UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

Endangered Species Act Section 7(a)(2) Biological Opinion

Issuance of a U.S. Army Corps of Engineers Permit and Incidental Harassment Authorization for Harvest Alaska LLC Cook Inlet Pipeline Cross-Inlet Extension Project

NMFS Consultation Number: AKR-2018-9719

Action Agencies: National Marine Fisheries Service, NOAA
Permits and Conservation Division, Office of Protected Resources
U.S. Army Corps of Engineers (Corps), Alaska District

Affected Species and Effects Determinations:

ESA-Listed Species	Status	Is the Action Likely To:			
		Adversely Affect:		Jeopardize the Species?	Destroy or Adversely Modify Critical Habitat?
		Species	CH		
Cook Inlet Beluga Whale (*Delphinapterus leucas)*	Endangered	Yes	No	No	No
Humpback Whale (*Megaptera novaeangliae*), Mexico DPS	Threatened	Yes	N/A	No	N/A
Humpback Whale (*Megaptera novaeangliae*), Western North Pacific DPS	Endangered	No	N/A	No	N/A
Steller Sea Lion, Western DPS (*Eumetopias jubatus*)	Endangered	Yes	No	No	No

Consultation Conducted By: National Marine Fisheries Service, Alaska Region

Issued By:

FOR
James W. Balsiger, Ph.D.
Regional Administrator

Date: 4/25/18

LIST OF TABLES

LIST OF FIGURES

TERMS AND ABBREVIATIONS

ADEC	Alaska Department of Environmental Conservation
ADNR	Alaska Department of natural Resources
AKR	Alaska Region - NMFS
APDES	Alaska Pollutant Discharge Elimination System ASRC
BMP	best management practices
CFR	U.S. Code of Federal Regulations
CIGGS	Cook Inlet Gas Gathering System
CIPL	Cook Inlet Pipeline
CIRCAC	Cook Inlet Regional Citizens Advisory Council
CISPRI	Cook Inlet Spill Prevention & Response, Inc.
cm	centimeters
Corps	U.S. Army Corps of Engineers
dB	decibel
DPH	detection positive hour
DPS	distinct population segment
EPA	Environmental Protection Agency
ESA	Endangered Species Act
Ft.	foot/feet (length measurement)
HCA	High Consequence Area
Hz	Hertz (unit of frequency – 1 cycle per second)
IHA	incidental harassment authorization
IMP	Integrity management plan
IPCC	Intergovernmental Panel on Climate Change
ITS	Incidental Take Statement
kHz	kilohertz
km	kilometer
km^2	square kilometer
KPL	Kenai pipeline
LLC	Limited Liability Corporation
logR	logarithm of the radius
mi.	miles
MLLW	mean lower low water
MMPA	Marine Mammal Protection Act m/s
NMFS	National Marine Fisheries Service NMML
NPMS	National Pipeline Management System
ODPCP	Oil Discharge Prevention and Contingency Plan
PBF	principal biological features (of critical habitat)
PCE	Primary Constituent elements (of critical habitat)
POA	Port of Alaska (formerly Port of Anchorage)
PR1	Protected Resources – Permits Division
Re: 1 μPa	referenced to 1 micropascal rms
rms	root mean square
ROW	right-of-way
PHMSA	Pipeline and Hazardous Materials Safety Administration

PSO	protected species observer
PTS	permanent threshold shift
SCADA	Supervisory Control and Data Acquisition
TL	transmission loss
TTS	temporary threshold shift
USACE	U.S. Army Corps of Engineers
U.S.C	United States Code
USFWS	U.S. Fish and Wildlife Service WNP

1.0 INTRODUCTION

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. § 1536(a)(2)), requires Federal agencies to insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat. When a Federal agency's action may affect ESA-listed species or critical habitat, consultation with the National Marine Fisheries Service (NMFS) and/or the U.S. Fish and Wildlife Service (USFWS) is required (50 CFR § 402.14(a)).

Section 7(b)(3) of the ESA requires that at the conclusion of consultation, NMFS and/or USFWS provide an opinion stating how the action will affect ESA-listed species and critical habitat under their jurisdiction (16 U.S.C. § 1536(b)(3)). If an incidental take is expected, section 7(b)(4) requires the consulting agency to provide an Incidental Take Statement (ITS) that specifies the impact of any incidental taking and includes reasonable and prudent measures to minimize such impacts and terms and conditions that must be complied with to implement those measures (16 U.S.C. § 1536(b)(4)).

Harvest, Alaska LLC (Harvest LLC), a subsidiary of Hilcorp Alaska LLC, proposes to modify the Cook Inlet Pipeline, Tyonek Pipeline, and the Cook Inlet Gas Gathering System (CIGGS) in Cook Inlet, Alaska. Harvest LLC is requesting a U.S. Army Corps of Engineers (Corps) permit for the proposed Cook Inlet Pipeline Cross-Inlet Extension Project under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. Harvest LLC is also requesting the NMFS Office of Protected Resources, Permits and Conservation Division (hereafter referred to as "the Permits Division" or PR1) issue an incidental harassment authorization (IHA) pursuant to section 101(a)(5)(D) of the Marine Mammal Protection Act of 1972, as amended (MMPA) (16 U.S.C. §§ 1361-1407), for harassment of marine mammals incidental to the Cook Inlet Pipeline Cross-Inlet Extension Project.

The NMFS Alaska Region (also referred to herein as NMFS AKR) has consulted with the Permits Division and the Corps (including the Corps' designated non-federal representative) on the proposed action. This document represents our biological opinion (Opinion) on the effects of the proposed actions on endangered and threatened species and critical habitat designated for those species.

The Opinion and Incidental Take Statement were prepared by NMFS Alaska Region in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. §§ 1531-1544), and implementing regulations at 50 CFR Part 402. The Opinion and Incidental Take Statement are in compliance with the Data Quality Act (44 U.S.C. § 3504(d)(1)) and underwent pre-dissemination review.

1.1 Background

This Opinion considers the effects to ESA-listed species from the proposed issuance of an IHA and Corps Letter of Permission (Standard Permit) authorizing the Cook Inlet Pipeline Cross-Inlet Extension Project, which is one component of Harvest LLC's current plans to modify pipeline infrastructure in Cook Inlet and which also includes additional onshore infrastructure and conversion of existing pipeline service across Cook Inlet. Accordingly, this Opinion analyzes Harvest LLC's current project plan for pipeline infrastructure in Cook Inlet. This project includes: (a) construction of two new pipelines from the Tyonek platform to the west side of Cook Inlet (the Cook Inlet Pipeline Cross-Inlet Extension component of the CIPL Project) and (b) reconfiguration of oil and gas flows across and around Cook Inlet, including a gas to oil conversion of one existing cross-inlet pipeline (the Cook Inlet Gathering System (CIGGS) A – Marine Pipeline Conversion component of the CIPL Project) (see Section 2 for project description). The project analyzed in the Opinion is hereinafter referred to as the Cook Inlet Pipeline Project, or CIPL Project.

