DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

[RTID 0648–XR027]

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to Construction of the Port of Alaska's Petroleum and Cement Terminal, Anchorage, Alaska

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice; proposed incidental harassment authorization; request for comments on proposed authorization and possible renewal.

SUMMARY: NMFS has received a request from the Port of Alaska (POA) for authorization to take marine mammals incidental to pile driving associated with the construction of a new Petroleum and Cement Terminal (PCT) in Knik Arm, Alaska. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is requesting comments on its proposal to issue two successive incidental harassment authorizations (IHAs) to incidentally take marine mammals during the specified activities. NMFS is also requesting comments on possible one-year renewals that could be issued under certain circumstances and if all requirements are met, as described in *Request for Public Comments* at the end of this notice. NMFS will consider public comments prior to making any final decision on the issuance of the requested MMPA authorizations and agency responses will be summarized in the final notice of our decision.

DATES: Comments and information must be received no later than January 29, 2020.

ADDRESSES: Comments should be addressed to Jolie Harrison, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service. Physical comments should be sent to 1315 East-West Highway, Silver Spring, MD 20910 and electronic comments should be sent to *ITP.Daly@noaa.gov.*

Instructions: NMFS is not responsible for comments sent by any other method, to any other address or individual, or received after the end of the comment period. Comments received electronically, including all attachments, must not exceed a 25-megabyte file size. Attachments to electronic comments will be accepted in Microsoft Word or Excel or Adobe PDF file formats only. All comments received are a part of the public record and will generally be posted online at *https://www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act* without change. All personal identifying information (*e.g.,* name, address) voluntarily submitted by the commenter may be publicly accessible. Do not submit confidential business information or otherwise sensitive or protected information.

FOR FURTHER INFORMATION CONTACT: Jaclyn Daly, Office of Protected Resources, NMFS, (301) 427–8401. Electronic copies of the application and supporting documents, as well as a list of the references cited in this document, may be obtained online at: *https://www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act.* In case of problems accessing these documents, please call the contact listed above.

SUPPLEMENTARY INFORMATION:

Background

The MMPA prohibits the ''take'' of marine mammals, with certain exceptions. Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq.*) direct the Secretary of Commerce (as delegated to NMFS) to allow, upon request, the incidental, but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are issued or, if the taking is limited to harassment, a notice of a proposed incidental take authorization may be provided to the public for review. Under the MMPA, ''take'' is defined as meaning to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal.

Authorization for incidental takings shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s) and will not have an unmitigable adverse impact on the availability of the species or stock(s) for taking for subsistence uses (where relevant). Further, NMFS must prescribe the permissible methods of taking and other ''means of effecting the least practicable adverse impact'' on the affected species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stocks for taking for certain subsistence uses (referred to in shorthand as ''mitigation''); and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth. The definitions of all applicable MMPA statutory terms cited above are included in the relevant sections below.

National Environmental Policy Act

To comply with the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq.*) and NOAA Administrative Order (NAO) 216–6A, NMFS must review our proposed action (*i.e.,* the issuance of an incidental harassment authorization) with respect to potential impacts on the human environment.

Accordingly, NMFS is preparing an Environmental Assessment (EA) to consider the environmental impacts associated with the issuance of the proposed IHA. NMFS' EA will be made available at *https://www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act.* We will review all comments submitted in response to this notice prior to concluding our NEPA process or making a final decision on the IHA request.

Summary of Request

On November 28, 2018, NMFS received a request from the POA for an IHA to take marine mammals incidental to pile driving associated with the construction of the PCT. On June 19, 2019, the POA submitted a subsequent, after request realizing the project would take two construction seasons (April–November) to complete. Because of this modified construction schedule, the POA submitted a new application on July 19, 2019 and a revised application on August 9, 2019. Although NMFS disagreed with some of the analysis in the application (as described later in this document), we deemed it adequate and complete on August 28, 2019, because it contained all the information necessary for us to conduct our MMPA analysis. The POA submitted a subsequent revised application on October 15, 2019, which is available at *https://www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act.* The POA's request is for take of small numbers of six species of marine mammals, by Level B harassment. Four of the species could also be taken by Level A harassment. Neither the POA nor NMFS expects serious injury or mortality to result from this activity; therefore, an IHA is appropriate.

NMFS previously issued IHAs and Letters of Authorization (LOAs) to the POA for pile driving (73 FR 41318, July 18, 2008; 74 FR 35136, July 20, 2009; and 81 FR 15048; March 21, 2016). The POA complied with all the requirements (*e.g.,* mitigation, monitoring, and reporting) of all previous incidental take authorizations and did not exceed authorized take. Information regarding their monitoring results may be found in the *Effects of the Specified Activity on Marine Mammals and their Habitat* and *Estimated Take* sections.

Description of Proposed Activity

Overview

The POA proposes to construct a new PCT comprised of a pile-supported structure located along the southernmost shoreline of the POA (see Figure 1–1 and Figure 1–2 in the POA's IHA application), as part of its Port of Alaska Modernization Project (PAMP). In general, the PAMP will include construction of new pile-supported wharves and trestles south and west of the existing terminals, with a planned design life of 75 years. The proposed project, the PCT project, is one component of the PAMP.

The PCT project will replace the existing Petroleum Oil Lubricants Terminal which is currently the only bulk cement-handling facility in Alaska and is the primary terminal for receipt of refined petroleum products. The PCT Project will involve new construction of a loading platform, access trestle, and dolphins; and installation of utilities (electricity, water, and communication), petroleum, and cement lines linking the terminal and shore. Ships mooring to the PCT will utilize both breasting dolphins and mooring dolphins. The PCT will be designed to satisfy project-specific seismic performance criteria, allowing the terminal to be quickly restored to service following a major seismic event such as the magnitude 7.0 earthquake that struck Anchorage on November 30, 2018.

The POA will install three breasting dolphins and six mooring dolphins as well as a new loading platform and catwalks. In addition to these permanent structures, temporary access trestles will be installed and subsequently removed. Pile installation will occur in water depths that range from a few feet or dry conditions nearest the shore to approximately 80 feet at the outer face of the loading platform, depending on tidal stage. Various work boats and barges will be utilized to support construction. Work will be completed over two construction seasons (April through November): Phase 1 will occur in 2020 and Phase 2 will occur in 2021.

Dates and Duration

POA anticipates two construction seasons (April–November) will be required to complete the PCT terminal. The POA has requested two IHAs to cover this work. These IHAs correspond with Phase 1 and Phase 2. The POA anticipates 359 hours of pile driving and removal over 127 days in Phase 1 and 229 hours of pile driving and removal over 75 days in Phase 2. For each phase, construction mobilization is planned to commence the first week of April, with the potential to initiate pile installation activities by mid-April. Construction demobilization is planned to occur in November, with the expectation to remove the final temporary piles by the first week of November. Between April and November, piles will be installed and removed during daylight hours only.

Specific Geographic Region

Cook Inlet is a large tidal estuary that exchanges waters at its mouth with the Gulf of Alaska. The inlet is roughly 20,000 square kilometers (km^2; 7,700 square miles [mi^2]) in area, with approximately 1,350 linear kilometers (840 miles) of coastline (Rugh et al. 2000) and an average depth of approximately 100 meters (330 feet). Cook Inlet is generally divided into upper and lower regions by the East and West Forelands. Northern Cook Inlet bifurcates into Knik Arm to the north and Turnagain Arm to the east. The POA is located in the southeastern shoreline of Knik Arm (Figure 1).

Knik Arm is generally considered to begin at Point Woronzof, 7.4 kilometers (4.6 miles) southwest of the POA. From Point Woronzof, Knik Arm extends about 48 kilometers (30 miles) in a north-northeasterly direction to the mouths of the Matanuska and Knik rivers. At Cairn Point, just northeast of the POA, Knik Arm narrows to about 2.4 kilometers (1.5 miles) before widening to as much as 8 kilometers (5 miles) at the tidal flats northwest of Eagle Bay at the mouth of Eagle River, which are heavily utilized by Cook Inlet beluga whales (CIBWs). Approximately 60 percent of Knik Arm is exposed at mean lower low water (MLLW). The intertidal (tidally influenced) areas of Knik Arm, including those at the POA, are mudflats, both vegetated and unvegetated, which consist primarily of fine, silt-sized glacial flour.

The POA's boundaries currently occupy an area of approximately 129 acres. Other commercial and industrial activities related to secure maritime operations are located near the POA on Alaska Railroad Corporation (ARRC) property immediately south of the POA, on approximately 111 acres.

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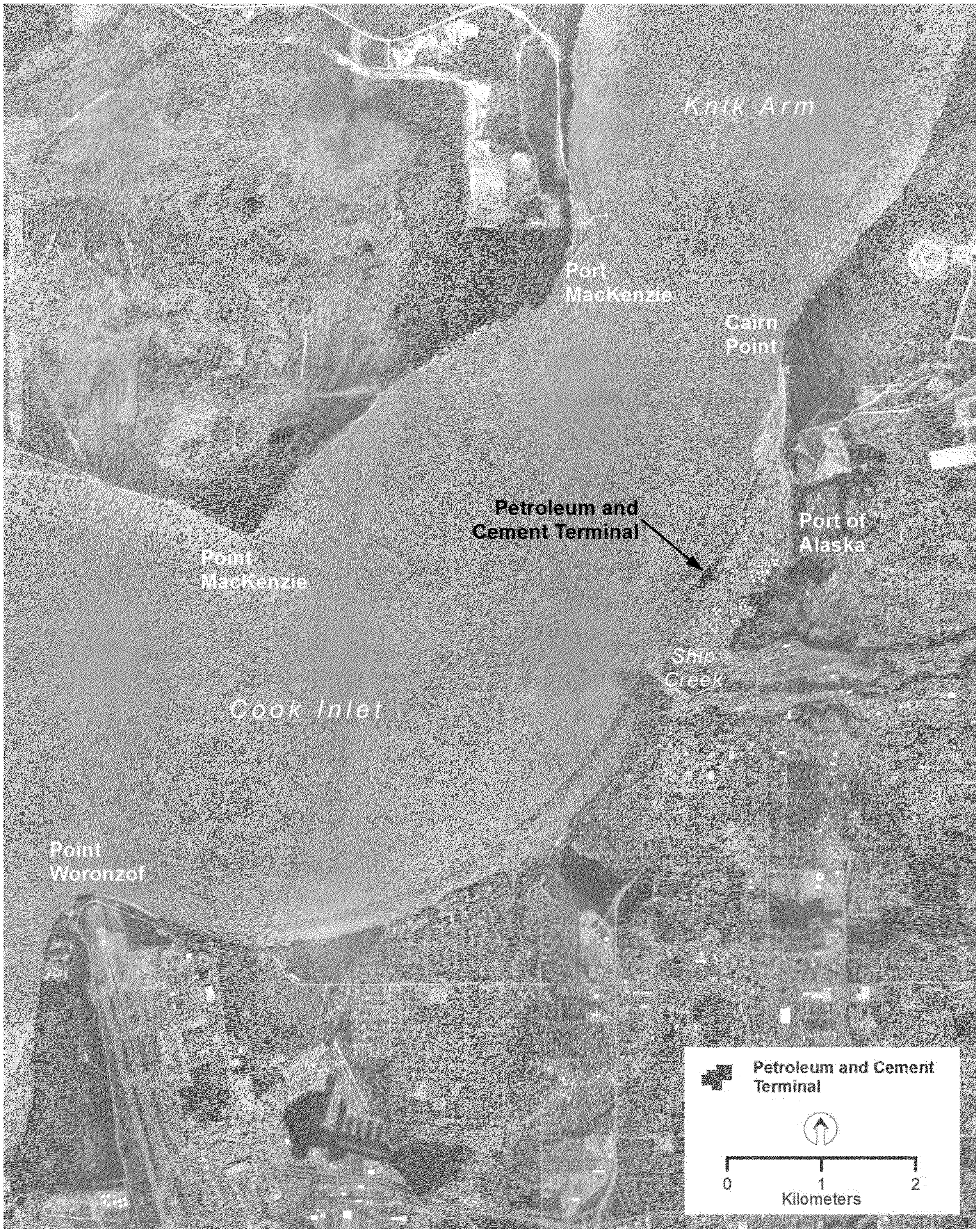

Figure 1. Port of Alaska Location Within Knik Arm, Alaska.

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Detailed Description of Specific Activity

Located within the Municipality of Anchorage on Knik Arm in upper Cook Inlet (see Figure 1–1 in the POA's IHA application), the POA's existing infrastructure and support facilities were constructed largely in the 1960s. Port facilities are substantially past their design life, have degraded to levels of marginal safety, and are in many cases functionally obsolete, especially in regard to seismic design criteria and condition.

The purpose for the PCT Project is to replace the existing Petroleum Oil Lubricants Terminal (POL 1), the only bulk cement-handling facility in Alaska and the primary terminal for receipt of refined petroleum products. POL 1, built in 1965, is more than 50 years old and consists of 160 wharf pilings that are uncoated, hollow-steel pile. The need for the PCT is based on the heavily deteriorated physical condition of POL 1. It suffers from severe corrosion of its foundation pilings to levels of marginal safety, as evidenced by currently imposed load restrictions. A 2014 pile condition assessment found severe corrosion throughout the facility, with pile wall losses exceeding 67 percent of their original thickness. It also sustained structural damage from a magnitude 7.1 earthquake that struck the area on November 30, 2018. Recent inspections in 2019 have led engineers to confirm that the stress imposed on the already-weakened structure by the November 30 quake caused some piling failure and predisposes the docks to additional failure during future earthquakes. The PCT has been designed to satisfy project-specific seismic performance criteria, allowing the terminal to be quickly restored to service following a major seismic event. POL 1 is functionally obsolete, has exceeded its useful life, and is unlikely to withstand another such earthquake.

The PCT Project includes three major components: (1) A loading platform in Phase 1, (2) an access trestle (bridge-like structure allowing access to the loading platform) in Phase 1, and (3) breasting and mooring dolphins in Phase 2 (see Table 1–1). A temporary work trestle and temporary templates are required for constructing the permanent access trestle in Phase 1, and temporary templates are required for constructing the dolphins in Phase 2. During both Phase 1 and Phase 2, temporary mooring dolphins will be required to accommodate construction barges and to moor construction vessels. Piles will be installed primarily with an impact hammer; however, some vibratory pile driving is also required. A bubble curtain will be deployed to reduce in-water sound levels during PCT construction for impact and vibratory hammer pile installation of 144-, 48-, 36-, and 24-inch plumb (vertical) piles and vibratory hammer removal of 36- and 24-inch plumb piles (all temporary and permanent piles). A bubble curtain will not be deployed during installation and removal of 24-inch battered (installed at an angle, not vertical) piles for the temporary construction work trestle and temporary dolphins due to the difficult geometric application.

All Phase 1 work will occur under the first IHA, while Phase 2 work will occur under the second IHA. Pile sizes and quantities for permanent and temporary components for each phase are shown in Table 1–1; estimates of the time required to install or remove piles for each phase are shown in Table 1–2.

TABLE 1–1—SUMMARY OF PCT PROJECT COMPONENTS AND ACTIVITIES

Type of activity	Location	Phase	Size and type	Total amount or number
Permanent Components				
Permanent pile installation (loading platform)	In water	1	48-inch steel pipe (plumb)	45 piles.
Permanent pile installation (access trestle)	In water	1	48-inch steel pipe (plumb)	26 piles.
Permanent pile installation (breasting and mooring dolphins).	In water	2	144-inch steel pipe (plumb)	9 piles.
Installation of concrete decking on loading platform and main trestle.	Above water	1	Pre-cast panels	About 120 panels.
Catwalks	Above water	2	Prefabricated steel or aluminum trusses with open steel grating.	9 units, totaling 990 feet.
Construction Support and Temporary Components				
Vessel support	In water	1 & 2	Barges and tugs	16 flat deck barges, 2 derrick barges, and 3–4 tugs.
Temporary pile installation (construction work trestle)	In-water	1 1	24-inch steel pipe (plumb) 24-inch steel pipe (battered).	26 piles 10 piles.
Temporary pile installation (dolphin templates)	In-water	2	36-inch steel pipe (plumb)	72 piles.
Temporary pile installation (construction work trestle)	In-water	1	36-inch steel pipe (plumb)	26 piles.
Temporary pile installation (access trestle templates)	In-water	1	24-inch steel pipe (plumb)	36 piles.
Temporary mooring anchor systems	In-water	1 & 2	20,000 pound Danforth anchors.	2 mooring systems.
Temporary derrick barge	In-water	1 & 2	36-inch steel pipe (plumb)	4 piles.
Temporary dolphins for mooring construction vessels	In-water	1 & 2	24-inch steel pipe (plumb) 4-inch steel pipe (battered)	3 dolphins, each with 1 plumb and 2 battered piles (9 piles total).
Installation of Utility, Petroleum, and Cement Lines				
Installation on access trestle and loading platform	Above water, on-dock.	1	Pipelines, various sizes and types.	300–600 linear feet each.

TABLE 1–2—PCT CONSTRUCTION PILE DETAILS AND ESTIMATED EFFORT REQUIRED FOR PILE INSTALLATION AND REMOVAL

Pipe pile diameter	Feature [a]	Number of piles	Total number of piles	Average embedded depth (feet)	Vibratory duration per pile (minutes)	Impact strikes per pile	Estimated total number of hours	Production rate piles per day (range)	Days of installation and removal
				Phase 1					
48-inch	Loading Platform	45	71	100	30	2,300 (50 restrikes each for 4 piles).	73	1.5	30.
	Access Trestle	26		130		3,000 (50 restrikes each for 3 piles).	56	(1–3)	17.
36-inch	Temporary Construction Work Trestle.	26	30	115	75	50 restrikes for 10 piles.	33	3 (2–4)	9 installation. 9 removal.
	Temporary Derrick Barge.	4		40	75	NA	5	4	1 installation. 1 removal.
24-inch	Temporary Construction Work Trestle.	26	81	140	75	50 restrikes of 10 piles.	65	3 (2–4)	9 installation 9 removal.
	Temporary Construction Work Trestle, Battered.	10		105	75	NA	25	1.6 (1–2)	6 installation. 6 removal.
	Temporary Construction Access Trestle Template.	36		105	75	NA	90	3 (2–4)	12 installation. 12 removal.
	Temporary Dolphins for mooring construction vessels.	3		50	30	NA	3	3	1 installation. 1 removal.
	Temporary Dolphins for mooring construction vessels, Battered.	6		50	30	NA	9	3	2 installation. 2 removal.
Phase 1 Construction Totals			182 piles				359		127.
				Phase 2					
24-inch	Temporary Dolphins for mooring construction vessels.	3	9	50	30	NA	3	3	1 installation. 1 removal.
	Temporary Dolphins for mooring construction vessels, Battered.	6		50	30	NA	9	3	2 installation. 2 removal.
36-inch	Temporary Construction Dolphin Template.	72	76	115	75	NA	180	3 (2–4)	24 installation. 24 removal.
	Temporary derrick barge.	4		40	75	NA	5	4	1 installation. 1 removal.
144-inch	Mooring Dolphin	6	9	140	45 (1 pile)	5,000 (1,500 first day, 3,500 second day).	21	0.5	13.
	Breasting Dolphin	3		135			11	(0.3 or 0.7)	6.
Phase 2 Construction Totals			94 piles				229		75.

The estimated source levels for each pile type and installation method are provided in Table 2. These source levels are from the acoustic monitoring during the POA's 2016 Test Pile Program (TPP) (for 48-in piles) and investigation of existing literature at other locations for non-48-in piles.

TABLE 2—ESTIMATED PILE SOURCE LEVELS WITH AND WITHOUT BUBBLE CURTAINS

Method and pile size	Sound level at 10 m		Data source
Vibratory	Unattenuated db rms	Bubble curtain 7 dB reduction, dB rms	
144-in	178	171	Caltrans 2015.
48-in	168	161	Austin et al 2016.
36-in	166	159	Navy 2015.
24-in	161	154	Navy 2015.

