15 mi of roadway, straightening curves, installing new passing lanes and parking areas, and replacing eight existing bridges. Replacement of these bridges included vibratory and impact pile installation and removal of both 24- and 48-inch steel pipe piles. In-water work on this project was avoided from 15 May to 15 June to avoid harassment of Cook Inlet beluga whales during the eulachon run, and work that was conducted in-water below MHW required marine mammal monitoring by MMOs. This project reached substantial completion in October 2023.

DOT&PF's Safer Seward Highway Project (earlier known as the Seward Highway Milepost 98.5 to 118 (Bird Flats to Rabbit Creek) Project), proposes safety and capacity improvements to the alignment and road cross-section. The upgrades would likely require widening the highway corridor either into the mountainside or toward the marine waters and may include relocating railroad track sections. Activities may include G&G testing, onshore blasting, pile installation and removal at stream crossings for new bridges, and placing fill into Turnagain Arm. The project is still in the early planning phases, and no construction schedule is available.

6.6.1.3 Renewable Energy Development

NMFS (2021) reports that several past State of Alaska oil and gas lease sales have occurred in Cook Inlet. Currently, 18 existing oil and gas drilling platforms are in Cook Inlet, 11 of which are active. While in-water drilling activities associated with these leases would be subject to federal authorization, unplanned activities, including the inadvertent release of oil into habitat occupied by Cook Inlet beluga whales, could result in impacts on the species. The effects of a potential oil spill on Cook Inlet beluga whales and their critical habitat would vary depending on the magnitude, location, and extent of the spill. Oil spills could negatively affect Cook Inlet beluga whales through the inhalation of hydrocarbon vapors, possible loss or contamination of prey, ingestion of contaminated prey, or skin and/or sensory organ damage (NMFS 2021).

A tidal energy project is in the preliminary stages of determining if a saltwater generator can be used to power the machine that provides cathodic protection to the Port MacKenzie dock. The saltwater generator could potentially generate 80 kilowatts of power (Poux 2022).

An application for a preliminary permit from the Federal Energy Regulatory Commission has been submitted for a proposed Turnagain Arm tidal electric generation project. The project is in the early planning stages, and details such as equipment and placement are not currently available.

6.6.1.4 Oil and Gas Development

The Alaska Department of Natural Resources' Division of Oil and Gas has issued a preliminary best interest finding for proposed Cook Inlet area-wide oil and gas lease sales, 2019 through 2028. The lease sales could lead to increased oil and gas development in Cook Inlet; however, it is uncertain if oil and gas companies will be interested in acquiring these leases given the commodity prices, the state's tax structure, and the sustainable investment required to explore and develop offshore leases. Currently, 18 existing oil and gas drilling platforms are in Cook Inlet, 11 of which are active.

Currently, 14 active Outer Continental Shelf Oil and Gas Leases occur in the Cook Inlet region (Bureau of Ocean Energy Management [BOEM] 2022). BOEM held Lease Sale 258 for Cook Inlet in 2022 that offered 193 blocks toward the northern part of the Cook Inlet Planning Area for leasing. These blocks stretch roughly from Kalgin Island in the north to Augustine Island in the south (BOEM 2022). The sale generated one bid for one tract.

Impacts from gas and oil development include temporary increased noise from seismic activity, vessel and air traffic, and well drilling; discharge of wastewater; small areas of habitat loss from the construction of oil and gas facilities; and contaminated food sources and/or injury from a natural gas blowout or oil spill. For projects where an IHA is requested, marine mammal exposure to seismic activities is mitigated to effect the least practicable adverse impact. It is a common requirement for seismic operations to maintain extensive marine mammal monitoring (e.g., flights) and shutdown if Cook Inlet beluga whales are observed. The risk of these impacts may increase as oil and gas development increases; however, new development will undergo consultation and permitting requirements prior to exploration and development. If authorizations are issued to these applicants, they will be required to implement mitigation and monitoring measures to reduce impacts to marine mammals and their habitat in the area and will be subject to the same MMPA and, when applicable, ESA standards.