The Corps and NMFS PR1 determined that the project is likely to adversely affect the endangered Cook Inlet Distinct Population Segment (DPS) of beluga whale (*Delphinapterus leucas*) (hereafter referred to as Cook Inlet beluga whale). Although the Corps determined the project would have no effect to humpback whales or Steller sea lions, NMFS PR1 proposes to authorize Level B harassment, pursuant to the MMPA, for the endangered western DPS Steller sea lion (*Eumetopias jubatus*), and the threatened Mexico DPS humpback whale (*Megaptera novaeangliae*). Therefore, NMFS AKR considers that the proposed project is likely to adversely affect these species, and they are included in this consultation. These action agencies further determined that the project may affect, but is not likely to adversely affect, designated critical habitat for Cook Inlet beluga whales. The action agencies determined that the project will have no effect on the Western North Pacific Distinct Population Segment (DPS) humpback whale (*Megaptera novaeangliae*) or designated critical habitat for Steller sea lions.

The Corps designated Harvest LLC as its non-federal representative for this project pursuant to 50 CFR 402.08. This Opinion is based on information provided to NMFS Alaska Region in the updated February 19, 2018 IHA application (ECO49 2018a); the February 5, 2018 Biological Assessment (ECO49 2018b); the proposed IHA (83 FR 8437; February 27, 2018); relevant literature; emails and telephone conversations between NMFS Alaska Region and NMFS Permits Division, Corps, Harvest LLC, and ECO49 staff; and other sources of information. A complete record of this consultation is on file at NMFS's Anchorage, Alaska office.

1.2 Consultation History

- April 27, 2017: Harvest LLC and ECO49 met with NMFS AKR to discuss the project prior to submitting their IHA application.
- May 25, 2017: NMFS AKR received a Draft Request for Incidental Harassment Authorization for the CIPL Cross Inlet Extension Project, dated May 16, 2017, from PR1.
- June 2017: PR1 and AKR began discussions on whether an IHA would be required for this project.
- August 2017 through January 2018: The Corps, NMFS, and Harvest LLC representatives held additional meetings, teleconferences, and exchanged emails.
- January 8, 2018: PR1 concluded that an IHA (and an associated formal Section 7 consultation) would be required for this project. In the interim, AKR and the Applicant (Harvest LLC) had resolved many Section 7 consultation-related issues associated with the proposed work.

- February 12, 2018: A request for formal consultation was received from PR1.
- February 22, 2018: A request for formal consultation was received from the Corps.
- February 27, 2018: The IHA proposal was published in the Federal Register.
- March 8, 2018: PR1 requested in an email to AKR a modification of the consultation request, to include takes of one Mexico DPS humpback whale and 6 (not 5) Steller sea lions.
- March 13, 2018: PR1 alerted AKR via email that in response to comments on the IHA proposal, the Level B harassment numbers were being revised upwards, to 40 Cook Inlet belugas.
- March 15, 2018: AKR and PR1 received a revision of Harvest LLC's Marine Mammal Mitigation and Monitoring Plan (4MP) that incorporated revised locations for PSOs compatible with site and vessel capacity requirements.
- March 20, 2018: AKR received confirmation via email that Harvest LLC agreed to incorporate an additional mitigation measure regarding observations of beluga whale behavior during diver activities.

2.0 DESCRIPTION OF THE PROPOSED ACTION AND ACTION AREA

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies. "Interrelated actions" are those that are part of a larger action and depend on the larger action for their justification. "Interdependent actions" are those that have no independent utility apart from the action under consideration (50 CFR 402.02).

The proposed action consists of the following:

- The issuance of a Corps permit for the installation of two new steel subsea pipelines: a 10-inch-diameter gas pipeline and an 8-inch-diameter oil pipeline between Tyonek Platform and Ladd Landing on the western side of Cook Inlet (Figure 1), which is one component of Harvest LLC's current plan for new and existing pipeline infrastructure in Cook Inlet; and
- NMFS Permits Division's issuance of authorization (IHA) for non-lethal takes of marine mammals by Level B harassment only (as defined by the MMPA) incidental to the installation of these pipelines.

The IHA is expected to extend from April 15, 2018 through March 31, 2019, and authorize the incidental harassment of 40 Cook Inlet beluga whales, 6 Steller sea lions, and 5 humpback whales, including up to one Mexico DPS individual, incidental to the Cook Inlet Pipeline Cross-Inlet Extension component of the CIPL project. The IHA will incorporate the protected species mitigation and monitoring measures and reporting requirements from Harvest LLC's Marine Mammal Monitoring & Mitigation Plan (4MP - See Appendix 1), which is included as part of the proposed action. Similarly, the Corps permit will incorporate special conditions to align with the IHA and this Opinion.

2.1. General Project Overview

Harvest LLC's Cook Inlet Pipeline Project, or CIPL Project, includes the installation of new 10-inch and 8-inch diameter steel subsea pipelines between the west side of Cook Inlet and the offshore[1] Tyonek Platform, a distance of about 5.5 miles (the Cross-Inlet Extension component of the CIPL Project). In addition, the existing 10-inch subsea pipeline that crosses Cook Inlet between Kaloa Junction and the East Forelands Facility will be converted from natural gas service to oil service (Figure 1) (the CIGGS Marine Pipeline Conversion component of the CIPL Project). In-water project work is expected to take about 108 days.

The overall goals of the project are to:

- Move crude oil from the west to east side of Cook Inlet via pipeline;
- Eliminate tanker traffic across Cook Inlet;
- Decommission the Drift River Terminal, thereby removing oil storage from an area subject to volcanic activity;
- Decommission pipelines south of Kustutan; and
- Allow direct transportation of gas from the Tyonek platform to west side of Cook Inlet.

The modifications proposed by Harvest LLC that are the subject of this consultation include:

- construction of: new onshore and offshore pipelines, pipeline junctions, shutdown valve stations, work pad, and a pumping station;
- pipeline conversions of service; and
- modifications to existing mechanical, electrical, civil, cathodic protection, and structural infrastructure.

2.1.1. Current Project Setting

Crude oil produced at Trading Bay and Granite Point wells currently flows from the platforms south through a 20 inch pipeline (named the CIPL 20) to the Drift River Terminal, where it is loaded onto a tanker and transported to the Tesoro Refinery on the east side of Cook Inlet. Natural gas, the only product produced at the Tyonek Platform, currently flows southeast through the Tyonek 10-inch pipeline to Moose Point Pad on the east side of Cook Inlet, and from there, south in the Tyonek 16-inch pipeline to the Conoco Kenai liquefied natural gas plant and into the existing Nikiski area gas system (Figure 2). Gas produced from various East side facilities is compressed and sent via pipelines to various end points. The system allows gas to flow northwest across Cook Inlet from East Forelands through subsea pipelines to Kaloa Junction and from there into the Beluga pipeline (BPL) and north to various end users on the west side of Cook Inlet (Figure 1).