Impact	Unattenuated			Bubble curtain			
	dB rms	dB SEL	dB peak	dB rms	dB SEL	dB peak	
144-in	209	198	220	202	191	213	Caltrans 2015.
48-in	200	187	215	193	180	208	Austin et al. 2016.

Impact	Unattenuated			Bubble curtain			
	dB rms	dB SEL	dB peak	dB rms	dB SEL	dB peak	
36-in	194	184	211	187	177	204	Navy 2015.
24-in	193	181	210	186	174	203	Navy 2015.

Phase 1—Loading Platform and Access Trestle Construction Description

Phase 1 will take place during 2020 and will include construction of the loading platform and access trestle. Construction will be accomplished from two concurrent headings or directions; one marine-side derrick barge with a crane/hammer will be used to construct the loading platform, and a land-side crawler crane/hammer will be used to construct the temporary and permanent access trestle from the shoreline out. The crawler crane will initially advance the temporary work trestle out from the shoreline with a top-down or leap-frog type construction method, and then the crawler crane will work off of the temporary work trestle to construct the permanent trestle all the way out to the loading platform.

For the loading platform, which is supported with 48-inch piles, the contractor will first mobilize the marine-based derrick barge on the seaward side of the platform location and install four temporary mooring piles to stabilize the derrick barge during the construction season. Also, three temporary mooring dolphins will be constructed in the vicinity of the PCT to serve as mooring for construction vessels and barges containing construction materials, and will be removed at the end of the construction season. The derrick barge will host the crane and hammer used to install the permanent loading platform piles and decking. Each of the platform piles will be installed using an impact hammer with a bubble curtain applied. A vibratory hammer would only be used in the infrequent event that an obstruction were encountered while driving the pile that requires removal or repositioning of the pile with a vibratory hammer.

Four of the permanent platform piles will be ‘‘proofed’’ to confirm their ability to withstand design loads. Proofing involves approximately 50 impact hammer restrikes over an approximate 10-minute period while instrumentation is attached to the pile during restrike to confirm design conformance. Pile cleanout activities, to prepare the interior of the hollow pile for partial concrete filling, will occur only in the top portion of the pile, but not below mudline. Any material adhered to the top inside of the pile will be removed to prepare for concrete installation, and a soffit form will be inserted into the hollow pile to prevent the closure pour concrete from reaching mudline. Formwork will be constructed around the top of the pile, out of the water, to support placement of a precast concrete cap on top of each pile. The closure pour, where concrete is poured into the pile above the soffit form, connects the pile to the precast pile caps, bonding the pile to the cap. Precast platform panels are then placed on the deck, and additional concrete will be poured on top of the panels to create the platform decking.

For the access trestle, the permanent access trestle construction requires construction of a parallel temporary trestle, installed adjacent to the permanent trestle, from which to advance the temporary piles used for templates and installation of the permanent access trestle piles. While the permanent trestle requires 48-inch piles, the temporary trestle will be constructed using 24- and 36-inch piles.

Initial construction of the temporary work trestle will be advanced first; then, as the work trestle advances water-ward and room is made available to accommodate construction equipment, work will commence on construction of the permanent access trestle coincidentally as the temporary work trestle is advanced water-ward toward the loading platform.

Construction of the trestles will occur concurrently with construction of the loading platform. A crawler crane will be used to install piles for the temporary trestle, building seaward from the shore using a top-down or leap-frog construction method. The crawler crane will advance onto the temporary trestle to complete pile installation and decking for the temporary trestle. Once the first section of temporary trestle is constructed and the crawler crane is advanced, a second crawler crane will advance onto the deck of the temporary trestle and be used to install the first section of template and permanent piles for the permanent access trestle (see *Pile Driving Scenarios,* below).

Three of the permanent trestle piles will be ‘‘proofed’’ to confirm their ability to withstand design loads. In addition, it is estimated that 10 each of the 24- and 36-inch temporary work trestle piles may need to be proofed to confirm load capacities for construction equipment. Template piles will stay in place until precast pile caps are placed on the permanent trestle piles following installation. The temporary trestle will stay in place for the entire construction season, and will be used as a work platform for decking installation on the permanent trestle. The temporary trestle decking and piles will be removed at the end of construction activities for Phase 1. Removal is expected to require the same amount of time as installation due to the strong pile setup and resistance conditions related to Knik Arm sediments.

The permanent access trestle is comprised of eight bents (clusters) of three piles each and one bent of two piles at the abutment. The abutment bent (two piles) is located above mean high water on shore and will be installed in the dry. The next three bents are located in the intertidal zone and therefore may or may not be installed in water depending upon the tidal stage (*i.e.,* if the tide is high, they may be in water, but if the tide is low, they will not be in water). The parallel temporary construction trestle will follow the same pattern. For purposes of this analysis, it is assumed that all piles will be driven in water; however, if piles are driven in the dry during actual construction, takes of marine mammals will be assumed not to occur. Also, some of the permanent trestle piles may be started/partially driven with a vibratory hammer when in the dry at the abutment (two piles) and the first three bents (three piles each) in order to set the pile up for impact hammer installation; this condition also is not expected to generate takes. This is a unique situation at this location due to the highly variable tidal conditions and the need to provide initial pile support for impact hammer installation.

To construct the loading platform and permanent access trestle, piles will be installed using an impact hammer to drive through the overburden sediment layer and into the bearing layer, to an average embedded depth of about 100 feet (loading platform piles) and 130 feet (access trestle piles) below the substrate. Installation and removal of all temporary piles, including derrick barge mooring piles, mooring dolphin piles for mooring construction vessels, temporary access trestle piles, and templates for installation of the permanent access trestle piles, will use vibratory hammer methods. Limited vibratory hammer application may be required for loading platform and permanent trestle piles due to safety reasons, constructability, or if a pile encounters an obstruction.

Phase 2—Mooring and Breasting Dolphins Construction Description

Phase 2 will occur in 2021 and will include construction of the mooring and breasting dolphins. Construction will be accomplished from one marine-based derrick barge with a crane/hammer work station. Similar to Phase 1, the contractor will initially install four temporary mooring piles to stabilize the derrick barge during the construction season. Also, three temporary mooring dolphins will be constructed in the vicinity of the PCT to serve as mooring for construction vessels and barges containing construction materials, and will be removed at the end of the construction season. The derrick barge will host the crane and hammer used to install the mooring and breasting dolphins. Temporary template piles will then be installed to anchor the template that will guide the installation of the permanent dolphin piles at each of the dolphin locations. Template piles will be installed approximately 115 feet into the substrate. Temporary template piles will be driven in a grid formation surrounding the location of each dolphin pile, with a steel framework bolted to the temporary piles to guide dolphin pile installation. The framework includes adjustable components and hydraulic guides that can be adjusted to maintain correct positioning of the dolphins once they are in place. All template piles will be aligned plumb (vertically) and installed and removed using a vibratory hammer due to accuracy requirements for setting the template. All plumb piles will employ a bubble curtain during all pile-driving activity.

Ships mooring to the PCT will utilize both breasting dolphins and mooring dolphins. To meet required structural demands, monopile dolphins are planned for both the breasting and mooring dolphins. Breasting dolphins are designed to assist in the berthing of vessels by absorbing some of the lateral load during vessel impact. Breasting dolphins also protect the loading platform from impacts by vessels. 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.

In total, nine 144-in mooring and breasting dolphins will be installed at the PCT. Six mooring dolphins will be constructed parallel to and landward of the loading platform face and three breasting dolphins will be installed in alignment with the loading platform (Figure 1–2 in the POA's IHA application). These dolphins will provide for secure ship docking at the terminal. Each mooring and breasting dolphin will be comprised of a single round 144-inch steel pipe pile or monopile, driven to an average embedded depth of about 140 feet below the substrate.

Following temporary pile installation with a vibratory hammer of the dolphin template, held in place with 36-inch piles, the crane will loft the first permanent pile length (approximately 100 feet) and ready it for lowering through the template framework. The crane will have a boom holding the top of the pile as well as a spotter arm lower on the pile to steady the pile for positioning. The pile will then be lowered through the template and readied for pile driving. Impact pile driving will be used to advance the pile to a prescribed depth, at which point pile-driving activity will stop to allow field splicing of the second pile length. Decking will be added to the temporary pile template framework to accommodate welders; no pile driving will be conducted during the welding and testing of the two lengths of pile, as the crane will be holding the second pile length in place. Once the first and second lengths of pile are spliced, pile driving will be reinitiated until the tip is at the prescribed depth. Limited vibratory hammer application may be required on the mooring or breasting dolphin piles for safety reasons or if a pile encounters an obstruction.

Following monopile installation, the superstructure will be installed atop the monopile. A precast concrete mooring cap will be added to the monopile. The caps will be welded to the piles by an embedded steel ring in the precast cap. This activity will not require in-water work or hammer activity. The three breasting dolphins will have fenders installed, which will be attached to the mooring cap and will not require in-water or hammer work.

Once the first and second lengths of pile, ring and mooring cap, and fender, if applicable, are assembled at the first location, the temporary pile template will be removed using a vibratory hammer. The barge will be repositioned to the next location, and the work activity will commence as described above.

One crane will be used for installation of dolphin piles and associated temporary template piles; multiple hammers will not be employed simultaneously. Templates will be re-used at each dolphin location. The crane will alternate between installing template piles, driving dolphin piles, removing template piles, and out-of-water work such as placement of decking, catwalks, and utility racks along the platform and trestle. All terminal utility work is out of the water, and includes installation of pipe racks and utilities along the platform and trestle.

Phases 1 and 2—Temporary Mooring Dolphins

Three temporary mooring dolphins will be installed near the PCT during Phases 1 and 2. Working barges and construction vessels associated with the PCT Project will use the temporary mooring dolphins during PCT construction. Each temporary mooring dolphin will consist of one 24-inch plumb pile and two 24-inch battered piles installed with a vibratory hammer (nine piles total).

Pile-Driving Summary—Phases 1 and 2

Pile installation will occur in water depths that range from a few feet or dry conditions (at low tide) nearest the shore to approximately 24 meters (80 feet) at the outer face of the loading platform at high tide, depending on tidal stage (see Figure 1–3 and Figure 1–4 in the POA's IHA application). Figure 1–3 in the POA's IHA application shows three test piles that were installed in 2016 and are located just water-ward of the face of the PCT loading platform (test piles were removed in 2019). The PCT will be constructed between these three test piles and the shore; for illustrative purposes, the distance from the water-ward edge of the PCT loading platform (general location of test piles) is approximately 30 meters from mean lower low water and 115 meters from mean higher high water.

The pile-driving construction season for Phase 1 is scheduled to commence April 15, 2020, and end the first week of November 2020 (November 7 for purposes of this analysis), with decommissioning occurring during the remainder of November. Decommissioning will not require in-water pile driving. Construction days when piles are not being installed or removed will be devoted to other work such as welding or deck work. The POA is working with their contractor to schedule deck work and other non-pile-driving work to the maximum extent practicable during the August/September timeframe when beluga whale abundance is higher in Knik Arm. Similarly, the pile driving construction season for Phase 2 is planned to commence in May 2021 and end in early November 2021. The estimated duration for installation and removal of PCT permanent and temporary piles is shown in Table 1–2.

Pile-Driving Scenarios

During Phase 1, the POA expects to utilize three hammers on the job site to expedite construction, including an impact hammer for loading platform construction and an impact hammer and a vibratory hammer for permanent and temporary work trestle construction. In order to mitigate potential impacts to beluga whales and attempt to maximize pile installation activities during the lower density months of occurrence (May–July), the contractor plans to add the third crane with a vibratory hammer to the equipment work mix in order to accelerate construction of the temporary and permanent trestles. This could mean that one vibratory and two impact hammers may be operating at the same time along the trestles for brief periods of time. Use of these hammers could also be coincidental with use of the impact hammer for installation of the platform piles. It is not anticipated that two vibratory hammers will be operating at the same time. Section 6.3.2.3 of the IHA application further details these conditions.

Given the proximity of the platform and trestle, hammers could work very close to each other or as far as 100 meters away from each other. The most likely combinations of piles that could be installed within a day include (1) vibratory hammer installation of 24-inch temporary piles and impact hammer installation of 48-inch permanent trestle or loading platform piles, and (2) vibratory hammer installation of 36-inch temporary piles and impact hammer installation of 48-inch permanent trestle or loading platform piles.

Since only one crane will be operational during Phase 2, there will be no additional pile-driving activity during the impact installation of either the 36-inch temporary template piles or 144-inch monopiles. When using two hammers, one must consider the accumulated energy, and there are fundamental approaches for adjusting source levels to account for the aforementioned scenarios. While two impact hammers could work at the same time, it is unlikely that the hammers would be dropping at the exact same time; therefore, two impact hammers would not necessitate additional acoustic analysis.

Auxiliary Non-Pile-Driving Activities

Other activities necessary to construct the PCT involve the installation of temporary mooring anchor systems, installation of utility lines and pipelines, and use of cranes, tugs, and floating barges. These activities are described in detail in the POA's IHA application. The National Marine Fisheries Service has evaluated these activities for the potential to harass marine mammals. Installation of the mooring anchor systems would not elevate noise levels in Knik Arm; therefore, marine mammal harassment is not a likely outcome. Utility, petroleum, and cement lines will extend between the PCT loading platform and the shore, and will connect with existing onshore infrastructure. The installed utility lines and pipelines will be supported by the access trestle and loading platform above marine waters. No pile installation or removal is associated with these auxiliary activities; therefore, no impacts on the aquatic environment, including elevated in-water noise, are anticipated from the installation of utility lines and pipelines.

Proposed mitigation, monitoring, and reporting measures are described in detail later in this document (please see *Proposed Mitigation* and *Proposed Monitoring and Reporting*).

Description of Marine Mammals in the Area of Specified Activities

There are six species of marine mammals that may be found in upper Cook Inlet during the proposed pile driving activities. Sections 3 and 4 of the POA's application summarize available information regarding status and trends, distribution and habitat preferences, and behavior and life history, of the potentially affected species. Additional information regarding population trends and threats may be found in NMFS's Stock Assessment Reports (SARs; *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments*) and more general information about these species (*e.g.,* physical and behavioral descriptions) may be found on NMFS's website (*https://www.fisheries.noaa.gov/find-species*). Additional information on beluga whales may be found in NMFS' 2016 Recovery Plan for the Cook Inlet Beluga Whale (*Delphinapterus leucas*), available online at *https://www.fisheries.noaa.gov/resource/document/recovery-plan-cook-inlet-beluga-whale-delphinapterus-leucas.*

Table 3 lists all species with expected potential for occurrence in upper Cook Inlet and summarizes information related to the population or stock, including regulatory status under the MMPA and ESA and potential biological removal (PBR), where known. For taxonomy, we follow Committee on Taxonomy (2016). PBR is defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population (as described in NMFS's SARs). While no mortality is anticipated or authorized here, PBR and annual serious injury and mortality from anthropogenic sources are included here as gross indicators of the status of the species and other threats.

Marine mammal abundance estimates presented in this document represent the total number of individuals that make up a given stock or the total number estimated within a particular study or survey area. NMFS's stock abundance estimates for most species represent the total estimate of individuals within the geographic area, if known, that comprises that stock. For some species, this geographic area may extend beyond U.S. waters. All managed stocks and all values presented in Table 3 are the most recent available at the time of publication and are available in the 2019 draft SARs (Muto *et al.,* 2019).

TABLE 3—MARINE MAMMAL SPECIES POTENTIALLY OCCURRING IN UPPER COOK INLET, ALASKA

Common name	Scientific name	Stock	ESA/MMPA status; strategic (Y/N) [1]	Stock abundance (CV, N_{min}, most recent abundance survey) [2]	PBR	Annual M/SI [3]
Order Cetartiodactyla—Cetacea—Superfamily Mysticeti (baleen whales)						
Family Balaenopteridae (rorquals):						
Humpback whale	*Megaptera novaeangliae*	Western North Pacific	E/D; Y	1,107 (0.3, 865, 2006)	3	2.6
Superfamily Odontoceti (toothed whales, dolphins, and porpoises)						
Family Delphinidae:						
Beluga whale	*Delphinapterus leucas*	Cook Inlet	E/D; Y	327 (0.06, 311, 2016)	0.54	0
Killer whale	*Orcinus orca*	Alaska Resident	-/-; N	2,347 (N/A, 2,347, 2012)	24	1
		Alaska Transient	-/-; N	587 (N/A, 587, 2012)	5.9	1
Family Phocoenidae (porpoises):						
Harbor porpoise	*Phocoena*	Gulf of Alaska	-/-; Y	31,046 (0.214, N/A, 1998)	Undet	72
Order Carnivora—Superfamily Pinnipedia						
Family Otariidae (eared seals and sea lions):						
Steller sea lion	*Eumetopias jubatus*	Western	E/D; Y	54,267 (N/A, 54,267, 2017)	326	247
Family Phocidae (earless seals):						
Harbor seal	*Phoca vitulina*	Cook Inlet/Shelikof	-/-; N	28,411 (26,907, N/A, 2018)	807	807

[1] Endangered Species Act (ESA) status: Endangered (E), Threatened (T)/MMPA status: Depleted (D). A dash (-) indicates that the species is not listed under the ESA or designated as depleted under the MMPA. Under the MMPA, a strategic stock is one for which the level of direct human-caused mortality exceeds PBR or which is determined to be declining and likely to be listed under the ESA within the foreseeable future. Any species or stock listed under the ESA is automatically designated under the MMPA as depleted and as a strategic stock.

[2] NMFS marine mammal stock assessment reports online at: *www.nmfs.noaa.gov/pr/sars/.* CV is coefficient of variation; N_{min} is the minimum estimate of stock abundance. In some cases, CV is not applicable because it has not been calculated.

[3] These values, found in NMFS' SARs, represent annual levels of human-caused mortality plus serious injury from all sources combined (*e.g.,* commercial fisheries, ship strike). Annual M/SI often cannot be determined precisely and is in some cases presented as a minimum value or range. A CV associated with estimated mortality due to commercial fisheries is presented in some cases.

As described below, all six species (comprising six managed MMPA stocks) temporally and spatially co-occur with the activity to the degree that take is reasonably likely to occur, and we have proposed authorizing it.

Humpback Whale

Currently, three populations of humpback whales are recognized in the North Pacific, migrating between their respective summer/fall feeding areas and winter/spring calving and mating areas (Baker *et al.* 1998; Calambokidis *et al.* 1997). Although there is considerable distributional overlap in the humpback whale stocks that use Alaska, the whales seasonally found in Cook Inlet are probably of the Central North Pacific stock (Muto *et al.* 2017). The Central North Pacific stock winters in Hawaii and summers from British Columbia to the Aleutian Islands (Calambokidis *et al.* 1997), including Cook Inlet. The humpback whale ESA listing final rule (81 FR 62259, September 8, 2016) established 14 Distinct Population Segments (DPSs) with different listing statuses. The Hawaii DPS is not listed as threatened or endangered under the ESA. NMFS is in the process of reviewing humpback whale stock structure under the MMPA in light of the 14 DPSs established under the ESA.

Humpback whales are encountered regularly in lower Cook Inlet and occasionally in mid-Cook Inlet; however, sightings are rare in upper Cook Inlet. There have been few sightings of humpback whales near the project area. Humpback whales were not documented during POA construction or scientific monitoring from 2005 to 2011 or during 2016 (Cornick and Pinney 2011; Cornick and Saxon-Kendall 2008, 2009; Cornick and Seagars 2016; Cornick et al. 2010, 2011; ICRC 2009a, 2010a, 2011a, 2012; Markowitz and McGuire 2007; Prevel-Ramos et al. 2006). Observers monitoring the Ship Creek Small Boat Launch from August 23 to September 11, 2017 recorded two sightings, each of a single humpback whale, which was presumed to be the same individual. One other humpback whale sighting has been recorded for the immediate vicinity of the project area. This event involved a stranded whale that was sighted near a number of locations in upper Cook Inlet before washing ashore at Kincaid Park in 2017; it is unclear as to whether the humpback whale was alive or deceased upon entering Cook Inlet waters.