NMFS has received applications requesting takes of marine mammals incidental to seismic surveys and drilling operations in this area. NMFS issued an LOA to the Alaska Gasline Development Corporation for take of marine mammals, by harassment, incidental to construction of a marine terminal near Nikiski and installation of a pipeline in Cook Inlet. NMFS issued the LOA on 21 September 2020, and it will be valid from 01 January 2021, through 31 December 2025 (85 FR 59291). Mitigation and monitoring measures include ramp-ups, shutdown zones, and MMO monitoring for the project, known as the Alaska Liquefied Natural Gas Project. Seismic surveys in Cook Inlet (such as Hilcorp's G&G surveys for which NMFS issued an LOA [84 FR 37442, 31 July 2019] that contained required mitigation, monitoring, and reporting measures) may continue as the industry seeks a better understanding of available oil and gas deposits. The key mitigation and monitoring measures contained in Hilcorp's rule and LOA for seismic activity (84 FR 37442, 31 July 2019), which are designed to reduce the intensity of any harassment that may occur incidental to the surveys, include the following:

- Establishment of an exclusion zone within 10 nautical miles of the Susitna River Delta during periods of biological significance for beluga whales.
- Establishment of an exclusion zone for the mouth of the Kasilof River.
- Implementation of shutdown whenever beluga whales are observed during use of airguns, regardless of distance.
- Implementation of airgun shutdown procedures during the activity when marine mammals are detected within or about to enter the exclusion zone to reduce the SEL to below that which could cause injury to marine mammals.
- Implementation of airgun ramp-up procedures when the array is started to provide marine mammals with a warning and allow marine mammals to vacate the area.
- Use of aerial surveys before starting seismic airgun surveys each day to look for groups of beluga whales that could be within the Level B harassment zone of the day's planned survey area.
- Use of NMFS-approved MMOs on the source vessel and mitigation vessel.

Any harassment from these oil and gas projects would not occur in Knik Arm and would be concentrated toward middle and lower Cook Inlet. Additionally, the LOAs proposed for these projects limit take to no more than 20 beluga whales per year; therefore, the separation of time and space as well as limited take authorized is not likely to result in significantly cumulative effects on beluga whales. Harassment of other species of marine mammals is also separated in time and space from the species impacted during construction of the CTR.

6.6.2 Subsistence Hunting

The practice of hunting marine mammals for food, clothing, shelter, heating, and other uses is an integral part of the cultural identity of Alaska Native peoples and communities. In Cook Inlet, Alaska Natives historically hunted beluga whales and continue to hunt harbor seals. However, NMFS determined that subsistence harvest activities by Alaska Natives would not contribute to significant cumulative impacts when considered with other past, current, or reasonably foreseeable future actions. There are currently no ESA-listed marine mammal species with subsistence value in Cook Inlet. Alaska Natives have not hunted Cook Inlet beluga whales since 2005. The effects of this Project would not adversely affect annual rates of recruitment or survival of the Cook Inlet beluga whale DPS (i.e., the Proposed Action would not contribute to the population decline).

6.6.2.1 Fisheries Interactions

Fishing is a major industry in Alaska. As long as fish stocks are sustainable, subsistence, personal use, recreational, and commercial fishing would continue in Cook Inlet. As a result, continued prey competition, risk of ship strikes, potential harassment, potential for entanglement in fishing gear, and potential displacement from important foraging habitat would occur for beluga whales and other marine mammals. NMFS and ADF&G will continue to manage fish stocks as well as monitor and regulate fishing in Cook Inlet to maintain sustainable stocks.

6.6.3 Research

Many important aspects of marine mammal biology remain unknown or are incompletely studied. Additionally, management of these species and stocks requires knowledge of their distribution, abundance, migration, population, ecology, physiology, genetics, behavior, and health. Therefore, free-ranging marine mammal species are frequently the subjects of scientific research and studies.