[1] In this Opinion, offshore is used to distinguish infrastructure located in the waters of Cook Inlet, which for this action area are entirely state waters, from infrastructure that is located onshore. Offshore is not meant to refer to lands subject to federal jurisdiction under the Outer Continental Shelf Lands Act.

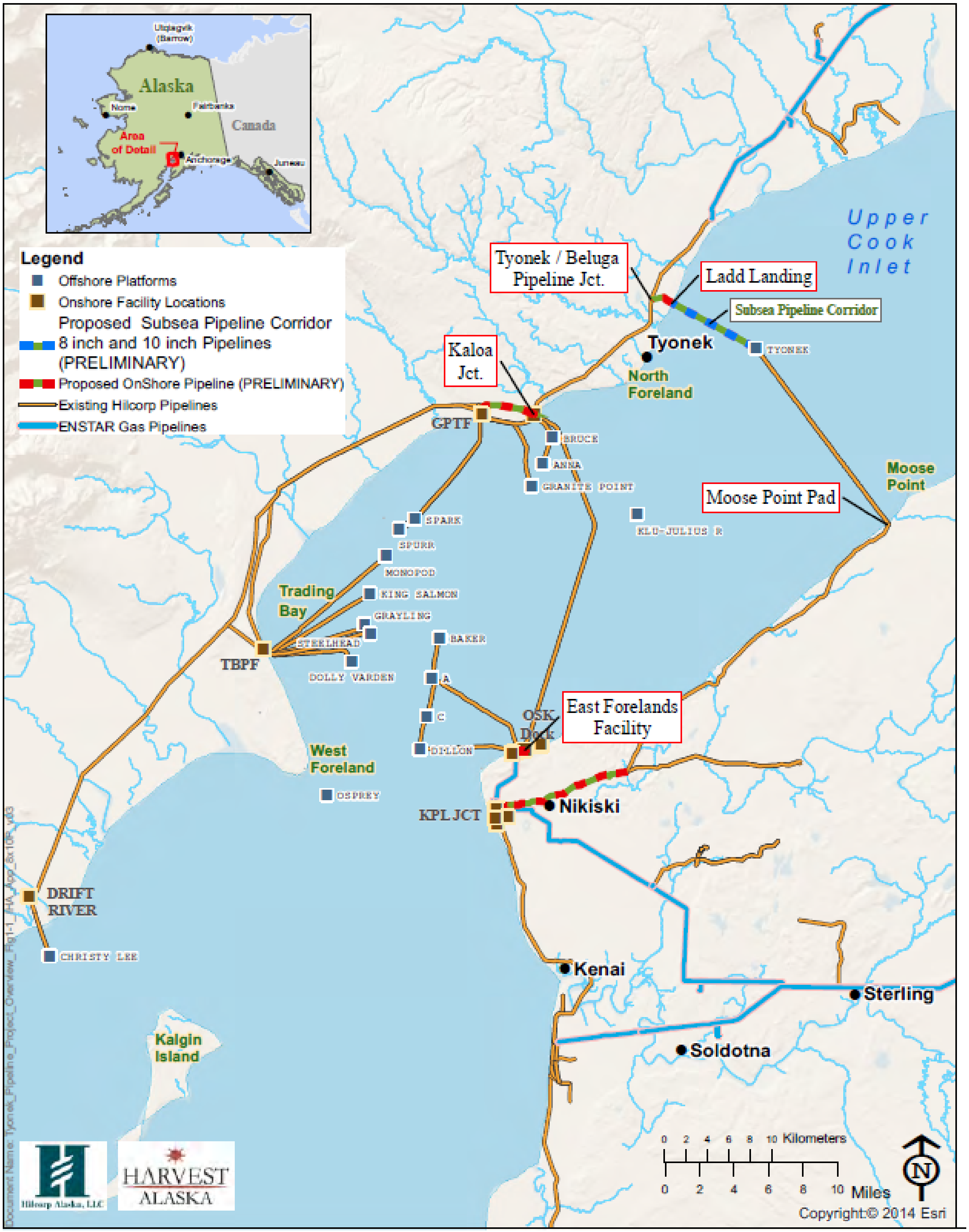

Figure 1. Project location and components.

Figure 2. Current Harvest LLC oil and gas flow.

2.1.2. Proposed New Oil & Gas Flows

Under the proposed modifications, the flow of crude oil and natural gas will be changed in some portions of the existing pipeline systems (Figure 3). Gas flow in the onshore Tyonek 16 inch pipeline will be reversed, to flow north through Moose Point Pad, and across the Cook Inlet through the existing Tyonek 10 inch pipeline to the Tyonek Platform. This gas and gas produced at the Tyonek Platform will flow west via the new subsea 10-inch gas pipeline (addressed in this consultation) through Ladd Landing onshore to a new tie-in to the BPL, a 16-inch onshore pipeline that will transport natural gas along the west side of Cook Inlet. The gas flow modifications are required so that two pathways of gas from the east side to the west side of Cook Inlet are maintained, since the existing CIGGS 10-inch (also referred to as CIGGS A) gas pipeline will be removed from gas service and changed to oil service.

Crude oil from the Trading Bay wells will still flow onshore and then north along the existing CIPL 20-inch pipeline, where it will join with crude oil from the Granite Point wells and flow through a new onshore pipeline section to Kaloa Junction. The crude oil will then flow south from the west to the east side of Cook Inlet through an existing CIGGS 10-inch pipeline that by then has been converted to carry oil. A short section of new onshore pipeline will connect the existing CIGGS 10-inch marine pipeline to Tesoro's existing pipeline and on to Tesoro's Kenai Pipeline (KPL) Tank Farm.

2.2. Tyonek Pipeline Construction Activities

2.2.1. *General*

The project includes the installation of two new steel subsea pipelines: a 10-inch-diameter gas pipeline and an 8-inch-diameter oil pipeline between Tyonek Platform and Ladd Landing on the western side of Cook Inlet. The gas pipeline will tie into the Beluga pipeline on the west side of the Inlet (Figure 1). The oil pipeline is intended for future use, and will not be connected to the Tyonek platform as part of this project. The new pipelines will extend about 8.9 kilometers (km, 5.5 miles (mi.)) in Cook Inlet waters from Ladd Landing to the Tyonek platform. In addition, the existing 10-inch nominal diameter steel subsea pipeline that runs from Kaloa Junction to the East Forelands Facility (Figure 1) will be converted from natural gas service to oil service. The potential indirect effects to listed species of the pipeline conversion are considered in this opinion; however, the project components under direct authority of the permitting agencies are limited to the new pipeline construction. A summary of projected in-water noise-producing activities and their duration appears in Table 1.