Potential concerns include elevated levels of sound from anthropogenic sources (*e.g.,* shipping, military sonars) but no specific habitat concerns have been identified for this stock. Other potential impacts include harmful algal blooms (Geraci et al. 1989), possible changes in prey distribution with climate change, entanglement in fishing gear, ship strikes due to increased vessel traffic (*e.g.,* from increased shipping in higher latitudes and through the Bering Sea with changes in sea-ice coverage), and oil and gas activities. An intentional unauthorized take of a humpback whale by Alaska Natives in Toksook Bay was documented in 2016 (Muto et al., 2019); however, no subsistence use of humpback whales occurs in Cook Inlet.

The overall trend for most humpback whale populations found in U.S. waters is positive and points toward recovery (81 FR 62259; September 8, 2016), indicating that prey availability is not a major problem. However, a sharp decline in observed reproduction and encounter rates of humpback whales from the Central North Pacific stock between 2013 and 2018 has been related to oceanographic anomalies and consequent impacts on prey resources (Cartwright et al. 2019), suggesting that humpback whales are vulnerable to major environmental changes.

Beluga Whale

The CIBW stock is a small, geographically isolated population separated from other beluga populations by the Alaska Peninsula. The population is genetically distinct from other Alaska populations, suggesting the peninsula is an effective barrier to genetic exchange (O'Corry-Crowe *et al.* 1997). The CIBW population is estimated to have declined from 1,300 animals in the 1970s (Calkins 1989) to about 340 animals in 2014 (Shelden *et al.* 2015). The precipitous decline documented in the mid-1990s was attributed to unsustainable subsistence practices by Alaska Native hunters (harvest of >50 whales per year) (Mahoney and Shelden 2000). In 2006, a moratorium to cease hunting was agreed upon to protect the species.

The Cook Inlet beluga stock remains within Cook Inlet throughout the year (Goetz *et al.* 2012a). NMFS designated two areas, consisting of 7,809 km2 (3,016 mi2) of marine and estuarine environments considered essential for the species' survival and recovery as critical habitat. However, in recent years the range of the beluga whale has contracted to the upper reaches of Cook Inlet because of the decline in the population (Rugh *et al.* 2010). Area 1 of the CIBW critical habitat encompasses all marine waters of Cook Inlet north of a line connecting Point Possession (61.04° N, 150.37° W) and the mouth of Three Mile Creek (61.08.55° N, 151.04.40° W), including waters of the Susitna, Little Susitna, and Chickaloon Rivers below mean higher high water (MHHW). This area provides important habitat during ice-free months and is used intensively by Cook Inlet beluga between April and November (NMFS 2016a). More information on CIBW habitat can be found at *https://www.fisheries.noaa.gov/action/critical-habitat-cook-inlet-beluga-whale*.

Since 1993, NMFS has conducted annual aerial surveys in June, July or August to document the distribution and abundance of beluga whales in Cook Inlet. The collective survey results show that beluga whales have been consistently found near or in river mouths along the northern shores of upper Cook Inlet (*i.e.,* north of East and West Foreland). In particular, beluga whale groups are seen in the Susitna River Delta, Knik Arm, and along the shores of Chickaloon Bay. Small groups had also been recorded farther south in Kachemak Bay, Redoubt Bay (Big River), and Trading Bay (McArthurRiver) prior to 1996 but very rarely thereafter. Since the mid-1990s, most (96 to 100 percent) beluga whales in upper Cook Inlet have been concentrated in shallow areas near river mouths, no longer occurring in the central or southern portions of Cook Inlet (Hobbs *et al.* 2008). Based on these aerial surveys, the concentration of beluga whales in the northernmost portion of Cook Inlet appears to be consistent from June to October (Rugh *et al.* 2000, 2004a, 2005, 2006, 2007). Research reports generated from the surveys can be found at *https://www.fisheries.noaa.gov/alaska/endangered-species-conservation/research-reports-and-publications-cook-inlet-beluga-whales*.

Though CIBWs can be found throughout the inlet at any time of year, they spend the ice-free months generally in the upper Cook Inlet, shifting into the middle and lower Inlet in winter (Hobbs *et al.* 2005). In 1999, one beluga whale was tagged with a satellite transmitter, and its movements were recorded from June through September of that year. Since 1999, 18 beluga whales in upper Cook Inlet have been captured and fitted with satellite tags to provide information on their movements during late summer, fall, winter, and spring. Using location data from satellite-tagged Cook Inlet belugas, Ezer *et al.* (2013) found most tagged whales were in the lower to middle inlet (70 to 100 percent of tagged whales) during January through March, near the Susitna River Delta from April to July (60 to 90 percent of tagged whales) and in the Knik and Turnagain Arms from August to December.

More recently, the Marine Mammal Lab has conducted long-term passive acoustic monitoring demonstrating seasonal shifts in CIBW concentrations throughout Cook Inlet. Castellote et al. (2015) conducted long-term acoustic monitoring at 13 locations throughout Cook Inlet between 2008 and 2015: North Eagle Bay, Eagle River Mouth, South Eagle Bay, Six Mile, Point MacKenzie, Cairn Point, Fire Island, Little Susitna, Beluga River, Trading Bay, Kenai River, Tuxedni Bay, and Homer Spit; the former six stations being located within Knik Arm. In general, the observed seasonal distribution is in accordance with descriptions based on aerial surveys and satellite telemetry: Beluga detections are higher in the upper inlet during summer, peaking at Little Susitna, Beluga River, and Eagle Bay, followed by fewer detections at those locations during winter. Higher detections in winter at Trading Bay, Kenai River, and Tuxedni Bay suggest a broader beluga distribution in the lower inlet during winter.

Beluga whales in Cook Inlet are believed to mostly calve between mid-May and mid-July, and concurrently breed between late spring and early summer (NMFS 2016a), primarily in upper Cook Inlet. The only known observed occurrence of calving occurred on July 20, 2015 in the Susitna Delta area (T. McGuire, pers. comm. March 27, 2017). The first neonates encountered during each field season from 2005 through 2015 were always seen in the Susitna River Delta in July. The photo ID team's documentation of the dates of the first neonate of each year indicate that calving begins in mid-late July/early August, generally coinciding with the observed timing of annual maximum group size. Probable mating behavior of belugas was observed in April and May of 2014, in Trading Bay. Young beluga whales are nursed for two years and may continue to associate with their mothers for a considerable time thereafter (Colbeck et al. 2013).

During the spring and summer, beluga whales are generally concentrated near the warmer waters of river mouths where prey availability is high and predator occurrence is low (Moore *et al.* 2000). Goetz et al. (2012b) modeled habitat preferences using NMFS' 1994–2008 June abundance survey data. In large areas, such as the Susitna Delta (Beluga to Little Susitna Rivers) and Knik Arm, there was a high probability that beluga whales were in larger group sizes. Beluga whale presence also increased closer to rivers with Chinook salmon (*Oncorhynchus tshawytscha*) runs, such as the Susitna River. Movement has been correlated with the peak discharge of seven major rivers emptying into Cook Inlet. Boat-based surveys from 2005 to the present (McGuire and Stephens 2017), and initial results from passive acoustic monitoring across the entire inlet (Castellote *et al.* 2015) also support seasonal patterns observed with other methods. Based on long-term passive acoustic monitoring, seasonally, foraging behavior was more prevalent during summer, particularly at upper inlet rivers, than during winter. Foraging index was highest at Little Susitna, with a peak in July-August and a secondary peak in May, followed by Beluga River and then Eagle Bay; monthly variation in the foraging index indicates belugas shift their foraging behavior among these three locations from April through September.

Despite protection from hunting, this stock continues to decline. The population was declining at the end of the period of unregulated harvest, with the relatively steep decline ending in 1999, coincident with harvest removals dropping from an estimated 42 in 1998 to just 0 to 2 whales per year in 2000 to 2006 (and with no removals after 2006). From 1999 to 2016, the rate of decline of the population was estimated to be 0.4% (SE = 0.6%) per year, with a 73% probability of a population decline. While from 2006 to 2016, the most recent 10-year period, the rate of decline was estimated to be 0.5% per year, (with a 70% probability of a population decline) (Shelden et al. 2017). No human-caused mortality or serious injury of CIBWs has been recently documented. Other potential threats most likely to result in direct human-caused mortality or serious injury of this stock include ship strikes.

Mortality related to live stranding events, where a beluga whale group strands as the tide recedes, has been regularly observed in upper Cook Inlet. Most whales involved in a live stranding event survive, although some associated deaths may not be observed if the whales die later from live-stranding-related injuries (Vos and Shelden 2005, Burek-Huntington et al. 2015). Between 2013 and 2017, there were reports of approximately 78 beluga whales involved in two known live stranding events, plus one suspected live stranding event with two associated deaths reported. In 2014, necropsy results from two whales found in Turnagain Arm suggested that a live stranding event contributed to their deaths as both had aspirated mud and water. No live stranding events were reported prior to the discovery of these dead whales, suggesting that not all live stranding events are observed. Most live strandings occur in Knik Arm and Turnagain Arm, which are shallow and have big tides. Another source of beluga whale mortality in Cook Inlet is predation by transient-type (mammal-eating) killer whales.

In its Recovery Plan (NMFS, 2016), NMFS identified several threats to CIBWs. Potential threats include: (1) High concern: Catastrophic events (*e.g.,* natural disasters, spills, mass strandings), cumulative effects of multiple stressors, and noise; (2) medium concern: Disease agents (*e.g.,* pathogens, parasites, and harmful algal blooms), habitat loss or degradation, reduction in prey, and unauthorized take; and (3) low concern: Pollution, predation, and subsistence harvest. The recovery plan did not treat climate change as a distinct threat but rather as a consideration in the threats of high and medium concern.

Killer Whale

Two stocks of killer whales may be present in upper Cook Inlet: The Eastern North Pacific Alaska Residents and the Gulf of Alaska, Aleutian Islands, and Bering Sea Transients. Both ecotypes overlap in the same geographic area; however, they maintain social and reproductive isolation and feed on different prey species. During aerial surveys conducted between 1993 and 2004, killer whales were observed on only three flights, all in the Kachemak and English Bay area (Rugh *et al.* 2005). Anecdotal reports of killer whales feeding on belugas in upper Cook Inlet began increasing in the 1990s; several of these sightings and strandings report killer whale predation on beluga Whales.

No killer whales were spotted in the vicinity of the POA during surveys by Funk et al. (2005), Ireland et al. (2005), or Brueggeman et al. (2007, 2008a, 2008b). No killer whale sightings were documented during POA construction or scientific monitoring from 2005 to 2011 or during the 2016 TPP. Very few killer whales, if any, are expected to approach or be near the project area during construction of the PCT.

There are no reports of a subsistence harvest of killer whales in Alaska. Based on currently available data, a minimum estimate of the mean annual mortality and serious injury rate for both the Alaska Residents and transient stocks due to U.S. commercial fisheries is less than 10% of the PBR and, therefore, is considered to be insignificant and approaching zero mortality and serious injury rate. Therefore, neither stock is classified as a strategic stock.

Harbor Porpoise

Harbor porpoises primarily frequent the coastal waters of the Gulf of Alaska and Southeast Alaska (Dahlheim *et al.* 2000, 2008), typically occurring in waters less than 100 m deep (Hobbs and Waite 2010). Harbor porpoise prefer nearshore areas, bays, tidal areas, and river mouths (Dahlheim et al. 2000, Hobbs and Waite 2010). In Alaskan waters, NMFS has designated three stocks of harbor porpoises for management purposes: Southeast Alaska, Gulf of Alaska, and Bering Sea Stocks (Muto *et al.* 2017). Porpoises found in Cook Inlet belong to the Gulf of Alaska Stock, which is distributed from Cape Suckling to Unimak Pass.

Although harbor porpoise have been frequently observed during aerial surveys in Cook Inlet (Shelden *et al.* 2014), most sightings are of single animals, and are concentrated at Chinitna and Tuxedni Bays on the west side of lower Cook Inlet (Rugh *et al.* 2005) and in the upper inlet. The occurrence of larger numbers of porpoise in the lower Cook Inlet may be driven by greater availability of preferred prey and possibly less competition with beluga whales, as belugas move into upper inlet waters to forage on Pacific salmon during the summer months (Shelden *et al.* 2014).

There has been an increase in harbor porpoise sightings in upper Cook Inlet over the past two decades (Shelden et al. 2014). Small numbers of harbor porpoises have been consistently reported in upper Cook Inlet between April and October (Prevel-Ramos et al. 2008). Harbor porpoises have been observed within Knik Arm during monitoring efforts since 2005. During POA construction from 2005 through 2011 and in 2016, harbor porpoises were reported in 2009, 2010, and 2011 (Cornick and Saxon-Kendall 2008, 2009; Cornick and Seagars 2016; Cornick et al. 2010, 2011; Markowitz and McGuire 2007; Prevel-Ramos et al. 2006; Table 4–2). In 2009, a total of 20 harbor porpoises were observed during construction monitoring, with sightings in June, July, August, October, and November. Harbor porpoises were observed twice in 2010, once in July and again in August. In 2011, POA monitoring efforts documented harbor porpoises five times, with a total of six individuals, in August, October, and November at the POA (Cornick et al. 2011). During other monitoring efforts conducted in Knik Arm, there were four sightings of harbor porpoises in 2005 (Shelden et al. 2014), and a single harbor porpoise was observed within the vicinity of the POA in October 2007.

Estimates of human-caused mortality and serious injury from stranding data and fisherman self-reports are underestimates because not all animals strand or are self-reported nor are all stranded animals found, reported, or have the cause of death determined. In addition, the trend of this stock is unknown given data is more than eight years old. Given their shallow water distribution, harbor porpoise are vulnerable to physical modifications of nearshore habitats resulting from urban and industrial development (including waste management and nonpoint source runoff) and activities such as construction of docks and other over-water structures, filling of shallow areas, dredging, and noise (Linnenschmidt et al. 2013). Subsistence users have not reported any harvest from the Gulf of Alaska harbor porpoise stock since the early 1900s (Shelden et al. 2014).

Steller Sea Lion

Steller sea lions inhabiting Cook Inlet belong to the western distinct population segment (WDPS), and this is the stock considered in this analysis. NMFS defines the Steller sea lion WDPS as all populations west of longitude 144° W to the western end of the Aleutian Islands. The most recent comprehensive aerial photographic and land-based surveys of WDPS Steller sea lions in Alaska were conducted during the 2014 and 2015 breeding seasons (Fritz *et al.* 2015). The WDPS of Steller sea lions is currently listed as endangered under the ESA (55 FR 49204, November 26, 1990) and designated as depleted under the MMPA. NMFS designated critical habitat on August 27, 1993 (58 FR 45269). The critical habitat designation for the WDPS of Steller sea lions was determined to include a 37 km (20 nm) buffer around all major haul outs and rookeries, and associated terrestrial, atmospheric, and aquatic zones, plus three large offshore foraging areas, none of which occurs in the project area. Steller sea lions feed largely on walleye pollock, salmon, and arrowtooth flounder during the summer, and walleye pollock and Pacific cod during the winter (Sinclair and Zeppelin 2002). Except for salmon, none of these are found in abundance in upper Cook Inlet (Nemeth *et al.* 2007).

Within Cook Inlet, Steller sea lions primarily inhabit lower Cook Inlet. However, they occasionally venture to upper Cook Inlet and Knik Arm. Steller sea lions have been observed near the POA in June 2009 (ICRC 2009a) and in May 2016 (Cornick and Seagars 2016). During POA construction monitoring in June of 2009, a Steller sea lion was documented three times (within the same day) in Knik Arm and was believed to be the same individual (ICRC 2009a). In 2016, Steller sea lions were observed on two separate days. On May w, 2016, one individual was sighted. On May 25, 2016, there were five Steller sea lion sightings within a 50-minute period, and these sightings occurred in areas relatively close to one another suggesting they were likely the same animal (Cornick and Seagars 2016). Steller sea lions are likely attracted to the salmon runs; however, their presence is less common in upper Cook Inlet than lower Cook Inlet.

The total estimated annual level of human-caused mortality and serious injury for Western U.S. Steller sea lions in 2012–2016 was 247 sea lions: 35 in U.S. commercial fisheries, 1.2 in unknown (commercial, recreational, or subsistence) fisheries, 2 in marine debris, 5.5 due to other causes (arrow strike, entangled in hatchery net, illegal shooting, Marine Mammal Protection Act (MMPA) authorized research-related), and 203 in the Alaska Native subsistence harvest. However, there are multiple nearshore commercial fisheries which are not observed; thus, there is likely to be unreported fishery-related mortality and serious injury of Steller sea lions.

Several factors may have been important drivers of the decline of the stock. However, there is uncertainty about threats currently impeding their recovery, particularly in the Aleutian Islands. Many factors have been suggested as causes of the steep decline in abundance of western Steller sea lions observed in the 1980s, including competitive effects of fishing, environmental change, disease, contaminants, killer whale predation, incidental take, and illegal and legal shooting (Atkinson et al. 2008, NMFS 2008). A number of management actions have been implemented since 1990 to promote the recovery of the Western U.S. stock of Steller sea lions, including 3-nmi no-entry zones around rookeries, prohibition of shooting at or near sea lions, and regulation of fisheries for sea lion prey species (*e.g.,* walleye pollock, Pacific cod, and Atka mackerel) (Sinclair et al. 2013, Tollit et al. 2017).

Harbor Seal

Harbor seals belonging to the Cook Inlet/Shelikof Strait stock inhabit the coastal and estuarine waters of Cook Inlet and are observed in both upper and lower Cook Inlet throughout most of the year (Boveng et al. 2012; Shelden et al. 2013). Recent research on satellite-tagged harbor seals observed several movement patterns within Cook Inlet (Boveng et al. 2012). In the fall, a portion of the harbor seals appeared to move out of Cook Inlet and into Shelikof Strait, northern Kodiak Island, and coastal habitats of the Alaska Peninsula. The western coast of Cook Inlet had higher usage by harbor seals than eastern coast habitats, and seals captured in lower Cook Inlet generally exhibited site fidelity by remaining south of the Forelands in lower Cook Inlet after release (Boveng et al. 2012).

The presence of harbor seals in upper Cook Inlet is seasonal. Harbor seals are commonly observed along the Susitna River and other tributaries within upper Cook Inlet during eulachon and salmon migrations (NMFS 2003). The major haulout sites for harbor seals are located in lower Cook Inlet with fewer sites in upper Cook Inlet (Montgomery et al. 2007). In the project area (Knik Amr), harbor seals tend to congregate near the mouth of Ship Creek (Cornick et al. 2011; Shelden et al. 2013), likely foraging on salmon and eulachon runs. Approximately 138 harbor seals were observed during previous POA monitoring with sightings ranging from 3 individuals in 2008 to 59 individuals in 2011 (see Table 4–1 in POA's application).

The most current population trend estimate of the Cook Inlet/Shelikof Strait stock is approximately −111 seals per year, with a probability that the stock is decreasing of 0.609 (Muto et al., 2015). The estimated level of human-caused mortality and serious injury for this stock is 234 seals, of which 233 seals are taken for subsistence uses. Additional potential threats most likely to result in direct human-caused mortality or serious injury for all stocks of harbor seals in Alaska include unmonitored subsistence harvests, incidental takes in commercial fisheries, and illegal shooting. Disturbance by cruise vessels is an additional threat for harbor seal stocks that occur in glacial fjords (Jansen et al. 2010, 2015; Matthews et al. 2016). The average annual harvest of this stock of harbor seals between 2004 and 2008 was 233 seals per year. The annual harvest in 2014 was 104 seals (Muto et al., 2019).

In addition, sea otters (*Enhydra lutris*) may be found in Cook Inlet. However, sea otters are managed by the U.S. Fish and Wildlife Service and are not considered further in this document.