Research activities typically include close approach by vessel and aircraft for line-transect surveys; behavioral observation; photo-identification and photo-video-grammetry; passive acoustic recording; attachment of scientific instruments (tagging) by both implantable and suction cup tags; biopsy sampling, including skin and blubber biopsy and swabbing; land-based surveys; and live capture for health assessments, blood and tissue sampling, pinniped tooth extraction, and related pinniped anesthesia procedures. All researchers are required to obtain scientific research permits from NMFS OPR under the MMPA and/or ESA (if an ESA-listed species is involved). Permits authorizing research in Cook Inlet on beluga whales, harbor seals, harbor porpoises, Steller sea lions, humpback whales, and killer whales may have cumulative effects on these species and stocks, but they are expected to be negligible to minor based on the specific research methodology. NMFS anticipates that scientific research on marine mammals in Cook Inlet will continue, and possibly expand, due to the increasing need to better understand distribution and abundance relative to temporal (e.g., seasonal, diel, or tidal) and spatial (e.g., geographic, bathymetric) parameters. However, the acoustic research currently conducted on beluga whales is passive in nature (hydrophone-based) and has no impact on marine mammals. Currently, there are no active research permits that may include studies on marine mammals in Cook Inlet.

6.6.4 Vessel Traffic

Major contributors to vessel traffic throughout Cook Inlet include port facilities, oil and gas development, and commercial and recreational fishing. Ongoing marine vessel use in Knik Arm will continue to affect Cook Inlet beluga whales in the action area through temporary disturbance due to underwater noise. In addition, recreational boating, though currently at low levels, may contribute to increased acoustic stress on Cook Inlet beluga whales in the action area and surrounding waters. Avoidance reactions have often been observed in beluga whales when approached by watercraft, particularly small, fast-moving craft that are able to maneuver quickly and unpredictably (NMFS 2008, 2021). However, larger vessels that do not alter course or motor speed around these whales seem to cause little, if any, reaction (NMFS 2008, 2021). The low number of observed ship-strike injuries suggests that either beluga whales do not often encounter vessels, they avoid interactions with vessels, or they suffer mortalities (NMFS 2021) before they can be observed.

The POA yields a high volume of vessel traffic that passes through or near the action area. The POA handles half of all Alaska inbound fuel and freight (shipped via marine, road, and air), half of which is delivered to final destinations statewide, outside the Municipality of Anchorage. It serves approximately 90 percent of Alaska's population (POA 2019b), providing access to fuel and non-fuel cargo items such as food, consumer goods, building materials, cars, cement, and other goods critical for Alaskans' everyday requirements. Seventy-five percent of all non-petroleum marine cargo shipped into Alaska (not including

Southeast Alaska, which is served from barges directly from Puget Sound) moves through the POA (POA 2019b).

Major vessels calling to the POA include cargo ships, barges, tankers, dredgers, military ships, and tugboats (POA 2009). According to data from 1998 to 2011, an average of approximately 450 vessels call to the POA annually (POA 2014). The POA is proposing to modernize its facilities; however, these facility updates are not expected to increase vessel traffic. An increase in vessel traffic could occur, however, from continuing city and state development and growth.

Port MacKenzie is also located in Knik Arm and contributes to vessel traffic that passes through or near the action area. It receives approximately two large ships (a landing craft and/or a barge) annually, which is substantially fewer than the POA. The Port MacKenzie Rail Extension Project, when completed, will connect Port MacKenzie to the Alaska Railroad Corporation's existing mainline between Wasilla and Willow, will provide freight service between Port MacKenzie and Interior Alaska. Currently, no funding is allocated for completion of the rail extension, and no work has been conducted since 2015. Additionally, Port MacKenzie has long-term plans to expand their deep-draft dock; however, no funding is currently allocated for design or construction. If it is expanded, the number of ships calling at Port MacKenzie is anticipated to increase. Increased vessel traffic could result in increased in-water noise and potential ship strikes to marine mammals.

Beyond Knik Arm, to a lesser extent, smaller port facilities may contribute to vessel traffic in Cook Inlet. These include Nikiski, the City of Kenai, Kasilof, Ninilchik, Williamsport, and Tyonek. Vessels ranging from tankers to fishing boats call to these ports (Kenai Peninsula Borough 2003). Gas and oil development, as well as commercial and recreational fishing vessels, also contribute to vessel traffic in the area.