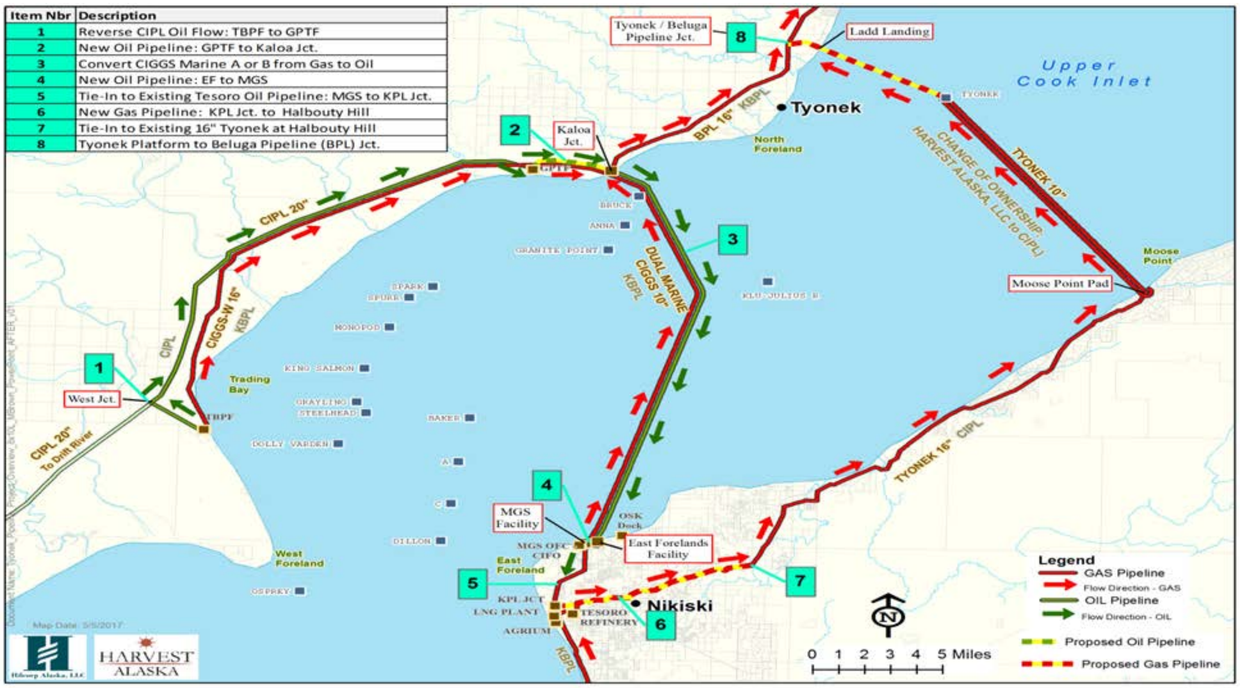

Figure 3. Proposed new oil and gas flow.

2.2.2. *Pre-construction work*

Mobilization of materials and equipment to pipe storage areas at Ladd Landing began in the fall of 2017. Bluff stabilization and vegetation clearing at Ladd Landing was also conducted. To prepare for pipeline installation beginning Spring 2018, preliminary materials were mobilized to the west side of Cook Inlet, along established shipping lanes. Additional equipment and material mobilization will occur through 2018 along these same lanes.

A sonar survey conducted in Spring 2017 identified a number of obstacles 1.5 meters (5 ft) in diameter or greater that could damage the pipe during installation or impede pipe pulling. The sonar array equipment used to identify obstacles operated at frequencies over 200 kHz, which is outside of the hearing range for marine mammals (NMFS 2016c). These obstacles (rocks or boulders) will be relocated so they do not interfere with the pipeline route. It is estimated that fewer than 50 obstacles will need to be moved away from the pipeline corridor. Equipment needed to move the obstacles includes a barge with crane (Manitowoc 4000 with 3.5-cubic yard bucket) or winch, two tugs, and dive boat. If the barge winch is used, it will pull a wire cable onto a drum (i.e., bucket) to move the obstacle. The obstacle will be moved the minimum distance to clear the route. During slack tide, divers will attach a 500-600 foot long pull cable to the obstacle. Slack wire will not remain in the water. The cable will then be pulled by a tug or, for larger objects, rolled up on a winch on the barge. No thrusters, which are used to position the tug, would be required. Because divers can only attach cables during slack tide, Harvest LLC anticipates this work will take approximately 15 days.

2.2.3. *Pipeline construction*

The new subsea gas pipeline (Tyonek W10) and subsea oil pipeline (Tyonek W8) will be installed concurrently, parallel to each other offshore from Ladd Landing (which is onshore) to the Tyonek Platform (which is offshore, located in Cook Inlet). To support pipeline installation, an onshore pipe fabrication and pulling area will be developed at Ladd Landing. The proposed method of construction is to fabricate the pipelines in approximately 0.8 km (0.5 mi) segments onshore in the cleared pull area. Each pipeline section is inspected and hydrotested[2], and coatings verified. The offshore and transition zone portions of the pipeline will be coated with a fusion bonded epoxy and an additional abrasion resistant overlay coating. Additional segments are welded together, welds inspected, and coatings applied to welds in the onshore fabrication area. The entire section is pulled offshore following connection of each new segment, until the pipeline section is approximately half of the entire offshore length of the pipeline (approximately 4.5 km (2.8 mi). This section will then be pulled towards the Tyonek Platform. Then a second pipeline section will be constructed using the same technique as the first, pulled into place, and attached to the first section with a subsea mechanical connection, which will be tested after installation. Once a segment for one pipeline has been pulled, the corresponding segment for the other pipeline will be pulled, until the long sections for both pipelines have been installed. The 10-inch line will be connected to existing infrastructure at Ladd Landing and Tyonek Platform. The 8-inch line will be capped subsea adjacent to the platform for future connection.

Pipeline segments/sections will be pulled from shore using a winch mounted on an anchored pull barge, intermittently repositioned by two tugs. An additional winch onshore will maintain alignment of the pipeline during pulling. A dive boat will be used to pull the tag line to the main winch line. The maximum velocity during pulling will be about 20 ft per minute or 0.2 knot.

There are 4 anchors for the barge and 2 anchors that will provide hold-back force for pulling pipe. Anchors will be set approx. 1.5-2 hours around each slack tide, to minimize cross currents and to maximize control of pipeline routing. During this time, tugs will move anchors and reposition the barge. Harvest LLC estimates that about 100-110 barge moves will be required over the construction period. Although tugs will be "powered on" 24-hours / day during pipe pulling, they will only be at full power while pulling anchors; otherwise, they are “standing by.” Actual time estimated for tugs to be working is a max of about 12 hours/day (full or operational power). Dive boats will be tied up to the barge and remain onsite during the project (no transiting required).