Marine Mammal Hearing

Hearing is the most important sensory modality for marine mammals underwater, and exposure to anthropogenic sound can have deleterious effects. To appropriately assess the potential effects of exposure to sound, it is necessary to understand the frequency ranges marine mammals are able to hear. Current data indicate that not all marine mammal species have equal hearing capabilities (*e.g.,* Richardson *et al.,* 1995; Wartzok and Ketten, 1999; Au and Hastings, 2008). To reflect this, Southall *et al.* (2007) recommended that marine mammals be divided into functional hearing groups based on directly measured or estimated hearing ranges on the basis of available behavioral response data, audiograms derived using auditory evoked potential techniques, anatomical modeling, and other data. Note that no direct measurements of hearing ability have been successfully completed for mysticetes (*i.e.,* low-frequency cetaceans). Subsequently, NMFS (2018) described generalized hearing ranges for these marine mammal hearing groups. Generalized hearing ranges were chosen based on the approximately 65 decibel (dB) threshold from the normalized composite audiograms, with the exception for lower limits for low-frequency cetaceans where the lower bound was deemed to be biologically implausible and the lower bound from Southall *et al.* (2007) retained. Marine mammal hearing groups and their associated hearing ranges are provided in Table 4.

TABLE 4—MARINE MAMMAL HEARING GROUPS

[NMFS, 2018]

Hearing group	Generalized hearing range *
Low-frequency (LF) cetaceans (baleen whales)	7 Hz to 35 kHz.
Mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	150 Hz to 160 kHz.
High-frequency (HF) cetaceans (true porpoises, *Kogia,* river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*).	275 Hz to 160 kHz.
Phocid pinnipeds (PW) (underwater) (true seals)	50 Hz to 86 kHz.
Otariid pinnipeds (OW) (underwater) (sea lions and fur seals)	60 Hz to 39 kHz.

* Represents the generalized hearing range for the entire group as a composite (*i.e.,* all species within the group), where individual species' hearing ranges are typically not as broad. Generalized hearing range chosen based on ~65 dB threshold from normalized composite audiogram, with the exception for lower limits for LF cetaceans (Southall et al. 2007) and PW pinniped (approximation).

The pinniped functional hearing group was modified from Southall *et al.* (2007) on the basis of data indicating that phocid species have consistently demonstrated an extended frequency range of hearing compared to otariids, especially in the higher frequency range (Hemilä *et al.,* 2006; Kastelein *et al.,* 2009; Reichmuth and Holt, 2013).

For more detail concerning these groups and associated frequency ranges, please see NMFS (2018) for a review of available information. Six marine mammal species (four cetacean and two pinniped (one otariid and one phocid) species) have the reasonable potential to co-occur with the proposed survey activities. Please refer to Table 3. Of the cetacean species that may be present, one is classified as a low-frequency cetacean (*i.e.,* all mysticete species), two are classified as mid-frequency cetaceans (*i.e.,* all delphinid and ziphiid species and the sperm whale), and one is classified as a high-frequency cetacean (*i.e.,* harbor porpoise and Kogia spp.).

Potential Effects of Specified Activities on Marine Mammals and Their Habitat

This section includes a summary and discussion of the ways that components of the specified activity may impact marine mammals and their habitat. The *Estimated Take by Incidental Harassment* section later in this document includes a quantitative analysis of the number of individuals that are expected to be taken by this activity. The *Negligible Impact Analysis and Determination* section considers the content of this section, the *Estimated Take by Incidental Harassment* section, and the *Proposed Mitigation* section, to draw conclusions regarding the likely impacts of these activities on the reproductive success or survivorship of individuals and how those impacts on individuals are likely to impact marine mammal species or stocks.

Description of Sound Sources—The primary relevant stressor to marine mammals from the proposed activity is the introduction of noise into the aquatic environment; therefore, we focus our impact analysis on the effects of anthropogenic noise on marine mammals. To better understand the potential impacts of exposure to pile driving noise, we describe sound source characteristics below. Specifically, we look at the following two ways to characterize sound: by its temporal (*i.e.,* continuous or intermittent) and its pulse (*i.e.,* impulsive or non-impulsive) properties. Continuous sounds are those whose sound pressure level remains above that of the ambient sound, with negligibly small fluctuations in level (NIOSH, 1998; ANSI, 2005), while intermittent sounds are defined as sounds with interrupted levels of low or no sound (NIOSH, 1998). Impulsive sounds, such as those generated by impact pile driving, are typically transient, brief (<1 sec), broadband, and consist of a high peak pressure with rapid rise time and rapid decay (ANSI, 1986; NIOSH, 1998). The majority of energy in pile impact pulses is at frequencies below 500 Hz. Impulsive sounds, by definition, are intermittent. Non-impulsive sounds, such as those generated by vibratory pile driving, can be broadband, narrowband or tonal, brief or prolonged, and typically do not have a high peak sound pressure with rapid rise/decay time that impulsive sounds do (ANSI 1995; NIOSH 1998). Non-impulsive sounds can be intermittent or continuous. Similar to impact pile driving, vibratory pile driving generates low frequency sounds. Vibratory pile driving is considered a non-impulsive, continuous source. Discussion on the appropriate harassment threshold associated with these types of sources based on these characteristics can be found in the *Estimated Take* section.

Potential Effects of the Specified Activity—In general, the effects of sounds from pile driving to marine mammals might result in one or more of the following: Temporary or permanent hearing impairment, non-auditory physical or physiological effects, behavioral disturbance, and masking (Richardson *et al.,* 1995; Gordon *et al.,* 2004; Nowacek *et al.,* 2007; Southall *et al.,* 2007). The potential for and magnitude of these effects are dependent on several factors, including received characteristics (*e.g.,* age, size, depth of the animal during exposure); the energy needed to drive the pile (usually related to pile size, depth driven, and substrate), the standoff distance between the pile and receiver; and the sound propagation properties of the environment.

Impacts to marine mammals from pile driving activities are expected to result primarily from acoustic pathways. As such, the degree of effect is intrinsically related to the received level and duration of the sound exposure, which are in turn influenced by the distance between the animal and the source. The further away from the source, the less intense the exposure should be. The substrate and depth of the habitat affect the sound propagation properties of the environment. Shallow environments are typically more structurally complex, which leads to rapid sound attenuation. In addition, substrates that are soft (*e.g.,* sand) absorb or attenuate the sound more readily than hard substrates (*e.g.,* rock) which may reflect the acoustic wave. Soft porous substrates also likely require less time to drive the pile, and possibly less forceful equipment, which ultimately decrease the intensity of the acoustic source.

Richardson *et al.* (1995) described zones of increasing intensity of effect that might be expected to occur, in relation to distance from a source and assuming that the signal is within an animal's hearing range. First is the area within which the acoustic signal would be audible (potentially perceived) to the animal, but not strong enough to elicit any overt behavioral or physiological response. The next zone corresponds with the area where the signal is audible to the animal and of sufficient intensity to elicit behavioral or physiological responsiveness. Third is a zone within which, for signals of high intensity, the received level is sufficient to potentially cause discomfort or tissue damage to auditory or other systems. Overlaying these zones to a certain extent is the area within which masking (*i.e.,* when a sound interferes with or masks the ability of an animal to detect a signal of interest that is above the absolute hearing threshold) may occur; the masking zone may be highly variable in size.

We describe the more severe effects (*i.e.,* permanent hearing impairment, certain non-auditory physical or physiological effects) only briefly as we do not expect that there is a reasonable likelihood that POA's activities would result in such effects (see below for further discussion).

NMFS defines a noise-induced threshold shift (TS) as ''a change, usually an increase, in the threshold of audibility at a specified frequency or portion of an individual's hearing range above a previously established reference level'' (NMFS, 2016). The amount of threshold shift is customarily expressed in dB (ANSI 1995, Yost 2007). A TS can be permanent (PTS) or temporary (TTS). As described in NMFS (2018), there are numerous factors to consider when examining the consequence of TS, including, but not limited to, the signal temporal pattern (*e.g.,* impulsive or non-impulsive), likelihood an individual would be exposed for a long enough duration or to a high enough level to induce a TS, the magnitude of the TS, time to recovery (seconds to minutes or hours to days), the frequency range of the exposure (*i.e.,* spectral content), the hearing and vocalization frequency range of the exposed species relative to the signal's frequency spectrum (*i.e.,* how animal uses sound within the frequency band of the signal; *e.g.,* Kastelein *et al.,* 2014), and the overlap between the animal and the source (*e.g.,* spatial, temporal, and spectral). When analyzing the auditory effects of noise exposure, it is often helpful to broadly categorize sound as either impulsive—noise with high peak sound pressure, short duration, fast rise-time, and broad frequency content—or non-impulsive. When considering auditory effects, vibratory pile driving is considered a non-impulsive source while impact pile driving is treated as an impulsive source.

Permanent Threshold Shift—NMFS defines PTS as a permanent, irreversible increase in the threshold of audibility at a specified frequency or portion of an individual's hearing range above a previously established reference level (NMFS 2018). Available data from humans and other terrestrial mammals indicate that a 40 dB threshold shift approximates PTS onset (see NMFS 2018 for review).

Temporary Threshold Shift—NMFS defines TTS as a temporary, reversible increase in the threshold of audibility at a specified frequency or portion of an individual's hearing range above a previously established reference level (NMFS 2018). Based on data from cetacean TTS measurements (see Finneran 2014 for a review), a TTS of 6 dB is considered the minimum threshold shift clearly larger than any day-to-day or session-to-session variation in a subject's normal hearing ability (Schlundt *et al.,* 2000; Finneran *et al.,* 2000; Finneran *et al.,* 2002).

Depending on the degree (elevation of threshold in dB), duration (*i.e.,* recovery time), and frequency range of TTS, and the context in which it is experienced, TTS can have effects on marine mammals ranging from discountable to serious (similar to those discussed in auditory masking, below). For example, a marine mammal may be able to readily compensate for a brief, relatively small amount of TTS in a non-critical frequency range that takes place during a time when the animal is traveling through the open ocean, where ambient noise is lower and there are not as many competing sounds present. Alternatively, a larger amount and longer duration of TTS sustained during time when communication is critical for successful mother/calf interactions could have more serious impacts. We note that reduced hearing sensitivity as a simple function of aging has been observed in marine mammals, as well as humans and other taxa (Southall *et al.,* 2007), so we can infer that strategies exist for coping with this condition to some degree, though likely not without cost.

Schlundt et al. (2000) performed a study exposing five bottlenose dolphins and two belugas (same individuals as Finneran's studies) to intense 1 second tones at different frequencies. The resulting levels of fatiguing stimuli necessary to induce 6 dB or larger masked TTSs were generally between 192 and 201 dB re: 1 microPascal (μPa). Dolphins began to exhibit altered behavior at levels of 178–193 dB re: 1μPa and above; belugas displayed altered behavior at 180–196 dB re: 1 μPa and above. At the conclusion of the study, all thresholds were at baseline values.

There are a limited number of studies investigating the potential for cetacean TTS from pile driving and only one has elicited a small amount of TTS in a single harbor porpoise individual (Kastelein et al., 2015). However, captive bottlenose dolphins and beluga whales have exhibited changes in behavior when exposed to pulsed sounds (Finneran *et al.,* 2000, 2002, 2005). The animals tolerated high received levels of sound before exhibiting aversive behaviors. Experiments on a beluga whale showed that exposure to a single watergun impulse at a received level of 207 kPa (30 psi) p-p, which is equivalent to 228 dB p-p, resulted in a 7 and 6 dB TTS in the beluga whale at 0.4 and 30 kHz, respectively. Thresholds returned to within 2 dB of the pre-exposure level within four minutes of the exposure (Finneran *et al.,* 2002). Although the source level of pile driving from one hammer strike is expected to be lower than the single watergun impulse cited here, animals being exposed for a prolonged period to repeated hammer strikes could receive more sound exposure in terms of SEL than from the single watergun impulse (estimated at 188 dB re 1 μPa^2-s) in the aforementioned experiment (Finneran *et al.,* 2002). Results of these studies suggest odontocetes are susceptible to TTS from pile driving, but that they seem to recover quickly from at least small amounts of TTS.

Behavioral Harassment—Behavioral disturbance may include a variety of effects, including subtle changes in behavior (*e.g.,* minor or brief avoidance of an area or changes in vocalizations), more conspicuous changes in similar behavioral activities, and more sustained and/or potentially severe reactions, such as displacement from or abandonment of high-quality habitat. Disturbance may result in changing durations of surfacing and dives, number of blows per surfacing, or moving direction and/or speed; reduced/increased vocal activities; changing/cessation of certain behavioral activities (such as socializing or feeding); visible startle response or aggressive behavior (such as tail/fluke slapping or jaw clapping); avoidance of areas where sound sources are located. Pinnipeds may increase their haul out time, possibly to avoid in-water disturbance (Thorson and Reyff 2006). Behavioral responses to sound are highly variable and context-specific and any reactions depend on numerous intrinsic and extrinsic factors (*e.g.,* species, state of maturity, experience, current activity, reproductive state, auditory sensitivity, time of day), as well as the interplay between factors (*e.g.,* Richardson *et al.* 1995; Wartzok *et al.* 2003; Southall *et al.* 2007; Weilgart 2007; Archer *et al.* 2010). Behavioral reactions can vary not only among individuals but also within an individual, depending on previous experience with a sound source, context, and numerous other factors (Ellison *et al.* 2012), and can vary depending on characteristics associated with the sound source (*e.g.,* whether it is moving or stationary, number of sources, distance from the source). In general, pinnipeds seem more tolerant of, or at least habituate more quickly to, potentially disturbing underwater sound than do cetaceans, and generally seem to be less responsive to exposure to industrial sound than most cetaceans. Please see Appendices B–C of Southall *et al.* (2007) for a review of studies involving marine mammal behavioral responses to sound.

Habituation can occur when an animal's response to a stimulus wanes with repeated exposure, usually in the absence of unpleasant associated events (Wartzok *et al.,* 2003). Animals are most likely to habituate to sounds that are predictable and unvarying. It is important to note that habituation is appropriately considered as a ''progressive reduction in response to stimuli that are perceived as neither aversive nor beneficial,'' rather than as, more generally, moderation in response to human disturbance (Bejder *et al.,* 2009). The opposite process is sensitization, when an unpleasant experience leads to subsequent responses, often in the form of avoidance, at a lower level of exposure.

As noted above, behavioral state may affect the type of response. For example, animals that are resting may show greater behavioral change in response to disturbing sound levels than animals that are highly motivated to remain in an area for feeding (Richardson *et al.,* 1995; NRC, 2003; Wartzok *et al.,* 2003). Controlled experiments with captive marine mammals have showed pronounced behavioral reactions, including avoidance of loud sound sources (Ridgway *et al.,* 1997; Finneran *et al.,* 2003). Observed responses of wild marine mammals to loud pulsed sound sources (typically seismic airguns or acoustic harassment devices) have been varied but often consist of avoidance behavior or other behavioral changes suggesting discomfort (Morton and Symonds 2002; see also Richardson *et al.,* 1995; Nowacek *et al.,* 2007).

Available studies show wide variation in response to underwater sound; therefore, it is difficult to predict specifically how any given sound in a particular instance might affect marine mammals perceiving the signal. If a marine mammal does react briefly to an underwater sound by changing its behavior or moving a small distance, the impacts of the change are unlikely to be significant to the individual, let alone the stock or population. However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on individuals and populations could be significant (*e.g.,* Lusseau and Bejder 2007; Weilgart 2007; NRC 2005). However, there are broad categories of potential response, which we describe in greater detail here, that include alteration of dive behavior, alteration of foraging behavior, effects to breathing, interference with or alteration of vocalization, avoidance, and flight.

Changes in dive behavior can vary widely, and may consist of increased or decreased dive times and surface intervals as well as changes in the rates of ascent and descent during a dive (*e.g.,* Frankel and Clark 2000; Costa *et al.,* 2003; Ng and Leung 2003; Nowacek *et al.,* 2004; Goldbogen *et al.,* 2013a,b). Variations in dive behavior may reflect interruptions in biologically significant activities (*e.g.,* foraging) or they may be of little biological significance. The impact of an alteration to dive behavior resulting from an acoustic exposure depends on what the animal is doing at the time of the exposure and the type and magnitude of the response.

Disruption of feeding behavior can be difficult to correlate with anthropogenic sound exposure, so it is usually inferred by observed displacement from known foraging areas, the appearance of secondary indicators (*e.g.,* bubble nets or sediment plumes), or changes in dive behavior. As for other types of behavioral response, the frequency, duration, and temporal pattern of signal presentation, as well as differences in species sensitivity, are likely contributing factors to differences in response in any given circumstance (*e.g.,* Croll *et al.* 2001; Nowacek *et al.* 2004; Madsen *et al.* 2006; Yazvenko *et al.* 2007). A determination of whether foraging disruptions incur fitness consequences would require information on or estimates of the energetic requirements of the affected individuals and the relationship between prey availability, foraging effort and success, and the life history stage of the animal.

Variations in respiration naturally vary with different behaviors and alterations to breathing rate as a function of acoustic exposure can be expected to co-occur with other behavioral reactions, such as a flight response or an alteration in diving. However, respiration rates in and of themselves may be representative of annoyance or an acute stress response. Various studies have shown that respiration rates may either be unaffected or could increase, depending on the species and signal characteristics, again highlighting the importance in understanding species differences in the tolerance of underwater noise when determining the potential for impacts resulting from anthropogenic sound exposure (*e.g.,* Kastelein *et al.,* 2001, 2005b, 2006; Gailey *et al.,* 2007).

Marine mammals vocalize for different purposes and across multiple modes, such as whistling, echolocation click production, calling, and singing. Changes in vocalization behavior in response to anthropogenic noise can occur for any of these modes and may result from a need to compete with an increase in background noise or may reflect increased vigilance or a startle response. For example, in the presence of potentially masking signals, humpback whales and killer whales have been observed to increase the length of their songs (Miller *et al.,* 2000; Fristrup *et al.,* 2003; Foote *et al.,* 2004), while right whales (Eubalaena glacialis) have been observed to shift the frequency content of their calls upward while reducing the rate of calling in areas of increased anthropogenic noise (Parks *et al.,* 2007b). In some cases, animals may cease sound production during production of aversive signals (Bowles *et al.,* 1994).

Avoidance is the displacement of an individual from an area or migration path as a result of the presence of a sound or other stressors, and is one of the most obvious manifestations of disturbance in marine mammals (Richardson *et al.,* 1995). For example, gray whales (Eschrictius robustus) are known to change direction—deflecting from customary migratory paths—in order to avoid noise from seismic surveys (Malme *et al.,* 1984). Avoidance may be short-term, with animals returning to the area once the noise has ceased (*e.g.,* Bowles *et al.,* 1994; Goold 1996; Stone *et al.,* 2000; Morton and Symonds, 2002; Gailey *et al.,* 2007). Longer-term displacement is possible, however, which may lead to changes in abundance or distribution patterns of the affected species in the affected region if habituation to the presence of the sound does not occur (*e.g.,* Blackwell *et al.,* 2004; Bejder *et al.,* 2006; Teilmann *et al.,* 2006).

A flight response is a dramatic change in normal movement to a directed and rapid movement away from the perceived location of a sound source. The flight response differs from other avoidance responses in the intensity of the response (*e.g.,* directed movement, rate of travel). Relatively little information on flight responses of marine mammals to anthropogenic signals exist, although observations of flight responses to the presence of predators have occurred (Connor and Heithaus 1996). The result of a flight response could range from brief, temporary exertion and displacement from the area where the signal provokes flight to, in extreme cases, marine mammal strandings (Evans and England 2001). However, it should be noted that response to a perceived predator does not necessarily invoke flight (Ford and Reeves 2008), and whether individuals are solitary or in groups may influence the response.