6.6.5 Pollution

The amounts of pollutants that enter this portion of Knik Arm are likely to increase as populations in urban areas continue to grow. Sources of pollutants in urban areas include runoff from streets and discharge from wastewater treatment facilities. Gas, oil, and coastal zone development projects also contribute to pollutants that enter Knik Arm through discharge. These sources of pollutants are expected to continue in Knik Arm; therefore, it would be anticipated that pollutants could increase in this portion of Knik Arm. However, the U.S. Environmental Protection Agency and the Alaska Department of Environmental Conservation will continue to regulate the pollutants that enter Knik Arm from point and non-point sources through Alaska Pollutant Discharge Elimination System permits. As a result, permit holders will be required to renew their permits, verify that they meet permit standards, and upgrade facilities if necessary. Additionally, the extreme tides and strong currents in Knik Arm and Cook Inlet may contribute to a reduction in the pollutants found there.

Currently proposed and future habitat improvements in watersheds and tributaries to upper Cook Inlet (e.g., Ship Creek) intended to reduce the amount of pollution that enters Knik Arm will improve water quality conditions for Cook Inlet beluga whales and their prey. However, many of these actions may require authorizations from federal permitting agencies, including USACE. Non-federally related current and future proposals to reduce point-source runoff into Knik Arm may minimize the release of contaminants at the source. For example, as part of the PAMP, the POA will update their existing Alaska Pollutant Discharge Elimination System permit, which may result in environmental-based restrictions intended to benefit marine aquatic species.

6.6.6 Climate Change

Climate change is a reasonably foreseeable condition that may result in cumulative effects to marine mammals in Cook Inlet (BOEM 2016). The 2023 Intergovernmental Panel on Climate Change (IPCC) synthesis report concluded that "human activities, principally through emissions of greenhouse gases have unequivocally caused global warming" (IPCC 2023). A recent special report indicates that human activities are estimated to have caused approximately 1.1 degree Celsius (°C) of global warming above pre-industrial levels, with a likely range of 0.95°C to 1.2°C with larger temperature increases over land than over the ocean. Global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate (IPCC 2023). The IPCC study involved numerous models to predict changes in temperature, sea level, ice pack dynamics, and other parameters under a variety of future conditions, including different scenarios for how human populations respond to the implications of the study.

Evidence of climate change in the past few decades has accumulated from a variety of geophysical, biological, oceanographic, and atmospheric sources. The scientific evidence indicates that average air, land, and sea temperatures are increasing at an accelerating rate. Although climate changes have been documented over large areas of the world, the changes are not uniform, and they affect different areas in different ways and at differing intensities. Arctic regions have experienced some of the greatest changes, with major implications for the marine environment as well as for coastal communities.

Marine mammals are classified as sentinel species because they are good indicators of environmental change. Arctic marine mammals are ideal indicator species for climate change due to their circumpolar distribution and close association with ice formation. NMFS recognizes that warming of the Arctic, which results in diminishing ice thickness and spatial extent, could be a cause for concern for marine mammals. In Cook Inlet, marine mammal distribution is dependent upon ice formation and prey availability, among other factors. For example, beluga whales often travel just along the ice pack and feed on prey beneath it (Richardson et al. 1990, 1991). Any loss of ice and environmental conditions such as rising water temperature could result in prey distribution changes or loss for beluga whales or other marine mammals. Ice, however, is not directly used in Cook Inlet for resting, reproduction, or rearing of young, as is the case for ice-dependent pinnipeds.

Models predict that the climate changes observed in the past 30 years will continue at the same or increasing rates for at least 20 years. Although NMFS recognizes that concern for climate change in the Project area is warranted, the full extent to which climate change would affect marine mammals in Knik Arm is unclear. The CTR Project is planned to occur during a 6-year period, during which time the impacts of climate change on marine mammals are likely to remain at baseline levels.

Section 7. Preliminary Take Assessment

In the LOA/IHA application, the POA requested potential exposures of Steller sea lions, humpback whales, and Cook Inlet beluga whales from temporary exceedance of underwater noise thresholds associated with in-water pile installation and removal (Table 7-1).

The analysis of in-water pile installation and removal associated with CTR predicts potential exposures of marine mammals to noise from vibratory pile installation and removal that could be classified as Level A and Level B harassment under the MMPA (Table 7-1). No Level A take is requested for beluga whales or humpback whales. The small numbers of potential exposures for each ESA-listed species are anticipated to have no measurable effect on individuals or their populations as a whole.