[2] A hydrotest is a way in which pipelines and other pressurized vessels can be tested for strength and leaks. The test involves filling the vessel or pipe system with a liquid, usually water, and pressurization of the vessel to a value higher than the maximum allowable operating pressure. Pipeline tightness can be tested by shutting off the supply valve and observing whether there is a pressure loss. Using this test helps maintain safety standards and durability of a pipeline over time. Newly manufactured pieces are initially qualified using the hydrostatic test. They are then re-qualified at regular intervals using the proof pressure test, which is also called the modified hydrostatic test. See also: https://primis.phmsa.dot.gov/comm/factsheets/fshydrostatictesting.htm

Pulling will occur between slack tides, with repositioning occurring during the slack water periods. A sonar array, operating at frequencies above 200 kHz, will be used to confirm that the pipe is being installed in the correct position. After installation, additional sonar surveys will be conducted to confirm that pipeline placement is correct. These post-installation sonar surveys will also operate at frequencies above 200 kHz. It is estimated that installation of the offshore pipeline sections (including obstacle removal and stabilization) will occur over a 68-day period (of the 108-day total construction period).

2.2.4. *Pipeline burial in the tidal zone*

The exposed pipelines will be buried through the tidal transition zone and each will be connected to its respective onshore pipeline and shutdown valve station. The proposed method for pipeline burial in the transition zone is by trenching adjacent to the pipeline using the open cut method, placing the pipeline in the trench, and burying it to a depth of approximately 1.8 m (6 ft). Each pipeline will be buried in a separate trench. The trench will be dug from the beach side as far offshore as possible, during low tide to allow shore-based excavators maximum distance into the tidal zone. The barge *Ninilchik* will then be anchored as close to the beach as possible and the trench continued the required distance from shore to adequately protect the pipe from ice damage (estimated as 420 ft.). This will be done from the barge with the crane equipped with a clam shell bucket or backhoe, or alternatively, with an excavator on the barge deck. The trenching will take place immediately prior to the pulling of the second pipe string to prevent the trench from filling with sediment during the tide cycles. If the trench is filled in by the tidal action and prevents the pipe from being pulled, a sheet pile cofferdam[3] or other method of burying the pipeline may be required to prevent the trench filling prior to the completion of the pull. Work in the transition zone will occur over a period of up to 8 days in late summer or fall, 2018.

2.2.5. Post-construction stabilization and connections

Once the pipeline sections are in place, divers working from a boat beside the barge will install sand or Seacrete bags on or under the pipelines for anchoring and stabilization. Weighted “pins” measuring 8’ x 8’ will be placed about every 100 feet along the pipeline to help anchor it in place. Stabilization is expected to take about 28 days. As with pipe-pulling, tugs will be used during slack tide to move four anchors and reposition the barge along the pipeline route during this stabilization work. Following pipeline stabilization, divers will install cathodic protection (anode sleds) along the pipelines[4].

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[3] If required, Harvest will keep the trench open during tidal swings using a trench box or a temporary concrete barrier. Prior to project start, a test trench will be dug (using the same methods described in 2.2.4) to determine if the trenching methodology will be effective. The trench will be cut when tide was out and then the trench box, constructed of braced sheet piles, will be placed adjacent to the trench area. Trench box walls will extend from the bottom of trench (6 feet) to above the high tide water level, and will not be driven into the substrate. Work will occur in waters less than 30-ft [9-m] deep for approximately 2-4 hours per slack tide. Based on the pre-project results, Harvest may alternatively place temporary blocks along the trench to minimize sediment infill.

[4] Cathodic protection is a technique used to control the corrosion of a metal surface by making it the cathode of an electrochemical cell. See section 2.4.3 for further detail.

Once each 2.5-mi section of each pipeline (four sections total) have been pulled into place, divers will measure the specific distances between the sections. Steel spool sections with gaskets that connect the two sections of each pipeline will be fabricated onshore; divers will use the spool sections to connect the pipeline segments underwater. The dive boat will be operating intermittently during the 9-day period needed to complete the underwater connections.

The subsea gas pipeline (Tyonek W10) will be connected to a new riser at the Tyonek Platform. In addition to modifications to existing piping, a shutdown valve will be installed. An existing pipeline lateral (from platform to subsea flange) will be capped and remain in place for potential

Table 1. Construction Scenarios, Associated Equipment and Estimated Source Levels during the 108-day CIPL Project (NMFS 2018).

Project Component/Scenario	Noise Source	Approximate Duration (days)	Approximate hours per day
Obstruction Removal and Pipeline pulling[1] (subtidal)	Tug (120 ft) x 2 Dive boat[3] Sonar boat[4] Work boat (120 ft) Crew boat (48 ft) Barge anchoring[4]	68 28 9 68 68	10-12 9 12 9 9
Pipeline pulling (intertidal)	Tug x 2 Barge anchoring Crew boat	16 16	10-12
Trenching (transition zone)	Tug x 2 Backhoe/bucket dredge (beach-based)	10 10	12 12
Mid-line Pipeline Tie-In Work	Tug x 2 Dive boat Work boat Barge anchoring	7 4 7 7	10-12 9 12 6
Connections of Tyonek Platform	Tug x 2 Work boat Dive boat Underwater tools (hydraulic wrench, pneumatic grinder, and pressure washer)	7 7 7 7	10-12 8 9 30 minutes
Total Duration	Tug x 2 Dive boat Sonar boat Work/crew boat	108 39 9 108	

[3]The dive boat, crew boat, and work boat durations are shorter because they would be tied to the barge most of the time. Main engines would not be running while tied up, but a generator and compressors would be running to support diving operations.
[3] Sonar boat engine noise only. Sonar equipment would operate at frequencies over 200 kHz.
[4] Barge is equipped with four anchors.
[5] Backhoe and tug will be used approximately 2-4 hours per low/slack tide to complete transition zone installation.
[7]Total time does not include allowance of 6 weather days because vessels would not be in the water during those days.

future use. The connections will be fabricated onshore, transported to the platform on a workboat, and lowered to the seafloor, where divers will complete the connection from new pipeline to the base of the new gas riser. The dive boat will be operating intermittently during the 9-day period needed to complete the underwater connections. The subsea oil pipeline (Tyonek W8) will not be connected to the Tyonek Platform at this time. Connection activities at the platform will occur in late Spring/Summer 2018. A set of underwater tools may be intermittently used for less 30 minutes at a time to expose and prepare the location where the new subsea gas pipeline will be connected to the existing pipeline. Tools used for this work may include chipping hammers, a hydraulic wrench to loosen bolts, underwater pressure washer to clean the existing infrastructure, and hydraulic grinder for removing concrete from existing infrastructure. Noise generated from the underwater hand tools will be lower than the levels estimated for the tugs. Therefore, takes associated with the use of underwater tools is considered as part of the takes associated with tug use; tugs affect a larger area of water that fully contains the area affected by the use of these tools (see Section 6).