Behavioral disturbance can also impact marine mammals in more subtle ways. Increased vigilance may result in costs related to diversion of focus and attention (*i.e.,* when a response consists of increased vigilance, it may come at the cost of decreased attention to other critical behaviors such as foraging or resting). These effects have generally not been demonstrated for marine mammals, but studies involving fish and terrestrial animals have shown that increased vigilance may substantially reduce feeding rates (*e.g.,* Beauchamp and Livoreil 1997; Fritz *et al.,* 2002; Purser and Radford 2011). In addition, chronic disturbance can cause population declines through reduction of fitness (*e.g.,* decline in body condition) and subsequent reduction in reproductive success, survival, or both (*e.g.,* Harrington and Veitch, 1992; Daan *et al.,* 1996; Bradshaw *et al.,* 1998). However, Ridgway *et al.* (2006) reported that increased vigilance in bottlenose dolphins exposed to sound over a five-day period did not cause any sleep deprivation or stress effects.

Many animals perform vital functions, such as feeding, resting, traveling, and socializing, on a diel cycle (24-hour cycle). Disruption of such functions resulting from reactions to stressors such as sound exposure are more likely to be significant if they last more than one diel cycle or recur on subsequent days (Southall *et al.,* 2007). Consequently, a behavioral response lasting less than one day and not recurring on subsequent days is not considered particularly severe unless it could directly affect reproduction or survival (Southall *et al.,* 2007). Note that there is a difference between multi-day substantive behavioral reactions and multi-day anthropogenic activities. For example, just because an activity lasts for multiple days does not necessarily mean that individual animals are either exposed to activity-related stressors for multiple days or, further, exposed in a manner resulting in sustained multi-day substantive behavioral responses.

Stress Responses—An animal's perception of a threat may be sufficient to trigger stress responses consisting of some combination of behavioral responses, autonomic nervous system responses, neuroendocrine responses, or immune responses (*e.g.,* Seyle 1950; Moberg 2000). In many cases, an animal's first and sometimes most economical (in terms of energetic costs) response is behavioral avoidance of the potential stressor. Autonomic nervous system responses to stress typically involve changes in heart rate, blood pressure, and gastrointestinal activity. These responses have a relatively short duration and may or may not have a significant long-term effect on an animal's fitness.

Neuroendocrine stress responses often involve the hypothalamus-pituitary-adrenal system. Virtually all neuroendocrine functions that are affected by stress—including immune competence, reproduction, metabolism, and behavior—are regulated by pituitary hormones. Stress-induced changes in the secretion of pituitary hormones have been implicated in failed reproduction, altered metabolism, reduced immune competence, and behavioral disturbance (*e.g.,* Moberg 1987; Blecha 2000). Increases in the circulation of glucocorticoids are also equated with stress (Romano *et al.,* 2004).

The primary distinction between stress (which is adaptive and does not normally place an animal at risk) and ''distress'' is the cost of the response. During a stress response, an animal uses glycogen stores that can be quickly replenished once the stress is alleviated. In such circumstances, the cost of the stress response would not pose serious fitness consequences. However, when an animal does not have sufficient energy reserves to satisfy the energetic costs of a stress response, energy resources must be diverted from other functions. This state of distress will last until the animal replenishes its energetic reserves sufficient to restore normal function.

Relationships between these physiological mechanisms, animal behavior, and the costs of stress responses are well-studied through controlled experiments and for both laboratory and free-ranging animals (*e.g.,* Holberton *et al.,* 1996; Hood *et al.,* 1998; Jessop *et al.,* 2003; Krausman *et al.,* 2004; Lankford *et al.,* 2005). Stress responses due to exposure to anthropogenic sounds or other stressors and their effects on marine mammals have also been reviewed (Fair and Becker 2000; Romano *et al.,* 2002b) and, more rarely, studied in wild populations (*e.g.,* Romano *et al.,* 2002a). For example, Rolland *et al.* (2012) found that noise reduction from reduced ship traffic in the Bay of Fundy was associated with decreased stress in North Atlantic right whales. These and other studies lead to a reasonable expectation that some marine mammals will experience physiological stress responses upon exposure to acoustic stressors and that it is possible that some of these would be classified as ''distress.'' In addition, any animal experiencing TTS would likely also experience stress responses (NRC, 2003).

Specific to CIBWs, we have several years of marine mammal monitoring data demonstrating the behavioral responses to pile driving at the POA. Previous pile driving activities range from the installation and removal of sheet pile driving to installation of 48-in pipe piles with both vibratory and impact hammers. Kendell and Cornick (2016) provide a comprehensive overview of four years of scientific marine mammal monitoring conducted during the POA's Expansion Project. These were observations made independent of pile driving activities (*i.e.,* not construction based PSOs). The authors investigated beluga whale behavior before and during pile driving activity at the POA. Sighting rates, mean sighting duration, behavior, mean group size, group composition, and group formation were compared between the two periods. A total of about 2,329 h of sampling effort was completed across 349 d from 2005 to 2009. Overall, 687 whales in 177 groups were documented during the 69 days that whales were sighted. A total of 353 and 1,663 h of pile driving activity took place in 2008 and 2009, respectively. There was no relationship between monthly beluga whale sighting rates and monthly pile driving rates ($r = 0.19$, $p = 0.37$). Sighting rates before ($n = 12$; 0.06 ± 0.01) and during ($n = 13$; 0.01 ± 0.03) pile driving activity were not significantly different. However, sighting duration of beluga whales decreased significantly during pile driving (39 ± 6 min before and 18 ± 3 min during). There were also significant differences in behavior before versus during pile driving. Beluga whales primarily traveled through the study area both before and during pile driving; however, traveling increased relative to other behaviors during pile driving activity. Suspected feeding decreased during pile driving although the sample size was low as feeding was observed on only two occasions before pile driving and on zero occasions during pile driving. Documentation of milling began in 2008 and was observed on 21 occasions. No acute behavioral responses were documented. Mean group size decreased during pile driving; however, this difference was not statistically significant. There were significant differences in group composition before and during pile driving ship between monthly beluga whale sighting rates and monthly pile driving rates with more white (*i.e.,* older) animals being present during pile driving.

Acoustically, Kendall et al. (2013) only recorded echolocation clicks and no whistles or noisy vocalizations near construction activity at the POA. Beluga whales have been occasionally documented to forage around Ship Creek (south of the POA) but, during pile driving, may choose to move past the POA to other, potentially richer, feeding areas further into Knik Arm (*e.g.,* Six Mile Creek, Eagle River, Eklutna River). These locations contain predictable salmon runs (ADFG, 2010), an important food source for CIBWss (NMFS1), and the timing of these runs has been correlated with beluga whale movements into the upper reaches of Knik Arm (Ezer et al., 2013).

Auditory Masking

Since many marine mammals rely on sound to find prey, moderate social interactions, and facilitate mating (Tyack, 2008), noise from anthropogenic sound sources can interfere with these functions, but only if the noise spectrum overlaps with the hearing sensitivity of the marine mammal (Southall *et al.,* 2007; Clark *et al.,* 2009; Hatch *et al.,* 2012). Chronic exposure to excessive, though not high-intensity, noise could cause masking at particular frequencies for marine mammals that utilize sound for vital biological functions (Clark *et al.,* 2009). Acoustic masking is when other noises such as from human sources interfere with animal detection of acoustic signals such as communication calls, echolocation sounds, and environmental sounds important to marine mammals. Therefore, under certain circumstances, marine mammals whose acoustical sensors or environment are being severely masked could also be impaired from maximizing their performance fitness in survival and reproduction.

Masking, which can occur over large temporal and spatial scales, can potentially affect the species at population, community, or even ecosystem levels, as well as individual levels. Masking affects both senders and receivers of the signals and could have long-term chronic effects on marine mammal species and populations. Masking occurs at the frequency band which the animals utilize so the frequency range of the potentially masking sound is important in determining any potential behavioral impacts. Pile driving generates low frequency sounds; therefore, mysticete foraging is likely more affected than odontocetes given very high frequency echolocation clicks (typically associated with odontocete foraging) are likely unmasked to any significant degree. However, lower frequency man-made sounds may affect communication signals when they occur near the sound band and thus reduce the communication space of animals (*e.g.,* Clark *et al.,* 2009) and cause increased stress levels (*e.g.,* Foote *et al.,* 2004; Holt *et al.,* 2009).

Moreover, even within a given species, different types of man-made noises may results in varying degrees of masking. For example, Erbe et al. (1999) and Erbe (2000), analyzed the effect of masking of beluga calls by exposing a trained beluga to icebreaker propeller noise, an icebreaker's bubbler system, and ambient Arctic ice cracking noise, and found that the latter was the least problematic for the whale detecting the calls. Sheifele et al. (2005) studied a population of belugas in the SLE to determine whether beluga vocalizations showed intensity changes in response to shipping noise. This type of behavior has been observed in humans and is known as the Lombard vocal response (Lombard 1911). Sheifele et al. (2005) demonstrated that shipping noise did cause belugas to vocalize louder. The acoustic behavior of this same population of belugas was studied in the presence of ferry and small boat noise. Lesage et al. (1999) described more persistent vocal responses when whales were exposed to the ferry than to the small-boat noise. These included a progressive reduction in calling rate while vessels were approaching, an increase in the repetition of specific calls, and a shift to higher frequency bands used by vocalizing animals when vessels were close to the whales. The authors concluded that these changes, and the reduction in calling rate to almost silence, may reduce communication efficiency which is critical for a species of a gregarious nature. However, the authors also stated that because of the gregarious nature of belugas, this ''would not pose a serious problem for intraherd communication'' of belugas given the short distance between group members, and concluded a noise source would have to be very close to potentially limit any communication within the beluga group (Lesage et al. 1999). However, increasing the intensity or repetition rate, or shifting to higher frequencies when exposed to shipping noise (from merchant, whale watching, ferry and small boats), is indicative of an increase of energy costs (Bradbury and Vehrencamp 1998).

Marine mammals in Cook Inlet are continuously exposed to anthropogenic noise which may lead to some habituation but is also a source of masking. A subsample (8,756 hours) of the acoustic recordings collected by the Cook Inlet Beluga Acoustics research program in Cook Inlet, Alaska, from July 2008 to May 2013, were analyzed to describe anthropogenic sources of underwater noise, acoustic characteristics, and frequency of occurrence and evaluate the potential for acoustic impact to Cook Inlet belugas. As described in Castellote et al. (2016), a total of 13 sources of noise were identified: Commerical ship, dredging, helicopter, jet aircraft (commercial or non-fighter), jet aircraft (military fighter), outboard engine (small skiffs, rafts), pile driving, propeller aircraft, sub-bottom profiler, unclassified machinery (continuous mechanical sound; *e.g.,* engine), unidentified 'clank' or 'bang' (impulsive mechanical sound; *e.g.,* barge dumping), unidentified (unclassifiable anthropogenic sound), unknown up- or down-sweep (modulated tone of mechanical origin; *e.g.,* hydraulics). A total of 6,263 anthropogenic acoustic events were detected and classified, which had a total duration of 1,025 hours and represented 11.7% of the sound recordings analyzed. There was strong variability in source diversity, loudness, distribution, and seasonal occurrence of noise, which reflects the many different activities within the Cook Inlet. Cairn Point was the location where the loudness and duration of commercial ship noise events were most concentrated, due to activities at the POA. This specific source of anthropogenic noise was present in the recordings from all months analyzed, with highest levels in August. In addition to the concentrated shipping noise at Cairn Point, a combination of unknown noiseclasses occurred in this area, particularly during summer. Specifically, unknown up or down sweeps, unidentified, unclassed machinery, and unidentified clank or bang noise classes were all documented. In contrast, Eagle River (north of the

POA and where CIBWs concentrate to forage) was the quietest of all sampled locations.

Potential Pile Driving Effects on Prey—Pile driving produces continuous, non-impulsive (*i.e.,* vibratory pile driving) sounds and intermittent, pulsed (*i.e.,* impact driving) sounds. Fish react to sounds that are especially strong and/or intermittent low-frequency sounds. Short duration, sharp sounds can cause overt or subtle changes in fish behavior and local distribution. Hastings and Popper (2005) identified several studies that suggest fish may relocate to avoid certain areas of sound energy. Additional studies have documented effects of pile driving on fish, although several are based on studies in support of large, multiyear bridge construction projects (*e.g.,* Scholik and Yan, 2001, 2002; Popper and Hastings, 2009). SPLs of sufficient strength have been known to cause injury to fish and fish mortality (summarized in Popper *et al.* 2014). The most likely impact to fish from pile driving activities at the project area would be temporary behavioral avoidance of the area. The duration of fish avoidance of this area after pile driving stops is unknown, but a rapid return to normal recruitment, distribution and behavior is anticipated.

As discussed in the *Marine Mammal* section above, NMFS designated CIBW critical habitat in Knik Arm. Knik Arm is Type 1 habitat for the CIBWs, which means it is the most valuable, used intensively by beluga whales from spring through fall for foraging and nursery habitat. However, the POA, the adjacent navigation channel, and the turning basin were excluded from critical habitat designation due to national security concerns (76 FR 20180, April 11, 2011). Foraging primarily occurs at river mouths (*e.g.,* Susitna Delta, Eagle River flats) which are unlikely to be influenced by pile driving activities. The Susitna Delta is more than 20 km from the POA and Cairn Point is likely to impede any pile driving noise from propagating into northern Knik Arm.

Acoustic habitat is the soundscape which encompasses all of the sound present in a particular location and time, as a whole, when considered from the perspective of the animals experiencing it. Animals produce sound for, or listen for sounds produced by, conspecifics (communication during feeding, mating, and other social activities), other animals (finding prey or avoiding predators) and the physical environment (finding suitable habitats, navigating). Together, sounds made by animals and the geophysical environment (*e.g.,* produced by earthquakes, lightning, wind, rain, waves) make up the natural contributions to the total acoustics of a place. These acoustic conditions, termed acoustic habitat, are one attribute of an animal's total habitat. Soundscapes are also defined by, and acoustic habitat influenced by, the total contribution of anthropogenic sound. This may include incidental emissions from sources such as vessel traffic or may be intentionally introduced to the marine environment for data acquisition purposes (as in the use of airgun arrays or other sources). Anthropogenic noise varies widely in its frequency content, duration, and loudness and these characteristics greatly influence the potential habitat-mediated effects to marine mammals (please see also the previous discussion on masking under ''Acoustic Effects''), which may range from local effects for brief periods of time to chronic effects over large areas and for long durations. Depending on the extent of effects to habitat, animals may alter their communications signals (thereby potentially expending additional energy) or miss acoustic cues (either conspecific or adventitious). For more detail on these concepts see, *e.g.,* Barber *et al.,* 2010; Pijanowski *et al.* 2011; Francis and Barber 2013; Lillis *et al.* 2014.

Beluga foraging habitat is limited at the POA given the highly industrialized area. However, foraging habitat exists near the POA, including Ship Creek and to the north of Cairn Point. Potential impacts to foraging habitat include increased turbidity and elevation in noise levels during pile driving. Because the POA is replacing an existing terminal, permanent impacts from the presence of structures is negligible. Here, we focus on construction impacts such as increased turbidity and reference the section on acoustic habitat impacts above.

Pile installation may temporarily increase turbidity resulting from suspended sediments. Any increases would be temporary, localized, and minimal. POA must comply with state water quality standards during these operations by limiting the extent of turbidity to the immediate project area. In general, turbidity associated with pile installation is localized to about a 25-foot (7.6 m) radius around the pile (Everitt *et al.* 1980). Cetaceans are not expected to be close enough to the project activity areas to experience effects of turbidity, and any small cetaceans and pinnipeds could avoid localized areas of turbidity. Therefore, the impact from increased turbidity levels is expected to be discountable to marine mammals. No impacts to Ship Creek or critical CIBW foraging habitats are anticipated.

In summary, activities associated with the proposed PCT project are not likely to have a permanent, adverse effect on marine mammal habitat or populations of fish species or on the quality of acoustic habitat. Marine mammals may choose to not forage in close proximity to the PCT site during pile driving; however, the POA is not a critical foraging location for any marine mammal species. As discussed above, harbor seals primarily use Ship Creek as foraging habitat within Knik Arm. Beluga whales utilize Eagle Bay and rivers north of the POA which are not expected to be ensonified by the PCT project. Therefore, no impacts to critical foraging grounds are anticipated.

Estimated Take

This section provides an estimate of the number of incidental takes proposed for authorization through this IHA, which will inform both NMFS' consideration of ''small numbers'' and the negligible impact determination.

Harassment is the only type of take expected to result from these activities. Except with respect to certain activities not pertinent here, section 3(18) of the MMPA defines ''harassment'' as any act of pursuit, torment, or annoyance, which (i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment).

Authorized takes would primarily be by Level B harassment, as pile driving has the potential to result in disruption of behavioral patterns for individual marine mammals. There is also some potential for auditory injury (Level A harassment) to result, primarily for mysticetes, high frequency species, and phocids because predicted auditory injury zones are larger than for mid-frequency species and otariids. Auditory injury is unlikely to occur for mid-frequency species and otariids. The proposed mitigation and monitoring measures are expected to minimize the severity of such taking to the extent practicable.

As described previously, no mortality is anticipated or proposed to be authorized for this activity. Below we describe how the take is estimated.

Generally speaking, we estimate take by considering: (1) Acoustic thresholds above which NMFS believes the best available science indicates marine mammals will be behaviorally harassed or incur some degree of permanent hearing impairment; (2) the area or volume of water that will be ensonified above these levels in a day; (3) the density or occurrence of marine mammals within these ensonified areas; and, (4) and the number of days of activities. We note that while these basic factors can contribute to a basic calculation to provide an initial prediction of takes, additional information that can qualitatively inform take estimates is also sometimes available (*e.g.,* previous monitoring results or average group size). Below, we describe the factors considered here in more detail and present the proposed take estimate.

Acoustic Thresholds

Using the best available science, NMFS has developed acoustic thresholds that identify the received level of underwater sound above which exposed marine mammals would be reasonably expected to be behaviorally harassed (equated to Level B harassment) or to incur PTS of some degree (equated to Level A harassment).

Level B harassment for non-explosive sources—Though significantly driven by received level, the onset of behavioral disturbance from anthropogenic noise exposure is also informed to varying degrees by other factors related to the source (*e.g.,* frequency, predictability, duty cycle), the environment (*e.g.,* bathymetry), and the receiving animals (hearing, motivation, experience, demography, behavioral context) and can be difficult to predict (Southall *et al.,* 2007, Ellison *et al.,* 2012). Based on what the available science indicates and the practical need to use a threshold based on a factor that is both predictable and measurable for most activities, NMFS uses a generalized acoustic threshold based on received level to estimate the onset of behavioral harassment. In general, NMFS predicts that marine mammals are likely to be behaviorally harassed in a manner we consider Level B harassment when exposed to underwater anthropogenic noise above received levels of 120 dB re 1 μPa (rms) for continuous (*e.g.,* vibratory pile-driving, drilling) and above 160 dB re 1 μPa (rms) for non-explosive impulsive (*e.g.,* seismic airguns) or intermittent (*e.g.,* scientific sonar) sources. However, ambient noise levels within Knik Arm are above the 120-dB threshold, and therefore, for purposes of this analysis, NMFS considers received levels above those of the measured ambient noise (122.2 dB) to constitute Level B harassment of marine mammals incidental to continuous noise, including vibratory pile driving.

Results from the most recent acoustic monitoring conducted at the port are presented in Austin et al. (2016) and Denes et al. (2016) wherein noise levels were measured in absence of pile driving from May 27 through May 30, 2016 at two locations: Ambient-Dock and Ambient-Offshore. NMFS considers the median sound levels to be most appropriate when considering background noise levels for purposes of evaluating the potential impacts of the POA's PCT Project on marine mammals. By using median value, which is the 50th percentile of the measurements, for ambient noise level, one will be able to eliminate the few transient loud identifiable events that do not represent the true ambient condition of the area. This is relevant because during two of the four days (50 percent) when background measurement data were being collected, the U.S. Army Corps of Engineers was dredging Terminal 3 (located just north of the Ambient-Offshore hydrophone) for 24 hours per day with two 1-hour breaks for crew change. On the last two days of data collection, no dredging was occurring. Therefore, the median provides a better representation of background noise levels when the PCT project would be occurring. With regard to spatial considerations of the measurements, the Ambient-Offshore location is most applicable to this discussion as it is complies with the NMFS 2012 memo discussed above. The median ambient noise level collected over four days at the end of May at the Ambient-Offshore hydrophone was 122.2 dB. We note the Ambient-Dock location was quieter, with a median of 117 dB; however, that hydrophone was placed very close to the dock and not where we would expect Level B harassment to occur given mitigation measures (*e.g.,* shut downs). If additional data collected in the future warrant revisiting this issue, NMFS may adjust the 122.2 dB rms Level B harassment threshold.