Table 7-1. Summary of All ESA-listed Species Potential Exposures (Takes) Requested by Species

<table>
<tr><th rowspan="3">Year</th><th colspan="4">Species</th></tr>
<tr><th rowspan="2">Steller Sea Lion
Western Stock and DPS</th><th rowspan="2">Beluga Whale
Cook Inlet Stock and DPS</th><th colspan="2">Humpback Whale</th></tr>
<tr><th>Mexico - North Pacific Stock</th><th>Hawai‘i Stock</th></tr>
<tr><td>Population Estimate[a]</td><td>52,932</td><td>331</td><td>Unknown</td><td>11,278</td></tr>
<tr><td colspan="5">Estimated Number of Exposures - Level B Harassment</td></tr>
<tr><td>Year 1</td><td>7</td><td>85</td><td colspan="2">2</td></tr>
<tr><td>Year 2</td><td>6</td><td>76</td><td colspan="2">2</td></tr>
<tr><td>Year 3</td><td>13</td><td>76</td><td colspan="2">4</td></tr>
<tr><td>Year 4</td><td>7</td><td>78</td><td colspan="2">2</td></tr>
<tr><td>Year 5</td><td>8</td><td>80</td><td colspan="2">2</td></tr>
<tr><td>Year 6</td><td>8</td><td>80</td><td colspan="2">3</td></tr>
<tr><td>6-Year Total</td><td>49</td><td>475</td><td colspan="2">15</td></tr>
<tr><td colspan="5">Estimated Number of Exposures - Level A Harassment</td></tr>
<tr><td>Year 1</td><td>15</td><td rowspan="6">0</td><td colspan="2">4</td></tr>
<tr><td>Year 2</td><td>13</td><td colspan="2">4</td></tr>
<tr><td>Year 3</td><td>6</td><td colspan="2">2</td></tr>
<tr><td>Year 4</td><td>13</td><td colspan="2">4</td></tr>
<tr><td>Year 5</td><td>12</td><td colspan="2">4</td></tr>
<tr><td>Year 6</td><td>13</td><td colspan="2">3</td></tr>
<tr><td>6-Year Total</td><td>72</td><td>0</td><td colspan="2">21</td></tr>
</table>

Note: NA = not applicable.

[a] Population estimates used in calculations are presented in Section 4.

[b] These percentages assume that all potential exposures come from each stock; thus, each percentage should be adjusted down if multiple stocks are actually affected.

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Section 8. Recommended Effect Determinations

8.1 Cook Inlet Beluga Whale

The CTR Project **may affect** Cook Inlet beluga whales because:

- Cook Inlet beluga whales are known to occur in the action area during the proposed period of in-water pile installation and removal and construction season (April to November); and
- In-water pile installation and removal will temporarily increase underwater noise in the action area to levels that may exceed Level B harassment thresholds as defined by NMFS under the MMPA.

The CTR Project is **likely to adversely affect** Cook Inlet beluga whales because:

- The POA has requested Level B harassment take of beluga whales under the MMPA during the CTR Project;
- Individual beluga whales may be harassed if they pass through waters of the action area during in-water pile installation and removal; and
- Behavioral harassment may result in disturbance or displacement of beluga whales.

Though the recommended effect determination is **likely to adversely affect** Cook Inlet beluga whales, the potential adverse effects on Cook Inlet beluga whales are anticipated to be reduced by the following measures:

- The POA will require that in-water pile installation and removal be delayed if a beluga whale is observed approaching the Level B harassment zone, as described in the CTR LOA/IHA application (POA 2024).
- The POA will require a mandatory shutdown zone for all in-water pile installation and removal to avoid injury-related impacts on marine mammals. This zone will fully encompass the MMPA (Level A) injury thresholds calculated for all functional hearing groups during in-water pile installation and removal.
- To date, Cook Inlet beluga whales have exhibited limited behavioral reactions to in-water pile installation and removal at the POA (NMFS 2009; 61N Environmental 2020, 2021, 2022a, 2022b). As such, the likelihood that individuals will exhibit significant behavioral modifications is relatively low.
- Any potential behavioral harassment of individual beluga whales would be minor and temporary in duration.