The entire pipeline installation process, including obstacle removal, pulling, stabilization, trenching, and connections, is expected to occur over a period of about 108 days in the spring/summer of 2018. A final hydrostatic test[5] of the entire pipeline will be made before it is placed into service, in accordance with requirements at 49 CFR Part 195. This testing will take about 5-6 days. During hydrostatic testing, the barge will be anchored and stationary near the Tyonek Platform.

Upon completion of this project, there will be a new gas pipeline and a new oil pipeline spanning the distance between Ladd Landing and the Tyonek Platform; most of these two lines will be subsea, with short non-submerged sections near Ladd Landing connecting the lines to the Tyonek/Beluga Pipeline Junction (the Mainline Junction).

2.3. Conversion of Existing Gas Pipeline to Oil

As shown on Figure 3, Harvest LLC proposes to convert the existing CIGGS Marine pipeline crossing Cook Inlet (connecting Kaloa Junction with the East Forelands Facility) from natural gas to oil. The conversion will not require any in-water work. The existing pipeline has a wall thickness of 0.59 inch, a coating for corrosion protection, and an additional concrete coating to provide negative buoyancy and mechanical protection. Flow meters for leak detection and shut down valves will be installed at the Koala and East Forelands locations. The overall Leak Detection System used for this and all other Harvest LLC pipelines is also described in Section 2.4.

The gas-to-oil pipeline conversion includes the following components:

- The existing shipping pumps at the Trading Bay Production Facility (TBPF) will be modified to fit the new flow requirements for flowing oil north into the CIPL system instead of south to Drift River. Restaging or replacement of the pumps and modification to controls is anticipated.

[5] The pipeline will be tested to a minimum of 125 percent of the design pressure for a minimum of 4 hrs, followed by a 4-hr leak test. Water for hydrotests is withdrawn from Cook Inlet and discharged back into the Inlet after treatment (if required), after the test is completed. Discharged water quality will follow ADEC wastewater permit requirements.

- The existing trail along the CIPL12 right-of-way (ROW) from Mainline Junction to TBPF will be upgraded to allow yearly access via small trucks. The final trail will be approximately 10 feet (ft) wide and 4,400 ft long.

- CIGGS-A marine pipeline is a 21-mile-long, 10-inch-diameter pipeline that will be converted from gas to oil. Its subsea depth varies, with a maximum depth of approximately 200ft. No work on the pipeline is anticipated; there are no proposed changes to pipeline size, engineering and design characteristics, or type of pipe.

- Mainline Junction will be modified by adding or modifying pig launching and receiving facilities[6] on the existing CIPL 20. Bypass piping will be installed to allow proper decommissioning of Drift River and the south end of CIPL 20. The existing pad at Mainline Junction will be expanded to support the additional pigging facilities (less than an acre) and fencing will be installed.

- After modifications are completed at Mainline Junction and Granite Point Tank Farm (GPTF), the existing CIPL 20 will be hydrotested between Mainline Junction and GPTF.

- The existing CIPL 20 at GPTF will be intercepted and rerouted to feed into a new booster pump package. The existing CIPL 20 pig trap will be relocated to near the booster pump site to receive pigs launched at Mainline Junction. The existing GPTF facility piping will be modified to route GPTF oil to the new booster pump package. The booster pump package will consist of a new pump module and a new electrical module and will be located in a developed area at the GPTF facility. The pump package controls will be tied into the existing Supervisory Control and Data Acquisition (SCADA) system[7]. The pump package will boost the pressure of the oil as needed to flow from GPTF to Tesoro's KPL Tank Farm. A new pig trap will be installed on downstream of the pump package for introducing pigs into the CIPL 10 pipeline system.

- A new below-grade onshore CIPL 10 will be installed from GPTF to Kaloa Junction (Figure 3). A fiber optic cable will be installed with the pipeline for an improved communication and alternative control connection between GPTF and Kaloa Junction.

- The piping at Kaloa Junction will be modified to connect the new CIPL 10 from GPTF to the existing CIPL 10 Subsea (converted CIGGS gas pipeline). The facility piping will include a new automated shutdown valve and a dropout spool[8] that will allow connection of temporary pig traps to the CIPL 10 from GPTF and the CIPL 10 Subsea. Normal

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[6] A detailed description of pipeline pigging is beyond the scope of this opinion. See the following references for more information:
https://www.rigzone.com/training/insight.asp?insight_id=310
https://en.wikipedia.org/wiki/Pigging

[7] SCADA is a control system architecture that uses computers, networked data communications, and graphical user interfaces for high-level process supervisory management. Oil pipeline SCADA systems provide operators with features such as emergency shutdown, batch tracking, leak detection, dynamic modelling, etc.

[8] A dropout spool is a small section of pipe that can be removed and replaced with a different spool to allow a pig trap to be connected to two different pipelines.

operation will be for pigs to pass through Kaloa Junction without being trapped. The shutdown valve system will include a module for automate remote valve control. The shutdown valve controls will be tied to the existing SCADA system. No new gravel pad construction or fencing is anticipated.

- The CIGGS 10 subsea from Kaloa Junction to East Forelands will be converted from gas service to oil service and will be hydrotested, as required. No other work is anticipated.

- The piping at East Forelands will be modified to connect the existing CIPL 10 Subsea (CIGGS gas pipeline converted to carry oil) to the new CIPL 10 to Middle Ground Shoal (MGS) Facility. The facility piping will include a new automated shutdown valve and a dropout spool that will allow connection of temporary pig traps to the CIPL 10 Subsea and the CIPL 10 to MGS Facility. Normal operation will be for pigs to pass through East Forelands without being trapped. The automated shutdown valve controls will be tied to the existing SCADA[9] system. No new gravel pad construction or fencing is anticipated.

- A new onshore CIPL 10 will be installed from East Forelands to MGS Facility, a length of approximately 0.9 mile.

- The piping at MGS Facility will be modified to connect the new CIPL 10 from East Forelands to the Tesoro MGS pipeline. The facility piping will include a new pig trap and pig cooker[10], and new leak detection metering that will tie into the existing ATMOS leak detection system[11]. Under normal operation, pigs that are launched from GPTF will be received here. No new gravel pads or fencing is anticipated.

- No modifications to Tesoro's MGS 12 Pipeline or KPL Tank Farm (both onshore) are anticipated. The facilities are currently capable of handling the new oil delivery rates.

2.4 Pipeline Operation and Maintenance Required Mitigation Measures

New and existing pipelines are designed in accordance with all Federal and State regulations and accepted industry standards. Pipelines in Cook Inlet are designed to withstand the pressure and forces of strong tidal currents, wind waves, ice, scour, and physical obstacles that may contact the pipe. The offshore and transition zone portions of the pipeline will be coated with a fusion bonded epoxy and an additional abrasion-resistant overlay coating.