Level A harassment for non-explosive sources—NMFS' Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0) (Technical Guidance, 2018) identifies dual criteria to assess auditory injury (Level A harassment) to five different marine mammal groups (based on hearing sensitivity) as a result of exposure to noise from two different types of sources (impulsive or non-impulsive). The POA's proposed activity includes the use of impulsive (impact pile driving) and non-impulsive (vibratory pile driving) sources.

These thresholds are provided in Table 5 below. The references, analysis, and methodology used in the development of the thresholds are described in NMFS 2018 Technical Guidance, which may be accessed at *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance.*

TABLE 5—THRESHOLDS IDENTIFYING THE ONSET OF PERMANENT THRESHOLD SHIFT

Hearing group	PTS onset acoustic thresholds * (received level)	
	Impulsive	Non-impulsive
Low-Frequency (LF) Cetaceans	$L_{pk,flat}$: 219 dB; $L_{E,LF,24h}$: 183 dB	$L_{E,LF,24h}$: 199 dB.
Mid-Frequency (MF) Cetaceans	$L_{pk,flat}$: 230 dB; $L_{E,MF,24h}$: 185 dB	$L_{E,MF,24h}$: 198 dB.
High-Frequency (HF) Cetaceans	$L_{pk,flat}$: 202 dB; $L_{E,HF,24h}$: 155 dB	$L_{E,HF,24h}$: 173 dB.
Phocid Pinnipeds (PW) (Underwater)	$L_{pk,flat}$: 218 dB; $L_{E,PW,24h}$: 185 dB	$L_{E,PW,24h}$: 201 dB.
Otariid Pinnipeds (OW) (Underwater)	$L_{pk,flat}$: 232 dB; $L_{E,OW,24h}$: 203 dB	$L_{E,OW,24h}$: 219 dB.

* Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds should also be considered.

Note: Peak sound pressure (L_{pk}) has a reference value of 1 µPa, and cumulative sound exposure level (L_E) has a reference value of 1µPa²s. In this Table, thresholds are abbreviated to reflect American National Standards Institute standards (ANSI 2013). However, peak sound pressure is defined by ANSI as incorporating frequency weighting, which is not the intent for this Technical Guidance. Hence, the subscript "flat" is being included to indicate peak sound pressure should be flat weighted or unweighted within the generalized hearing range. The subscript associated with cumulative sound exposure level thresholds indicates the designated marine mammal auditory weighting function (LF, MF, and HF cetaceans, and PW and OW pinnipeds) and that the recommended accumulation period is 24 hours. The cumulative sound exposure level thresholds could be exceeded in a multitude of ways (*i.e.,* varying exposure levels and durations, duty cycle). When possible, it is valuable for action proponents to indicate the conditions under which these acoustic thresholds will be exceeded.

Ensonified Area

Here, we describe operational and environmental parameters of the activity that will feed into identifying the area ensonified above the acoustic thresholds, which include source levels and transmission loss coefficient.

The estimated sound source levels and transmission loss coefficient used in our analysis are based on direct measurements during installation of unattenuated 48-in piles during the POA's 2016 TPP and measurements collected during marine construction projects conducted by the U.S. Navy. All source levels used in our analysis are presented in Table 6.

TABLE 6—ESTIMATED SOUND SOURCE LEVEL WITH AND WITHOUT A BUBBLE CURTAIN

Method and pile size	Sound Level at 10 m						Data source
	Unattenuated [1]			Bubble curtain			
Vibratory	db rms			7 dB reduction, dB rms			
144-in	178			171			Caltrans 2015.
48-in	168			161			Austin et al. 2016
36-in	166			159			Navy 2015.
24-in	161			154			Navy 2015.
	Unattenuated [1]			Bubble curtain			
Impact	dB rms	dB SEL	dB peak	dB rms	dB SEL	dB peak	
144-in	209	198	220	202	191	213	Caltrans 2015.
48-in	200	187	215	193	180	208	Austin et al. 2016.
36-in	194	184	211	187	177	204	Navy 2015.
24-in	193	181	210	186	174	203	Navy 2015.

[1] We note the only piles that may be driven or removed without a bubble curtain are 24-in battered piles. We included unattenuated SLs here for 36-in, 48-in, and 144-in piles to demonstrate how the 7dB reduction for bubble curtains was applied.

During the TPP, JASCO computed transmission loss (TL) coefficients, derived from fits of the received sound level data versus range. TL coefficients varied between piles with values ranging from 13 to 19.2 for impact pile driving and from 12.6 to 17.9 for vibratory pile driving when using sound attenuation devices. Results for the unattenuated hydraulic impact hammer yielded the highest TL coefficient, 19.2, indicating that sounds from the hydraulic impact hammer decayed most rapidly with range compared to the other hammers. The TL coefficient for the unattenuated diesel impact hammer averaged 17.5. Sounds from the unattenuated vibratory hammer had the lowest TL coefficient, with values of 16.1 and 16.9.

Based on these data, the POA proposed different transmission loss rates depending on if SEL (used for Level A harassment) or rms (used for Level B harassment) values were being evaluated. SPLrms is a pressure metric and SEL an energy metric. The difference in TL coefficient is a reflection of how SPLrms or SEL is dissipated in the marine environment. During underwater sound propagation, pressure amplitude tends to suffer more loss due to multipath propagation and reverberation, while acoustic energy does not dissipate as rapidly. Accordingly, the POA proposed using TL rate of 16.85 for assessing potential for Level A harassment from impact pile driving but a TL rate of 18.35, based on Austin et al. (2016), when assessing potential for Level B harassment from impact pile driving. For vibratory pile driving, SPLrms is used for both Level A harassment and Level B harassment analysis and, based on Austin et al. (2016), the POA applied a TL rate of 16.5. NMFS found these transmission loss rates acceptable and carried them forward in our analysis.

When the NMFS Technical Guidance (2016) was published, in recognition of the fact that ensonified area/volume could be more technically challenging to predict because of the duration component in the new thresholds, we developed a User Spreadsheet that includes tools to help predict a simple isopleth that can be used in conjunction with marine mammal density or occurrence to help predict takes. We note that because of some of the assumptions included in the methods used for these tools, we anticipate that isopleths produced are typically going to be overestimates of some degree, which may result in some degree of overestimate of Level A harassment take. However, these tools offer the best way to predict appropriate isopleths when more sophisticated 3D modeling methods are not available, and NMFS continues to develop ways to quantitatively refine these tools, and will qualitatively address the output where appropriate. For stationary sources (such as pile driving), NMFS User Spreadsheet predicts the closest distance at which, if a marine mammal remained at that distance the whole duration of the activity, it would not incur PTS.

The User Spreadsheet also includes a default, single frequency weighting factor adjustment (WFA) to account for frequency hearing groups. During the 2016 TPP, the POA collected direct measurements of sound generated during installation of 48-in piles. The spectra associated with impact and vibratory driving 48-in unattenuated piles was also derived. Therefore, we accepted POA's applied spectra approach for 48-in piles but relied on the User Spreadsheet default WFA for all other pile sizes.

Inputs used in the User Spreadsheet for 24-in, 36-in and 144-in piles, and the resulting isopleths are reported in Table 7.

TABLE 7—NMFS USER SPREADSHEET INPUTS

Spreadsheet Tab Used	24-in (unattenuated)	24-in (bubble curtain)	36-in (bubble curtain)	48-in (bubble curtain)	144-in (bubble curtain)
	(E.1) Impact pile driving	(E.1) Impact pile driving	(E.1) Impact pile driving	(E.1) Impact pile driving	(E.1) Impact pile driving
User Spreadsheet Input: Impact Pile Driving (TL = 16.85)					
Source Level (Single Strike/shot SEL)	181	174	177	180	191
Weighting Factor Adjustment (kHz)	2	2	2	measured spectra	2
Number of strikes pile	100	100	3,000	2,300 or 3,000	5,000
Piles per day	5	5	1–3	1–3	0.3 or 0.7
User Spreadsheet Input: Vibratory Pile Driving (TL = 16.5)					
Spreadsheet Tab Used	(A) Non-Impul, Stat, Cont.	(A) Non-Impul, Stat, Cont.	(A) Non-Impul, Stat, Cont.	(A) Non-Impul, Stat, Cont.	(A) Non-Impul, Stat, Cont.
Source Level (SPL RMS)	161	154	159	171	171
Weighting Factor Adjustment (kHz)	2.5	2.5	2.5	measured spectra	2.5
Time to drive single pile (minutes)	75	100	75	30	45
Piles per day	1–5	1–3	1–3	1	1

To calculate the Level B harassment isopleths, NMFS considered SPLrms source levels and the corresponding TL coefficients of 18.35 and 16.5 for impact and vibratory pile driving, respectively. The resulting Level A harassment and Level B harassment isopleths are presented in Table 8.

TABLE 8—DISTANCES TO LEVEL A HARASSMENT, BY HEARING GROUP, AND LEVEL B HARASSMENT THRESHOLDS PER PILE TYPE AND INSTALLATION METHOD

Pile size	Hammer type	Attenuation	Piles installed/ day	Level A harassment (m)					Level B harassment (m)
				LF	MF	HF	PW	OW	
48-in (2,300 strikes per pile).	Impact	Bubble Curtain	1	655	34	766	376	36	629
			2	989	51	1156	567	55	
			3	1258	65	1470	721	70	
48-in (3,000 strikes per pile).	Impact	Bubble Curtain	1	767	39	897	440	43	629
			2	1158	59	1353	664	64	
			3	1473	76	1721	844	82	
48-in	Vibratory	Bubble Curtain	1	5	1	7	3	0	2,247
36-in	Vibratory	Bubble Curtain	3	12	1	17	8	1	1,699
			4	14	2	20	9	1	
	Impact	Bubble Curtain	1	509	26	595	292	28	296
			2	768	39	898	440	43	
			3	978	50	1142	560	54	
24-in	Vibratory	Bubble Curtain	3	3	0	5	2	0	846
			4	7	1	10	4	0	
		Unattenuated	3	9	1	13	6	1	2,247
			4	19	2	27	12	1	
	Impact	Bubble Curtain	5	77	4	90	44	4	261
		Unattenuated	5	304	16	355	174	17	629
144-in	Impact	Bubble Curtain	0.3	2286	117	2672	1311	127	1,945
			0.7	3781	194	4418	2167	210	1,945
	Vibratory		1	24	3	34	15	1	9,069

Marine Mammal Occurrence and Take Estimation

In this section we provide the information about the presence, density, or group dynamics of marine mammals and present take calculations.

For all species of cetaceans other than beluga whales, density data is not available for upper Cook Inlet. Therefore, the POA relied on marine mammal monitoring data collected during past POA projects. These data cover the construction season (April through November) across multiple years. Estimated exposure from pile installation for all marine mammals except beluga whales is calculated by the following equation: Exposure estimate = N * # days of pile installation, where: N = highest daily abundance estimate for each species in project area across all years of data.

Harbor Seals

Marine mammal monitoring data collected during from previous POA projects were used to estimate daily sighting rates for harbor seals in the project area. The highest individual sighting rate recorded for a previous year was used to quantify take of harbor seals for pile installation associated with the PCT. The number of sightings of harbor seals during 2016 TPP construction monitoring was 28 sightings recorded over 83.5 hours of monitoring from May 3 through June 21, 2016. Based on these observations, the sighting rate during the 2016 TPP construction monitoring period was one harbor seal every 3 hours, or approximately four harbor seals per 12-hour work day. Given projected positive population growth, it is anticipated that eight harbor seals may be observed, and potentially exposed to noise, per 12-hour work day.

Pile installation and removal is anticipated to take approximately 127 days for Phase 1 and 75 days for Phase 2. Therefore, we estimate that no more than 1,016 harbor seals during Phase 1 (8 harbor seals per day * 127 days) plus 600 harbor seals (8 harbor seals per day * 75 days) during Phase 2, for a total of 1,616 harbor seals, would be potentially exposed to in-water noise levels exceeding the Level B harassment thresholds for pile installation/removal during PCT construction.

The mouth of Ship Creek, where harbor seals tend to concentrate is located approximately 700 m from the southern end of the PCT, and is therefore located outside the harbor seals Level A zone for the majority of pile sizes for both impact and vibratory pile installation. However, there is potential for Level A harassment near Ship Creek during installation of three 48-in piles per day and installation of 144-in piles. We estimate 30 percent of the Level B exposures could result in Level A harassment which is similar to the proportion of work where the Level A harassment isopleth extend to Ship Creek. Therefore, the POA has requested, and NMFS proposes to authorize 305 Level A harassment and 711 Level B harassment takes in Phase 1 and 180 Level A harassment and 420 Level B harassment takes in Phase 2.

Steller Sea Lions

Steller sea lions are anticipated to be encountered in low numbers, if at all, within the project area. Three sightings of what was likely a single individual occurred in the project area in 2009 and two sightings occurred in 2016. Based on observations in 2016, we anticipate an exposure rate of 2 individuals every 19 days during PCT pile installation and removal. Based on this rate, the POA requested 13 sea lions takes during Phase 1 (127 days * [2 sea lions every 19 days]) and 8 Steller sea lion takes during Phase 2 (75 days for Phase 2 * [2 sea lions every 19 days]). During installation of 144-in piles (Phase 2), the Level A harassment isopleth extends beyond 100 m. Although Steller sea lions are readily detectable at these distances, we are not proposing the POA be required to shut down if a Steller sea lion is observed. Steller sea lions are rarely present in Knik Arm; however, they can linger in the area for multiple days. During Phase 1, the Level A harassment isopleth is less than the 100 m shutdown zone for all scenarios; therefore, the potential for Level A take is negligible. During installation of the 144-in piles in Phase 2, there is a low potential for Level A harassment and an animal may remain for a couple days; therefore, we allocate two takes in Phase 2 to Level A harassment.

Harbor Porpoise

Previous monitoring data at the POA were used to evaluate daily sighting rates for harbor porpoises in the project area. During most years of monitoring, no harbor porpoises were observed. The highest individual sighting rate for any recorded year during pile installation and removal associated with the PCT was an average of 0.09 harbor porpoises per day during 2009 construction monitoring, but this value may not account for increased sightings in Upper Cook Inlet (Shelden et al. 2014). Therefore, the POA assumed that one harbor porpoise could be observed every 2 days of pile driving. Based on this assumption, the POA has requested, and NMFS is proposing to authorize, 64 exposures during Phase 1 (127 days * [1 harbor porpoise every 2 days]) and 38 harbor porpoises during Phase 2 (75 days for Phase 2 * [1 harbor porpoise every 2 days]). This estimate also covers the possibility that larger groups (2–3 individuals) of harbor porpoise could occur occasionally.

Harbor porpoises are relatively small cetaceans that move at high velocities, which can make their detection and identification at great distances difficult. Using the NMFS User Spreadsheet, impact driving 36-in, 48-in and 144-in piles results in Level A harassment isopleths larger than the Level B harassment isopleth. Vibratory driving and removal result in much smaller Level B harassment zone than Level B harassment zones and many temporary piles (the bulk of the work) would be installed and removed with a vibratory hammer. Further, the Level A harassment isopleths consider long durations and harbor porpoise are likely moving through the area, if present, not lingering. Therefore, we propose to authorize approximately one-third of the expected take to Level A harassment. For Phase 1, we are proposing to authorize 21 takes by Level A harassment and 43 takes by Level B harassment. For Phase 2, we propose to authorize 13 Level A harassment and 25 Level B harassment takes.

Killer Whales

Few, if any, killer whales are expected to approach the project area. No killer whales were sighted during previous monitoring programs for the Knik Arm Crossing and POA construction projects, including the 2016 TPP. The infrequent sightings of killer whales that are reported in upper Cook Inlet tend to occur when their primary prey (anadromous fish for resident killer whales and beluga whales for transient killer whales) are also in the area (Shelden et al. 2003). Previous sightings of transient killer whales have documented pod sizes in upper Cook Inlet between one and six individuals (Shelden et al. 2003). The potential for exposure of killer whales within the Level B harassment isopleths is anticipated to be extremely low. Level B take is conservatively estimated at no more than 12 individuals during Phase 1 and Phase 2 to account for two large (n = 12) groups or several smaller groups. No Level A harassment take for killer whales is anticipated or proposed to be authorized due to the small Level A harassment zones and implementation of a 100 m shutdown which is larger than Level A harassment isopleths.

Humpback Whales

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, there were two sightings in 2017 of what was likely a single individual at the Ship Creek Boat Launch (ABR 2017) which is located south of the project area. Based on these data, the POA conservatively estimates one humpback whale could be harassed every 16 days of pile driving. Therefore, the POA requested 8 humpback whale takes during Phase 1 (127 days for Phase 1 * [1 humpback whale every 16 days]) and 5 takes (75 days for Phase 2 * [1 humpback whale every 16 days]) for Phase 2. This could include sighting a cow-calf pair on multiple days or multiple sightings of single humpback whales. The POA did not request Level A take of humpback whales; however, based on the distances to the large Level A harassment thresholds relative to Level B harassment isoplehts and the fact humback whale sightings in Upper Cook Inlet is rare, NMFS is proposing to issue two Level A harassment takes per year to account for a single individual or a cow/calf pair. Therefore, NMFS is proposing to issue two Level A harassment takes and six Level B harassment takes during Phase 1 and two Level A harassment takes and three Level B harassment takes for Phase 2.

Beluga Whales

For beluga whales, we looked at several sources of information on marine mammal occurrence in upper Cook Inlet to determine how best to estimate the potential for exposure to pile driving noise from the PCT Project. In their application, the POA took a two-step approach to estimating Level B harassment take. The POA first estimated the numbers of beluga whales potentially exposed to noise levels above the Level B harassment threshold for pile installation and removal using the following formula: Beluga Exposure Estimate = N * Area * number of days of pile installation/removal, where: N = maximum predicted # of beluga whales/km² in Knik Arm (0.291 whales/km²) based on data from Goetz et al. (2012a) and Area = Area ensonified above Level B harassment threshold (km²). We note the actual beluga whale densities within the Level B harassment isopleths predicted for the PCT project ranged from 0.042 to 0.236 beluga whales/km². However, the POA applied the highest beluga whale density in upper Knik Arm. The higher densities north of the POA are expected as beluga whales tend to concentrate in Eagle Bay to forage whereas in the lower Arm, where the POA is located, habitat use is more commonly associated with traveling. The POA's simple calculation results in 103 takes in Phase 1 and 125 takes in Phase 2. The second step in POA's take estimate approach was to apply a 50 percent correction factor to their density-based calculation. The POA provided several reasons why this reduction factor was appropriate, including, but not limited to: The POA's commitment to using a bubble curtain means that noise levels along the western side of Knik Arm will remain below the regulatory thresholds; providing a travel corridor for beluga whales to access upper Knik Arm; for the majority of PCT construction and pile installation and removal, only approximately half of the width of Knik Arm, along the eastern shore, would be ensonified; beluga whales observed in Knik Arm during the autumn were most frequently sighted on the western side of the arm (Funk et al. 2005); and beluga whales in Knik Arm year-round; however, sightings are much lower in winter through early summer.

We reviewed the POA's density-based take calculation approach and their reasons for applying a 50 percent correction factor. We determined use of the Goetz density data for this specific project is problematic because the density data is based on June aerial surveys while the PCT project is occurring from April through November, the data is over seven years old, and the multiple years of monitoring data collected by the POA is not incorporated into this approach. Regarding the rationale for applying a 50 percent correction factor, we found the use of a bubble curtain and the fact the majority of pile driving would ensonify half or less than half of the width of Knik Arm is already captured by the ensonsified area which is embedded into the take calculation. The POA is not pile driving during winter when beluga whale abundance is lowest and although early summer tends to see lower beluga abundance, the density used in the take calculation is from June surveys. Finally, any habituation to repeated exposure may be considered qualitatively in analyzing the intensity of reactions to pile driving but it cannot be quantified and is not considered in take estimates.