8.2 Cook Inlet Beluga Whale Critical Habitat

A **may affect** determination is warranted for Cook Inlet beluga whale critical habitat because:

- A small portion of the action area is located within designated critical habitat; and
- In-water pile installation and removal may temporarily increase underwater noise in portions of designated critical habitat.

A **not likely to adversely affect** determination is warranted for Cook Inlet beluga whale critical habitat because:

- The temporary and intermittent increase in underwater noise levels in a small portion of designated critical habitat will not result in measurable changes to habitat quality; and
- Observations of beluga whales near the POA during past in-water construction programs suggest that beluga whales are not displaced from critical habitat due to underwater noise. Therefore, the CTR Project is not expected to measurably change beluga whale use of critical habitat.

8.3 Steller Sea Lion

The CTR Project **may affect** western DPS Steller sea lions because:

- Steller sea lions are known to occur in the action area during the proposed period of in-water work (April to November); and
- In-water pile installation and removal will temporarily increase underwater noise in the action area to levels that may exceed Level B harassment thresholds as defined by NMFS under the MMPA.

The CTR Project is **likely to adversely affect** western DPS Steller sea lions because:

- The POA has requested Level B and Level A take of Steller sea lions under the MMPA during the CTR Project;
- Individual Steller sea lions may be harassed if they pass through waters of the action area during in-water pile installation and removal; and
- Behavioral harassment may result in disturbance or displacement of Steller sea lions.

Though the recommended effect determination is **likely to adversely affect** western DPS Steller sea lions, the potential adverse effects on western DPS Steller sea lions are anticipated to be reduced by the following measures:

- The POA will require a mandatory shutdown zone for all in-water pile installation and removal to avoid injury-related impacts on Steller sea lions. This zone will fully encompass the MMPA (Level A) injury thresholds calculated for otariid pinnipeds during in-water pile installation and removal. Therefore, it is unlikely that a Steller sea lion will be exposed to potentially injurious noise levels.
- Upper Knik Arm is considered extralimital for this species, and Steller sea lions are rare in the action area. Therefore, it is unlikely that individuals will be affected by CTR.
- Any potential behavioral harassment of individual Steller sea lions will be minor and temporary in duration.

8.4 Steller Sea Lion Critical Habitat

A **no effect** determination is warranted for western DPS Steller sea lion critical habitat because:

- The action area is not located in or near designated Steller sea lion critical habitat.

8.5 Humpback Whale

The CTR Project **may affect** Western North Pacific or Mexico DPS of humpback whales because:

- Humpback whales are known to occur in the action area during the proposed period of in-water work (April to November); and

- In-water pile installation and removal will temporarily increase underwater noise in the action area to levels that may exceed Level B harassment thresholds as defined by NMFS under the MMPA.

The CTR Project is **likely to adversely affect** Western North Pacific or Mexico DPS humpback whales because:

- The POA has requested Level B take of humpback whales under the MMPA during CTR;
- Individual humpback whales may be harassed if they pass through waters of the action area during in-water pile installation and removal; and
- Behavioral harassment may result in disturbance or displacement of humpback whales.

Though the recommended effect determination is **likely to adversely affect** Western North Pacific or Mexico DPS humpback whales, the potential adverse effects to Western North Pacific or Mexico DPS humpback whales is anticipated to be reduced by the following measures:

- The POA will require a mandatory shutdown zone for all in-water pile installation and removal to avoid injury-related impacts on humpback whales. This zone will fully encompass the MMPA (Level A) injury thresholds calculated for low-frequency cetaceans during in-water pile installation and removal. Therefore, it is very unlikely that humpback whales will be exposed to potentially injurious noise levels.
- Upper Knik Arm is considered extralimital for this species, and humpback whales are rare in the action area. Therefore, it is unlikely that individuals will be affected by CTR.
- Any potential behavioral harassment of individual humpback whales will be minor and temporary in duration.

8.6 Humpback Whale Critical Habitat

A **no effect** determination is warranted for the Western North Pacific DPS or Mexico DPS of humpback whale critical habitat because:

- The action area is not located in or near designated humpback whale critical habitat.

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