Harvest LLC has multiple independent leak detection systems operating continuously.

- Onshore pipeline routes are flown bi-monthly to identify 3rd party activities or any abnormal operating conditions along the pipeline.
- Offshore pipelines are inspected by divers if determined to be necessary based on operational leak detection systems and/or the results of in-line inspections conducted by smart-pigs that detect anomalies in the pipeline.
- All pipeline valves are inspected every 7.5 months and at least twice each calendar year to verify proper operation.

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[9] Supervisory Control and Data Acquisition – See 2.4.2 below
[10] Pig cooker: a heater that melts paraffin buildup on cleaning pigs
[11] See Section 2.4.2 below for description of ATMOS.

- Harvest LLC personnel inspect cathodic protection equipment monthly.
- A comprehensive annual survey of the cathodic protection system and system performance is conducted by third party contractors.

2.4.1. Leak Prevention: Pipeline Construction

During pipeline construction, all welds will be radiographically or ultrasonically examined prior to pulling the pipe along the seafloor. Once construction is complete for each pipeline segment, hydrostatic testing will occur onshore prior to pulling the segment into place. A final hydrostatic test of the entire pipeline will occur before it is placed into service. Hydrostatic testing of the subsea pipeline will take about 5-6 days. In accordance with requirements at 49 CFR Part 195, the pipeline will be tested to a minimum of 125 percent of the design pressure for a minimum of 4 hrs. An additional 4-hr leak test will be conducted following the pressure test. Water used to test each pipeline segment will be withdrawn from Cook Inlet and discharged back into the Inlet after treatment (if required), when the test is complete. The discharge will follow all Alaska Department of Environmental Conservation (ADEC) wastewater permit requirements.

2.4.2. Leak Detection Technology: Existing and New Pipelines

USDOT-regulated Crude Oil Transmission Pipelines are also regulated for leak detection through the state Oil Discharge Prevention and Contingency Plans (ODPCPs). The ATMOS Pipe leak detection system is utilized on Harvest LLC pipelines for leak detection. ATMOS Pipe is a statistical pipeline volume balance leak detection system that provides a very accurate method of detecting smaller leaks over a longer period of time or larger leaks over a short period of time.[12] Operational experience at other Alaska oil pipelines using the ATMOS Pipe system has verified its high reliability and accuracy for leak detection on crude oil pipelines in similar oil production service (ADEC 2012).

Flow meters carefully monitor inlet and outlet flows of the pipeline system for comparison of these values. Differences would indicate possible leaks. A statistical mass balance leak detection computer modeling system ties into the SCADA system that is monitored 24-hours per day in the Harvest LLC Control Room and includes a leak detection alarm for both the static and transient conditions. The operator on duty constantly monitors pipeline transfer operations via the SCADA system. In addition, the controller takes readings to compare the accumulated total throughput from all Harvest pipelines and compares with what has been received at the MGS Onshore Facility.

In addition to ATMOS Pipe, Hilcorp/Harvest uses the ATMOS Wave Leak Detection System (LDS), which is suited to identify larger leaks in a shorter period of time and is also able to identify the location of both large and small leaks along the pipeline.[11]

ATMOS Wave LDS[11] is based on state-of-the-art pressure sensors (and other hardware) and telecommunication technology. It examines all aspects of the negative pressure wave front and its propagation through the entire pipeline length. The system includes three comprehensive algorithms that have been rigorously tested in operational pipelines with great success.

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[12] For further description of ATMOS leak detection technology, see: https://atmosi.com/en-us/products-services/leak-detection/

In combined mode, ATMOS Pipe acts as the primary leak detection system aided by ATMOS Wave LDS; however, both leak detection systems run independently. If one system fails, the other system would continue leak detection. When running concurrently, ATMOS Wave LDS[11] provides the ATMOS Pipe System with the ability to detect leaks more quickly and provide a more accurate leak location. The ATMOS Pipe System meets the required leak detection limit of 1 percent of the oil pipeline's daily throughput as specified by 18 AAC 75.055(a)(1).

In addition to the leak detection systems described above, Harvest LLC must comply with pipeline design, construction, pressure testing and corrosion control, and operation and maintenance criteria, as well as pipeline personnel criteria, that are required by the U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (PHMSA).[13] Pipeline operators must prepare and implement Integrity Management Plans (IMPs), as specified in 49 CFR 195.452. This regulation details the requirements for Pipeline Integrity Management for Hazardous Liquid Pipelines located in or that could affect High Consequence Areas (HCA) (including Ecological Resources of Unusually Sensitive Areas). This applies to all Harvest LLC pipelines, including new ones proposed for the Tyonek Platform that could affect a HCA such as upper Cook Inlet. The IMP provides the ability to continually assess the pipeline integrity. It also requires an evaluation of the range of threats to pipeline integrity as well as the consequence of failure, and the identification of preventive and mitigative measures to protect the HCAs from a pipeline release (Hilcorp 2017a). Per their Integrity Management Plan, Hilcorp/Harvest conducts the following:

1) Annual review of National Pipeline Management System (NPMS) data for changes to HCA information
2) Annual review of other data sources for changes to U.S. Information
3) Annual identification of new HCAs.

2.4.3. Cathodic Protection

In addition to protective coatings, leak protection systems for the pipelines include the use of cathodic protection in accordance with federal regulations (49 CFR Part 192, Subpart I; 49 CFR Part 195, Subpart H) . Cathodic protection controls external corrosion by converting all of the anodic (active) sites on the metal surface to cathodic (passive) sites by supplying electrical current (or free electrons) from an alternate source.[14]

Cathodic protection will be installed on the new subsea pipelines and subsea valves at the Tyonek Platform as necessary. Existing subsea anode sleds[15] that may interfere with the offshore pipeline installation will be moved prior to pipeline installation. Existing sleds will be inspected and if damaged, replaced. Sand bags will be installed over the cables for new anode sleds or sleds that have been moved as part of pipeline installation. Additional sleds will be installed if required, based on size of subsea components.

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[13] For more information on PHMSA requirements, see 49 CFR Parts 192 and 195. These requirements generally apply to the design, construction, pressure testing and corrosion control, and operation and maintenance of new steel pipelines as well as some modifications to existing pipelines.
[14] See: http://www.cathodicprotection101.com/ for further explanation; see also: https://primis.phmsa.dot.gov/comm/FactSheets/FSCathodicProtection.htm.
[15] See: https://www.sciencedirect.com/science/article/pii/S2238785416300825 for information & description.