To better capture beluga whale distribution and abundance, we undertook a multi-step analysis consisting of an evaluation of long-term, seasonal sighting data, proposed mitigation and monitoring measures, the amount of documented take from previous POA projects compared to authorized take, and considered group size. First, in lieu of density data, NMFS applied sighting rate data presented in Kendell and Cornick (2015) to estimate hourly sighting rates per month (April through November). We then identified hours of pile driving per month. The POA indicated there will be extended durations when no pile driving is happening (*e.g.,* later in the season when decking and other out-of-water work is occurring); however, the schedule could not be more refined than assuming an equal work distribution across the construction season. The POA did indicate the first two weeks of April and the last two weeks in November would be most likely utilized for equipment mobilization and demobilization; therefore, pile driving effort during those months were limited to two weeks. The data and calculated exposure estimates are presented below. These calculations assume no mitigation (*i.e.,* uncorrected take estimates) and that all animals observed would enter a given Level B harassment zone during pile driving. In total, we would expect approximately 94 exposures in Phase 1 and 60 exposures in Phase 2.

TABLE 9—UNCORRECTED BELUGA WHALE EXPOSURE ESTIMATES FOR PHASE 1 AND PHASE 2

Month	Monitoring data [1]			Estimated instances of take			
	Effort hours	Number of whales observed	Average whale/hr	Pile driving hours Phase 1 [2]	CIBW exposures Phase 1	Pile driving hours Phase 2 [2]	CIBW exposures Phase 2
April	12	2	0.17	25.64	4.27	16.37	2.73
May	156	40	0.26	51.29	13.15	32.71	8.39
June	280	8	0.03	51.29	1.47	32.71	0.94
July	360	2	0.01	51.29	0.28	32.71	0.18
August	426	269	0.63	51.29	32.38	32.71	20.65
Sept	447	169	0.38	51.29	19.37	32.71	12.35
October	433	22	0.05	51.29	2.61	32.71	1.66
Nov	215	175	0.82	25.64	20.91	16.37	13.35
Total	2317	685	0.30	359.02	94.44	229.00	60.25

[1] From Kendell and Cornick 2015.

[2] Assumes equal work distribution/month except in April and November when the POA has indicated they would be conducting only 2 weeks of pile driving due to time needed for mobilization and demobilization.

Second, NMFS then considered the proposed mitigation and distribution of beluga whales in Knik Arm. In the POA's application, they proposed a 100-m shutdown zone. However, as described in more detail below, NMFS has imposed additional mitigation designed to reduce Level B harassment take as well as Level A harassment take. We recognize that in certain situations, pile driving may not be able to be shutdown prior to whales entering the Level B harassment zone due to safety concerns. Sometimes beluga whales were initially observed when they surfaced within the harassment zone. For example, on November 4, 2009, 15 whales were initially sighted approximately 950 meters north of the project site near the shore, and then they surfaced in the Level B harassment zone during vibratory pile driving (ICRC 2009b). Construction activities were immediately shut down, but the 15 whales were documented as takes. On other occasions, beluga whales were initially sighted outside of the harassment zone and shut down was called, but the beluga whales swam into the harassment zone before activities could be halted, and take occurred. For example, on September 14, 2009, a construction observer sighted a white beluga whale just outside the harassment zone, moving quickly towards the 1,300 meter Level B harassment zone during vibratory pile driving. The animal entered the harassment zone before construction activity could be shut down, and was documented as a take (ICRC 2009c).

To more accurately estimate potential exposures, we looked at previous takes at the POA and those actually authorized. Between 2008 and 2012, NMFS authorized 34 beluga whale takes per year to POA with mitigation measures similar to the measures proposed here. The percent of the authorized takes that were documented as actually occurring during this time period ranged from 12 to 59 percent with an average of 36 percent (Table 10). The previous method of estimating take was based on density; however, the results between using densities versus sighting rate are somewhat comparable (*e.g.,* 94 exposures in Phase 1 using sighting rates versus 103 exposures using density). Further, there was extensive scientific monitoring and POA construction monitoring occurring during these time periods; therefore, we believe there is little potential animals were taken but not observed. Therefore we believe this first step in our analysis is reasonable.

TABLE 10—AUTHORIZED AND REPORTED BELUGA WHALE TAKES DURING POA ACTIVITIES FROM 2009–2012

ITA effective dates	Reported takes	Authorized take	Percent of authorized takes occurred
15 July 2008–14 July 2009	12	34	35
15 July 2009–14 July 2010	20	34	59
15 July 2010–14 July 2011	13	34	38
15 July 2011–14 July 2012	4	34	12

Second, we applied the highest percentage of previous takes to ensure potential impacts to beluga whales are fully evaluated and to ensure the POA has an adequate amount of take. Therefore, we assume that approximately 59 percent of the takes calculated for Phase 1 (n=94) and Phase 2 (n=64) will actually be realized. This approach is further supported by the proposed mitigation measures which are strict shutdown requirements for CIBWs with a goal of avoiding Level B take altogether, similar to previous POA mitigation measures.

Finally, we then considered group size from the long-term scientific monitoring effort and POA opportunistic data to determine if these numbers represented realistic scenarios. Figure 2 presents data from the scientific monitoring program. The APU scientific monitoring data set documented 390 beluga whale sightings.

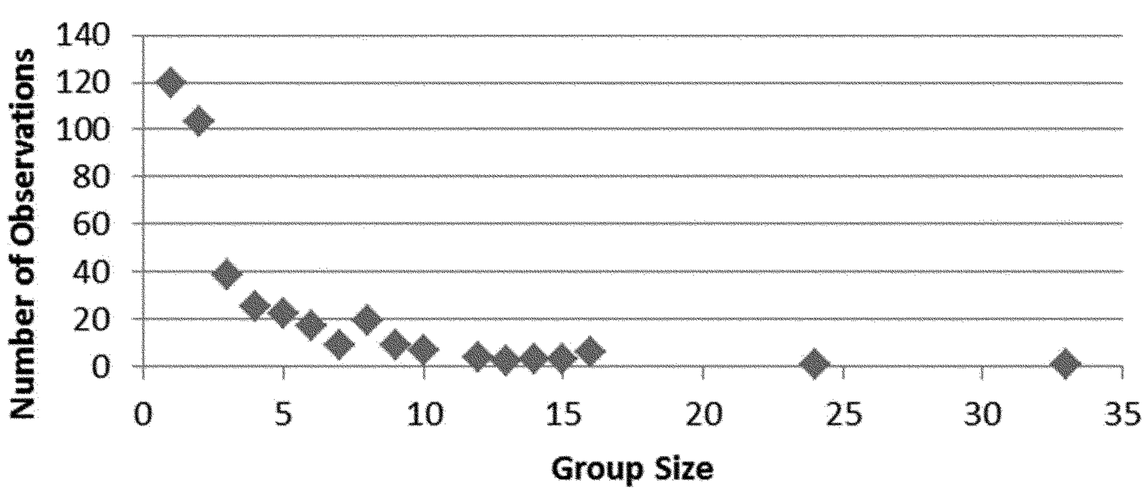

Figure 2. CIBW Sighting Data from POA Scientific Monitoring.

Group size exhibits a mode of 1 and a median of 2, indicating that over half of the beluga groups observed over the 5-year span of the monitoring program were of individual beluga whales or groups of 2. The 95th percentile of group size from the APU scientific monitoring data set is 11.1 beluga whales. This means that, of the 390 documented beluga whale groups in this data set, 95 percent consisted of fewer than 11.1 whales; 5 percent of the groups consisted of more than 11.1 whales. We conclude the amount of take proposed to be authorized following the approach above allows for the potential for large groups to be exposed to noise above NMFS harassment thresholds.

For reasons described above, NMFS believes this approach adequately analyzes the risk of beluga whale exposure to Level B harassment from the PCT Project. We conclude there is the potential for 45 exposures in Phase 1 and 33 exposures in Phase 2 (Table 11).

TABLE 11—PROPOSED BELUGA WHALE LEVEL B HARASSMENT EXPOSURES

PCT construction phase	Calculated exposure	Proposed take [1]
Phase 1—2020	94	55
Phase 2—2021	60	35

[1] Proposed take is identified as 59 percent of the calculated exposures using sighting rates.

In summary, the total amount of Level A harassment and Level B harassment proposed to be authorized for each marine mammal stock is presented in Table 12.

TABLE 12—PROPOSED AMOUNT OF TAKE, BY STOCK AND HARASSMENT TYPE

Species	Stock	Phase 1 (2020)			Phase 2 (2021)		
		Level A	Level B	Percent of stock	Level A	Level B	Percent of stock
Humpback whale	Western N Pacific	2	6	0.7	2	4	0.7
Beluga whale	Cook Inlet	0	55	17	0	35	11
Killer whale	Transient/Alaska Resident.	0	12	2	0	12	2
Harbor porpoise	Gulf of Alaska	21	43	0.2	13	25	0.2
Steller sea lion	Western	0	13	<0.1	2	6	<0.1
Harbor seal	Cook Inlet/Shelikof	305	711	3.6	180	420	2.1

Proposed Mitigation

In order to issue an IHA under Section 101(a)(5)(D) of the MMPA, NMFS must set forth the permissible methods of taking pursuant to such activity, and other means of effecting the least practicable impact on such species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stock for taking for certain subsistence uses. NMFS regulations require applicants for incidental take authorizations to include information about the availability and feasibility (economic and technological) of equipment, methods, and manner of conducting such activity or other means of effecting the least practicable adverse impact upon the affected species or stocks and their habitat (50 CFR 216.104(a)(11)).

In evaluating how mitigation may or may not be appropriate to ensure the least practicable adverse impact on species or stocks and their habitat, as well as subsistence uses where applicable, we carefully consider two primary factors:

(1) The manner in which, and the degree to which, the successful implementation of the measure(s) is expected to reduce impacts to marine mammals, marine mammal species or stocks, and their habitat. This considers the nature of the potential adverse impact being mitigated (likelihood, scope, range). It further considers the likelihood that the measure will be effective if implemented (probability of accomplishing the mitigating result if implemented as planned), the likelihood of effective implementation (probability implemented as planned), and;

(2) the practicability of the measures for applicant implementation, which may consider such things as cost, impact on operations, and, in the case of a military readiness activity, personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity.

The POA presented a number of mitigation measures in section 11 of their application. NMFS accepted a number of these measures (*e.g.,* use of bubble curtains on all plumb piles) but also requested the POA consider additional noise attenuation measures and modified shut down zones, among other things. We present mitigation measures NMFS has determined to affect the least practicable adverse impact on marine mammals and their habitat followed by a discussion of the ongoing considerations by NMFS and the POA which will be made final prior to issuance of the final IHA.

A key mitigation measure NMFS considered for this project is reducing noise levels propagating into the environment. The POA will use a bubble curtain on all plumb piles. At this time, NMFS is not requiring an unconfined bubble curtain. The POA presented a Technical Manual on the analysis of water current velocity data collected in the vicinity of the proposed PCT (TerraSound 2016) demonstrating current speeds were approximately 3 knots (kts) during times when tides were strongest. The POA has not finalized the bubble curtain design; however, bubble ring placement and bubble sizes and spacing must combat the current. In addition, the sound source verification results (see Proposed

Monitoring and Reporting Measures section below) must demonstrate the bubble curtain is achieving consistent noise attenuation such that source levels are at or below those evaluated in this document during all tide phases. The bubble curtain will be designed to absorb as much sound as possible. The POA proposed, and NMFS is requiring, all plumb piles installed in-water be done so in the presence of a fully operational bubble curtain.

The POA is also currently evaluating means by which to reduce sound propagation on battered piles. The POA has indicated that a full bubble curtain ring is not possible on battered piles; however, NMFS has requested the POA further investigate other means of reducing noise such as a linear or semi-circular curtain around the work area. The POA is actively looking into this and final noise attenuation plans will be made prior to issuance of the IHA. We note that for purposes of our analysis here, NMFS did not consider any noise attenuation during installation of battered piles. However, we are requiring that unattenuated piles not be driven in water depths greater than 3 meters based on the cutoff frequency (Roger and Cox, 1988). The intent of this measure is to reduce sound propagation. In shallower waters, lower frequencies tend to be cutoff more rapidly than high frequency sources.

In addition to noise attenuation devices, NMFS considered the amount of sound energy entering the aquatic environment. The installation of 144-in piles is included in Phase 2 (2021) and NMFS has determined that given the extensive Level B harassment zone generated from this activity, vibratory driving these large piles during peak beluga whale season poses an amount of risk and uncertainty to the degree that it should be minimized. Therefore, vibratory driving 144-in piles will not occur during August. Further, to minimize the potential for overlapping sound fields from multiple stressors, the POA will not simultaneously operate two vibratory hammers for either pile installation or removal. This measure is designed to reduce simultaneous in-water noise exposure. Because impact hammers will unlikely be dropping at the same time, and to expedite construction of the project to minimize pile driving during peak beluga whale abundance periods, NMFS is not proposing to restrict the operation of two impact hammers at the same time. We note that harassment zones during impact pile driving will radiate from both of the piles being driven, not a single pile.

NMFS also considered other means by which to remove piles since the majority of piles installed for this project are temporary (we note the POA reduced the amount of temporary piles originally proposed for this project). NMFS inquired about the potential to direct pull piles or cut them off at the mudline; thereby, reducing in-water noise levels. The POA responded that the depth at which temporary piles would be installed and substrate precludes directly pulling the piles. Cutting piles at the mudline also presents navigational (*e.g.,* anchoring) and safety concerns.

In their IHA application, the POA proposed a 100-m shutdown zone for all marine mammals or, where the Level A harassment zone was deemed to be greater than 100 m, a shutdown zone equivalent to the Level A harassment zone. NMFS found this measure did not effect the least practicable adverse impact on marine mammals for several reasons.

First, except for 48-in piles, the Level A harassment zones in the application are based on estimated spectra which NMFS does not support. Therefore, NMFS calculated Level A harassment zones for all piles (except 48-in piles) using the single frequency, default weighting factor adjustment provided in the NMFS User Spreadsheet. As shown in Table 8, Level A harassment zones for low-frequency and high frequency cetaceans and pinnipeds are rather large when considering multiple piles installed per day and installation of the 144-in piles. Sighting rates at these distances, specifically for harbor seals and porpoise, are unlikely to be good enough to ensure effective coverage. For these reasons, NMFS proposes a 100-m shutdown zone for all marine mammals (except beluga whales).

For beluga whales, NMFS determined the proposed shutdown zone of 100 m or the Level A harassment zone (if greater than 100 m) was not consistent with the conservation intentions of the POA nor what NMFS would consider as effecting the least practicable adverse impact based on the proposed project description and acoustic analysis. NMFS and the POA entered into discussions to discuss these opinions and have determined that measures and shutdown zones used in previous IHAs would ensure valuable protection and conservation of beluga whales. For this reason, NMFS is proposing the POA implement the following measures for CIBWs:

- Prior to the onset of pile driving, should a beluga whale(s) be observed within Knik Arm or approaching the mouth of Knik Arm, pile driving will be delayed until the whale moves away from the POA or is not re-sighted within 30 minutes. If non-beluga whale species are observed within or likely to enter the Level B harassment zone prior to pile driving, the POA may commence pile driving, recording and reporting MMPA take that occurs as a result.
- If pile driving has commenced and a beluga whale is observed within or likely to enter the Level B harassment zone, pile driving will shut down and not re-commence until the 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.
- If, during pile driving, PSOs can no longer effectively monitor all waters within the Level B harassment zone for the presence of marine mammals due to environmental conditions (*e.g.,* fog, rain, wind), pile driving may continue only until the current segment of pile is driven; no additional sections of pile or additional piles may be driven until conditions improve such that the Level B harassment zone can be effectively monitored. If the Level B harassment zone cannot be monitored for more than 15 minutes, the entire Level B zone must be cleared again for 30 minutes prior to pile driving.

In addition to these measures which greatly reduce the potential for harassment to beluga whales and set shutdown zones that realistically reflect non-beluga whale detectability, NMFS is including general mitigation measures typically included in IHAs:

- PSOs shall begin observing for marine mammals 30 minutes before pile driving begins for the day and must continue for 30 minutes when pile driving ceases at any time. If pile driving has ceased for more than 30 minutes within a day, another 30-minute pre-pile driving observation period is required before pile driving may commence.
- POA must use soft start techniques when impact pile driving. Soft start requires contractors to provide an initial set of three strikes at reduced energy, followed by a thirty-second waiting period, then two subsequent reduced energy strike sets. A soft start must be implemented at the start of each day's impact pile driving and at any time following cessation of impact pile driving for a period of thirty minutes or longer.
- For in-water construction other than pile driving, the POA must cease operations or reduce vessel speed to the minimum level required to maintain steerage and safe working conditions if a marine mammal approaches within 10 m of the equipment or vessel.

• POA is required to conduct briefings for construction supervisors and crews, the monitoring team, and POA staff prior to the start of all pile driving activity, and when new personnel join the work, in order to explain responsibilities, communication procedures, the marine mammal monitoring protocol, and operational procedures.

• If a species for which authorization has not been granted, or a species for which authorization has been granted but the authorized takes are met, is observed approaching or within the monitoring zone (Table 8), pile driving and removal activities must shut down immediately using delay and shut-down procedures. Activities must not resume until the animal has been confirmed to have left the area or the 30 minutes observation time period has elapsed.

Based on our evaluation of the applicant's proposed measures, as well as other measures considered by NMFS, NMFS has preliminarily determined that the proposed mitigation measures provide the means effecting the least practicable impact on the affected species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance and on the availability of such species or stock for subsistence uses.

Proposed Monitoring and Reporting

In order to issue an IHA for an activity, Section 101(a)(5)(D) of the MMPA states that NMFS must set forth requirements pertaining to the monitoring and reporting of such taking. The MMPA implementing regulations at 50 CFR 216.104 (a)(13) indicate that requests for authorizations must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present in the proposed action area. Effective reporting is critical both to compliance as well as ensuring that the most value is obtained from the required monitoring.

Monitoring and reporting requirements prescribed by NMFS should contribute to improved understanding of one or more of the following:

• Occurrence of marine mammal species or stocks in the area in which take is anticipated (*e.g.,* presence, abundance, distribution, density).

• Nature, scope, or context of likely marine mammal exposure to potential stressors/impacts (individual or cumulative, acute or chronic), through better understanding of: (1) Action or environment (*e.g.,* source characterization, propagation, ambient noise); (2) affected species (*e.g.,* life history, dive patterns); (3) co-occurrence of marine mammal species with the action; or (4) biological or behavioral context of exposure (*e.g.,* age, calving or feeding areas).

• Individual marine mammal responses (behavioral or physiological) to acoustic stressors (acute, chronic, or cumulative), other stressors, or cumulative impacts from multiple stressors.

• How anticipated responses to stressors impact either: (1) Long-term fitness and survival of individual marine mammals; or (2) populations, species, or stocks.

• Effects on marine mammal habitat (*e.g.,* marine mammal prey species, acoustic habitat, or other important physical components of marine mammal habitat).

• Mitigation and monitoring effectiveness.

During the 2016 TPP, observers for that project ()provided a number of recommendations to improve marine mammal monitoring for POA projects. These recommendations included:

• A minimum of three PSOs at an observation station is necessary to prevent fatigue and increase accuracy of detecting marine mammals, especially for large-radius zones. When using three PSOs, one PSO is observing, one PSO is recording data (and observing when there are no data to record), and the third PSO is resting. A fourth PSO allows the scanning of a 90-degree arc, instead of a 180-degree arc, increasing scan intensity and the likelihood of detecting marine mammals. Thirty to 60 minute rotations work well with this schedule.

• Communications between the pile driving/construction contractor and the PSOs should take place between one dedicated point of contact, or Lead PSO, for each shift.

• Each observation station should employ a pair of 25-power binoculars as they were superior to the 7- and 10-power binoculars at detecting and identifying marine mammals at greater distances.

• Electronic data collection methods should be considered. iPad applications and other technological advances make it possible to collect data quickly and accurately. A theodolite can be plugged into the device and marine mammal locations can be calculated on the spot, minimizing uncertainty. Data can be downloaded throughout the day to a database, eliminating the need for data entry by hand, and allowing quicker data assessment.

• Hard copy maps with pre-established grid-cells and harassment zones specific to the pile location being driven were invaluable. These maps allowed for immediate, accurate and consistent identification of marine mammal locations relative to the harassment zones, regardless of observation station.

The POA's IHA application addresses the majority of these recommendations in its Marine Mammal Monitoring Plan (Appendix A in POA's application) and NMFS proposes additional measures here. NMFS is requiring at least three PSOs (two on-watch and one to record data) will be positioned at the norther and southern station while two PSOs will be on-watch at the PCT (*i.e.,* pile driving) station. Each station will be equipped with several pieces of equipment (see section 2.4 in Appendix A of POA's application), including 25x binoculars and a range finders, as recommended above. One station will have a theodolite. PSOs may observe for no more than 4 hours at time and no more than 12 hours per day. The POA will submit all PSO CVs to NMFS prior to a PSO working on this project. Where necessary, NMFS may require a potential PSO shadow an experienced PSO before working independently.

To improve beluga whale detection, NMFS has worked with the POA to include PSO stations in different locations than the three stations proposed by the POA, which were all on POA property. The POA will have three PSO stations. One PSO station will be located at the PCT pile driving site. One station will be at Port Wornzof or a similar location to maximize beluga whale detection outside of Knik Arm and the mouth of Knik Arm. PSOs at this location will have unencumbered views of the entrance to Knik Arm and can provide information on beluga whale group dynamics (*e.g.,* group size, demographics, etc) and behavior of animals approaching Knik Arm in the absence of and during pile driving. We have also considered moving a station from the POA property to Port MacKenzie for an improved view of beluga whales moving from north to south within Knik Arm. However, the POA is currently investigating if this is an option with respect to accessibility (*i.e.* private property) and personnel safety. If Port MacKenzie is not an available option, the third PSO station will be located toward the north end of the POA property. The exact placement of this northern station will be determined prior to issuing the IHA. We note the previous station at Cairn Point used several years ago is Elemendorf Air Force Base property and is no longer accessible.

For both Phase 1 and Phase 2, NMFS is requiring the POA submit interim weekly and monthly monitoring reports during the PCT construction season. These reports must include a summary of marine mammal species and behavioral observations, pile driving shutdowns or delays, and pile work completed. A final end-of season report will be submitted to NMFS within 90 days following pile driving. The report must include: Dates and times (begin and end) of all marine mammal monitoring; a description of daily construction activities, weather parameters and water conditions during each monitoring period; number of marine mammals observed, by species, distances and bearings of each marine mammal observed to the pile being driven or removed, age and sex class, if possible; number of individuals of each species (differentiated by month as appropriate) detected within the monitoring zone, and estimates of number of marine mammals taken, by species (a correction factor may be applied); description of mitigation triggered, and description of attempts to distinguish between the number of individual animals taken and the number of incidences of take. In addition, any acoustic data and analysis collected throughout the year will also be made available to NMFS in the form of an interim report within 10 days of data collection and a final report within 60 days. Mean, median, and peak sound source levels (dB re: 1μPa): cumulative sound exposure level (SELcum), peak sound pressure level (SPLpeak), root mean square sound pressure level (SPLrms), and single-strike sound exposure level (SELs-s) will be reported as well as pile descriptions and acoustic monitoring methods (*e.g.,* sampling rate, distance to the hydrophone from the pile, etc.).

NMFS has also included reporting requirements for more uncommon situations. In the unanticipated event that the specified activity clearly causes the take of a marine mammal in a manner prohibited by this IHA, such as serious injury, or mortality, POA must immediately cease the specified activities and report the incident to the NMFS. In the event POA discovers an injured or dead marine mammal, and the lead observer determines that the cause of the injury or death is unknown and the death is relatively recent (*e.g.,* in less than a moderate state of decomposition), POA must immediately report the incident to the Office of Protected Resources, NMFS, and the Alaska Region Stranding Coordinator, NMFS. In addition, in the event that POA discovers an injured or dead marine mammal, and the lead observer determines that the injury or death is not associated with or related to the specified activities (*e.g.,* previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), POA must report the incident to the Office of Protected Resources, NMFS, and the Alaska Region Stranding Coordinator, NMFS, within 24 hours of the discovery.

Negligible Impact Analysis and Determination

NMFS has defined negligible impact as an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival (50 CFR 216.103). A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (*i.e.,* population-level effects). An estimate of the number of takes alone is not enough information on which to base an impact determination. In addition to considering estimates of the number of marine mammals that might be ''taken'' through harassment, NMFS considers other factors, such as the likely nature of any responses (*e.g.,* intensity, duration), the context of any responses (*e.g.,* critical reproductive time or location, migration), as well as effects on habitat, and the likely effectiveness of the mitigation. We also assess the number, intensity, and context of estimated takes by evaluating this information relative to population status. Consistent with the 1989 preamble for NMFS's implementing regulations (54 FR 40338; September 29, 1989), the impacts from other past and ongoing anthropogenic activities are incorporated into this analysis via their impacts on the environmental baseline (*e.g.,* as reflected in the regulatory status of the species, population size and growth rate where known, ongoing sources of human-caused mortality, or ambient noise levels).

To avoid repetition, the majority of our analysis applies to all species listed in Table 4 except for CIBWs, given that many of the anticipated effects of this project on different marine mammal stocks are expected to be relatively similar in nature. For CIBWs, there are meaningful differences in anticipated individual responses to activities, impact of expected take on CIBWs), or impacts on habitat; therefore, we provide a supplemental analysis for CIBWs, independent of the other species for which we propose to authorize take.

NMFS has identified key factors which may be employed to assess the level of analysis necessary to conclude whether potential impacts associated with a specified activity should be considered negligible. These include (but are not limited to) the type and magnitude of taking, the amount and importance of the available habitat for the species or stock that is affected, the duration of the anticipated effect to the species or stock, and the status of the species or stock. The following factors support a negligible impact determination for the affected stocks of humpback whales, killer whales, harbor porpoise, harbor seals, and Steller sea lions. Some of these also apply to CIBWs; however, a more detailed analysis for CIBWs is provided below.

- No takes by mortality or serious injury are anticipated or authorized;
- The number of total takes (by Level A and Level B harassment) are less than 3 percent of the best available abundance estimates for all stocks;
- Take would not occur in places and/or times where take would be more likely to accrue to impacts on reproduction or survival, such as within ESA-designated or proposed critical habitat, biologically important areas (BIA), or other habitats critical to recruitment or survival (*e.g.,* rookery);
- Take would occur over a short timeframe, being limited to the short duration a marine mammal would likely be present within a Level B harassment zone during pile driving;
- Any impacts to marine mammal habitat from pile driving are temporary and minimal; and
- Take would only occur within upper Cook Inlet—a limited, confined area of any given stock's home range.

For CIBWs, we further discuss our negligible impact finding in the context of potential impacts to this endangered stock. As described in the Recovery Plan for the Cook Inlet Beluga Whale (NMFS, 2016), NMFS determined the following physical or biological features are essential to the conservation of this species: (1) Intertidal and subtidal waters of Cook Inlet with depths less than 30 feet mean lower low water (9.1 m) and within 5 mi (8 km) of high and medium flow anadromous fish streams; (2) Primary prey species consisting of four species of Pacific salmon (Chinook, sockeye, chum, and coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole, (3) Waters free of toxins or other agents of a type and amount harmful to CI beluga whales, (4) Unrestricted passage within or between the critical habitat areas, and

(5) Waters with in-water noise below levels resulting in the abandonment of critical habitat areas by CI beluga whales. The PCT would not impact essential features 1–3 listed above. All construction would be done in a manner implementing best management practices to preserve water quality and no work would occur around creek mouths or river systems leading to prey abundance reductions. In addition, no physical structures would restrict passage; however, impacts to the acoustic habitat are of concern. Previous marine mammal monitoring data at the POA demonstrate beluga whales indeed pass by the POA during pile driving. As described above, there was no significant difference in beluga sighting rate with and in the absence of pile driving (Kendell and Cornick, 2015). However, beluga whales do swim faster and in tighter formation in the presence of pile driving (Kendell and Cornick, 2015).

During review of the POA's application, NMFS was concerned that exposure to pile driving at the PCT could result in beluga whales avoiding Knik Arm and thereby not accessing the productive foraging grounds north of POA such as Eagle River flats based on the proposed project and mitigation measures—thus, impacting essential feature number 5 above. Although the data previously presented demonstrate whales are not abandoning the area (*i.e.,* no significant difference in sighting rate with and without pile driving), we considered the results of a recent expert elicitation (EE) at a 2016 workshop, which predicted the impacts of noise on CIBW survival and reproduction given lost foraging opportunities, to inform our assessment of impacts on this stock. The 2016 EE workshop used conceptual models of an interim population consequences of disturbance (PCoD) for marine mammals (NRC 2005; New et al. 2014, Tollit et al., 2016) to help in understanding how noise-related stressors might affect vital rates (survival, birth rate and growth) for CIBW (King et al. 2015). NMFS (2015, section IX.D—CI Beluga Hearing, Vocalization, and Noise Supplement) suggests that the main direct effects of noise on CIBW are likely to be through masking of vocalizations used for communication and prey location, and habitat degradation. The 2016 workshop on beluga whales was specifically designed to provide regulators with a tool to help understand whether chronic and acute anthropogenic noise from various sources and projects are likely to be limiting recovery of the CIBW population. The full report can be found at *http://www.smruconsulting.com/publications/* and we provide a summary of the expert elicitation portion of the workshop here.

For each of the noise effect mechanisms chosen for expert elicitation, the experts to provide a set of parameter values that determined the forms of a relationship between the number of days of disturbance a female CIBW experiences in a particular period and the effect of that disturbance on her energy reserves. Examples included the number of days of disturbance during the period April, May and June that would be predicted to reduce the energy reserves of a pregnant CIBW to such a level that she is certain to terminate the pregnancy or abandon the calf soon after birth, the number of days of disturbance in the period April-September required to reduce the energy reserves of a lactating CIBW to a level where she is certain to abandon her calf, and the number of days of disturbance where a female fails to gain sufficient energy by the end of summer to maintain themselves and their calves during the subsequent winter. Overall, median values ranged from 16 to 69 days of disturbance depending on the question. However, for this elicitation, a ''day of disturbance'' was defined as any day on which an animal loses the ability to forage for at least one tidal cycle (*i.e.,* it forgoes 50–100% of its energy intake on that day). Therefore, disturbance in this context is not equivalent to Level B harassment. The mitigation measures NMFS has proposed for the PCT project are designed to avoid the potential that any animal would lose the ability to forage for one or more tidal cycles. While Level B harassment (behavioral disturbance) is proposed to be authorized, our mitigation measures would minimize the intensity of that harassment to behavioral changes such as increased swim speeds, tighter group formations, and cessation of vocalizations, not the loss of foraging capabilities. Regardless, this elicitation recognized that pregnant or lactating females and calves are inherently more at risk than other animals, such as males. NMFS first considered proposing the POA shutdown based on more vulnerable life stages (*e.g.,* calf presence) but ultimately determined all beluga whales warranted pile driving shutdown to be protective of potential vulnerable life stages, such as pregnancy, that could not be determined from observations, and to avoid more severe behavioral reaction.

Monitoring data from the POA suggest pile driving does not discourage beluga whales from entering Knik Arm and travelling to critical foraging grounds such as those around Eagle Bay. As previously described, sighting rates were not different in the presence or absence of pile driving. This is not surprising as food is a strong motivation for marine mammals. As described in Forney et al. (2017), animals typically favor particular areas because of their importance for survival (*e.g.* feeding or breeding), and leaving may have significant costs to fitness (reduced foraging success, increased predation risk, increased exposure to other anthropogenic threats). Consequently, animals may be highly motivated to remain in an area despite negative impacts (*e.g.,* Rolland et al. 2012). Previous monitoring data indicates beluga whales are responding to pile driving noise but not through abandonment of critical habitat, including primary foraging areas north of the port. Instead, they travel faster past the POA, more quietly, and in tighter groups (which may be linked to the decreased communication patterns). We anticipate these behaviors to continue; however, do not believe they had adverse effects on reproduction or survival as the whales continue to access critical foraging grounds north of the POA and tight associations combat any communication space lost within a group. Finally, as described previously, beluga whales likely stay in upper Knik Arm for several days before exiting Knik Arm. Acoustic data indicate beluga whales move through lower Knik Arm relatively quickly, when entering or exiting the arm, and remain in the upper arm for several days, or weeks, before moving back out into Cook Inlet (Castellote et al., *in press*). Satellite telemetry data indicate such a movement pattern may be common. Specifically, a beluga instrumented with a satellite link time/depth recorder entered Knik Arm on August 18th and remained in Eagle Bay until September 12th (Ferrero et al. 2000). This longer-term use of upper Knik Arm would avoid repetitive exposures from pile driving noise.

NMFS has included mitigation measures beyond those proposed by the POA in the IHA application, specifically, not commencing pile driving if beluga whales are observed within Knik Arm or within 1 km of the mouth of Knik Arm, shutting down pile driving should a beluga whale approach or enter the Level B harassment zone, stationing PSOs at Point Woronzof, and not vibratory pile driving 144-in piles during August (peak beluga season). These measures are designed to ensure beluga whales will not abandon critical habitat and exposure to pile driving noise will not result in adverse impacts on the reproduction or survival of any individuals. The location of PSOs at Point Woronzof allows for detection of beluga whales at much farther distances than previous years and behavioral observations prior to whales entering Knik Arm. Although NMFS does not anticipate beluga whales would abandon entering Knik Arm in the presence of pile driving with the proposed mitigation measures, these PSOs will be integral to identifying if belugas are potentially altering pathways they would otherwise take in the absence of pile driving. Because the POA is submitting weekly and monthly reports, NMFS will be able to regularly evaluate the impacts of the project on beluga whales. Finally, take by mortality, serious injury, or Level A harassment of CIBWs is not anticipated or proposed to be authorized.

In summary and as described above, the following factors primarily support our preliminary determination that the impacts resulting from this activity are not expected to adversely affect CIBWs through effects on annual rates of recruitment or survival:

- No mortality or serious injury is anticipated or authorized.
- Area of exposure would be limited to travel corridors. Data demonstrates Level B harassment manifests as increased swim speeds past the POA and tight group formations and not through habitat abandonment.
- No critical foraging grounds (*e.g.* Eagle Bay, Eagle River, Susitna Delta) would be impacted by pile driving.
- While animals could be harassed more than once, exposures are not likely to exceed more than a few per year for any given individual and are not expected to occur on sequential days; thereby, decreasing the likelihood of physiological impacts caused by chronic stress or masking.

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the proposed monitoring and mitigation measures, NMFS preliminarily finds that the total marine mammal take from the proposed activity will have a negligible impact on all affected marine mammal species or stocks.

Small Numbers

As noted above, only small numbers of incidental take may be authorized under Sections 101(a)(5)(A) and (D) of the MMPA for specified activities other than military readiness activities. The MMPA does not define small numbers and so, in practice, where estimated numbers are available, NMFS compares the number of individuals taken to the most appropriate estimation of abundance of the relevant species or stock in our determination of whether an authorization is limited to small numbers of marine mammals. Additionally, other qualitative factors may be considered in the analysis, such as the temporal or spatial scale of the activities.

For all stocks, the amount of taking is small relative to the population size (0.2 to 17 percent). Further, the amount of take proposed to be authorized likely represents smaller numbers of individual harbor seals and Steller sea lions. Harbor seals tend to concentrate near Ship Creek and have small home ranges; therefore, the amount of take authorized likely represents repeat exposures to the same animals. Previous Steller sea lion sightings identified that if a Steller sea lion is within Knik Arm, it is likely lingering to forage on salmon or eulachon runs and may be present for several days. With respect to CIBW, they are known to enter Knik Arm and then exit after several days of remaining within Knik Arm. There is potential an individual is taken on both ingress and egress; however, due to the mitigation measures (essentially takes are for animals where pile driving cannot be shut down before exposure), the circumstances would have to be such that pile driving is occurring while the whale is both entering and exiting Knik Arm and that the animal is missed or taken due to logistical constraints of shutting down pile driving immediately in both cases. Therefore, the potential for repeat takes is low and we anticipate take predominantly represents individual animals. Regardless, the amount of take proposed to be authorized for CIBW is small (17 percent or less).

Based on the analysis contained herein of the proposed activity (including the proposed mitigation and monitoring measures) and the anticipated take of marine mammals, NMFS preliminarily finds that small numbers of marine mammals will be taken relative to the population sizes of the affected species or stocks.

Unmitigable Adverse Impact Analysis and Determination

There are no relevant subsistence uses of the affected marine mammal stocks or species implicated by this action. No subsistence use of CIBWs occurs and subsistence harvest of other marine mammals is limited. The potential impacts from harassment on stocks that are harvested would be limited to minor behavioral changes (*e.g.,* increased swim speeds, changes in dive time, temporary avoidance near the POA, etc.) within the vicinity of the POA. Therefore, NMFS has determined that the total taking of affected species or stocks would not have an unmitigable adverse impact on the availability of such species or stocks for taking for subsistence purposes.

Endangered Species Act (ESA)

Section 7(a)(2) of the Endangered Species Act of 1973 (ESA: 16 U.S.C. 1531 *et seq.*) requires that each Federal agency insure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat. To ensure ESA compliance for the issuance of IHAs, NMFS consults internally, in this case with the Alaska Region Protected Resources Division Office, whenever we propose to authorize take for endangered or threatened species.

NMFS is proposing to authorize take of CIBWs, humpback whales from the Mexico DPS stock, and Steller sea lions from the western DPS, which are listed under the ESA. Therefore, the Permit and Conservation Division has requested initiation of Section 7 consultation with the Alaska Region for the issuance of this IHA. NMFS will conclude the ESA consultation prior to reaching a determination regarding the proposed issuance of the authorization.

Proposed Authorization

As a result of these preliminary determinations, NMFS proposes to issue an IHA to the POA for the PCT Project, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated. A draft of the proposed IHA can be found at *https://www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act.*

Request for Public Comments

We request comment on our analyses, the proposed authorization, and any other aspect of this Notice of Proposed IHA for the POA's PCT Project. We also request comment on the potential for renewal of this proposed IHA as described in the paragraph below. Please include with your comments any supporting data or literature citations to help inform our final decision on the request for MMPA authorization.

On a case-by-case basis, NMFS may issue a one-year IHA renewal with an expedited public comment period (15 days) when (1) another year of identical or nearly identical activities as described in the Specified Activities section is planned or (2) the activities would not be completed by the time the IHA expires and a second IHA would allow for completion of the activities beyond that described in the Dates and Duration section, provided all of the following conditions are met:

- A request for renewal is received no later than 60 days prior to expiration of the current IHA.
- The request for renewal must include the following:

(1) An explanation that the activities to be conducted beyond the initial dates either are identical to the previously analyzed activities or include changes so minor (*e.g.,* reduction in pile size) that the changes do not affect the previous analyses, take estimates, or mitigation and monitoring requirements.

(2) A preliminary monitoring report showing the results of the required monitoring to date and an explanation showing that the monitoring results do not indicate impacts of a scale or nature not previously analyzed or authorized.

- Upon review of the request for renewal, the status of the affected species or stocks, and any other pertinent information, NMFS determines that there are no more than minor changes in the activities, the mitigation and monitoring measures remain the same and appropriate, and the original findings remain valid.

Dated: December 20, 2019.

Donna S. Wieting,

Director, Office of Protected Resources, National Marine Fisheries Service.

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