2.5. Contingency Planning for Oil Spills

In addition to leak detection, surveillance, maintenance, and corrosion monitoring, ADEC, under title 18 AAC 75, requires Alaska pipeline operators to provide spill prevention. ADEC is currently reviewing and accepting comments on Harvest Alaska's Amendment Application for Revision 6 to their ODPCP. Harvest's ODPCP revision and response to reviewer comments can be found at: http://dec.alaska.gov/Applications/SPAR/PublicMVC/IPP/CPlansUnderReview (search for Harvest).

The Biological Assessment prepared for this project estimates that the worst case discharge of oil associated with the converted pipeline is approximately 43,218 gallons (1,372 barrels). The ODPCP presents state-of-the-art scenarios and planned responses for such contingencies (which are considered highly unlikely, due to the leak detection systems described in sections 2.4.3-2.4.4 above). Spill response activities will be coordinated with Cook Inlet Spill Prevention & Response Inc. (CISPRI). CISPRI's recently updated Technical Manual can be accessed here: https://cispri.org/wp-content/uploads/2017/09/CISPRI-Technical-Manual-June-2017-Low.pdf

How to respond to spills under ice is a major concern when evaluating the effectiveness of spill response in Cook Inlet. The "tactic to recover oil from ice-infested water" is specifically addressed under Tactic # Open Water (OW)-2 in the CISPRI Technical Manual. Evaluating the effectiveness of oil spill response is beyond the scope of this Opinion. However, we note that much effort, public review, and scrutiny by ADEC goes into the ODPCP approval process (see Section 6.3.5 of this Opinion).

2.6. Mitigation Measures related to Noise

The revised Marine Mammal Monitoring Mitigation Plan (4MP), received on March 15, 2018, and appended to this Opinion, updates the measures NMFS PR1 proposed to incorporate into the IHA to reduce impacts to marine mammals associated with the pipeline construction portion of the CIPL Project. The derivation of specified distances is described in section 6.2 of this Opinion.

- Harvest LLC will establish a 2,200 m exclusion zone (Level B isopleth – see section 6.1.2) from any of the vessels on-site and employ NMFS-approved protected species observers (PSOs) to conduct marine mammal monitoring for the duration of the pipeline construction process.
- PSOs will be on-watch daily during daylight hours for the duration of the project.
- PSOs will be stationed on a bluff at Ladd Landing, when pipeline installation activities are nearshore, and on the Tyonek Platform, once installation activities have reached the mid-way point between shore and the platform
- Observation height of PSOs both onshore and offshore will be approximately 30 meters, at which height, the estimated maximum viewing distance is 5.1-6.3 kilometers (km) (3-3.9 miles [mi]).
- Minimum requirements for a PSO and their required equipment, as specified in the IHA and appended to this Opinion, will be followed.
- PSOs will work in shifts lasting no more than four hours without a minimum of a one hour break, and will not be on-watch for more than 12 hours within a 24-hour period.

- Prior to commencing activities for the day or if there is a 30 minute lapse in operational activities, the PSO will clear the area by observing the safety zone for marine mammals for 30 minutes. If the safety zone is clear of marine mammals, operations may begin.
- If any marine mammals are observed within the 2,200 m exclusion zone during the clearing, the PSO will continue to watch until the animal(s) is outside of and on a path away from this zone, or 15 minutes have elapsed since a marine mammal (other than a humpback whale) was last observed within the 2,200 m exclusion zone. For humpback whales, the watch will extend to 30 minutes. Once the PSO has indicated that the exclusion zone is free of marine mammals, operations may begin.
- Should a marine mammal be observed during pipe-pulling, the PSO will monitor and carefully record any reactions until the pipe is secure. No new operational activities will be started until the exclusion zone is free of marine mammals.
- PSOs will collect behavioral information on marine mammals beyond the exclusion zone.
- Other measures to minimize the acoustic footprint of the project include:
    - the dive boat, sonar boat, work boat, and crew boat will be tied to the barge or anchored with engines off when practicable;
    - all vessel engines will be placed in idle when not working if they cannot be tied up to the barge or anchored with engines off;
    - all sonar equipment will operate at or above 200 kilohertz (kHz).

2.7. Additional Mitigation Measures (not related to noise)

- Harvest LLC shall abide by NMFS marine mammal viewing guidelines while operating vessels or land-based personnel (for hauled-out pinnipeds); including not approaching within 100 yards of marine mammals and slowing vessels to the minimum speed necessary in the vicinity of marine mammals. NMFS Alaska Marine Mammal Viewing Guidelines may be found at https://alaskafisheries.noaa.gov/pr/mm-viewing-guide.
- When divers are in the water, sonar operators on the dive boat will collect opportunistic data on any observed beluga presence and behavior. For any belugas seen during dive operations, the following information will be conveyed to PSOs:
    - Date and time of observation;
    - Amount of time present;
    - Group size;
    - Presence of any calves or young animals;
    - Any noted behaviors, such as reactions to divers (e.g., approach or/avoidance), distance from divers, etc.
- All vessel and rig personnel will be responsible for cutting loops of all used packing straps, plastic rings, and other synthetic materials that have the potential to become entangled around fish or wildlife.
- All cables used for obstacle removal, pipe-pulling, anchoring etc. will be under tension (i.e., no slack) when in use and will be removed from the CIPL Project area following their use.

2.8. Additional Project Components

Harvest LLC will partner with NMFS Alaska Fisheries Science Center to conduct acoustic monitoring in order to collect measurements of noise generated by the CIPL Project. Vocalizations of belugas in the project vicinity will also be recorded, as practicable. Deliverables will include an estimate of noise levels and beluga vocalizations during the CIPL Project as compared with these components in the absence of project-related activities. The acoustic plan will be finalized prior to IHA issuance.

Pending receipt of necessary authorizations, Harvest LLC has also proposed to augment their PSO program with the use of an unmanned aerial system (UAS), pending final Federal Aviation Administration (FAA) approval. The UAS will be operated by either land-based or vessel-based pilots. All observer vantage points will be elevated, and will thus allow for increased viewing distances for detection of marine mammals for monitoring and mitigation purposes.

2.9 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). For this reason, the action area is typically larger than the project area and extends out to a point where no measurable effects from the proposed action occur.

The action area for this biological opinion extends out to a point where no measurable effects from the project are expected to occur, including transit areas for mobilization, demobilization, and support activities (Figure 4). Within the action area, the loudest sound is emitted by tugs when moving the pipe-pulling barge (170 dB source level of continuous sound). Received levels of tug noise are expected on average to decline to 120 dB re 1 μPa (rms) within 2,200 m of the tugs (see Section 6.1.2 for derivation of this distance).

NMFS PR1 estimated the ensonified area to encompass a rectangle centered along the pipeline corridor and extending laterally to 2,200 m (Figure 4). NMFS PR1 determined that a 120 dB isopleth for a source level of 170 dB re: 1 μPa along the pipeline corridor for the duration of all in-water project work represents a reasonable ensonified zone since other activities (e.g., trenching, obstacle removal, underwater tools) are all expected to produce less noise.

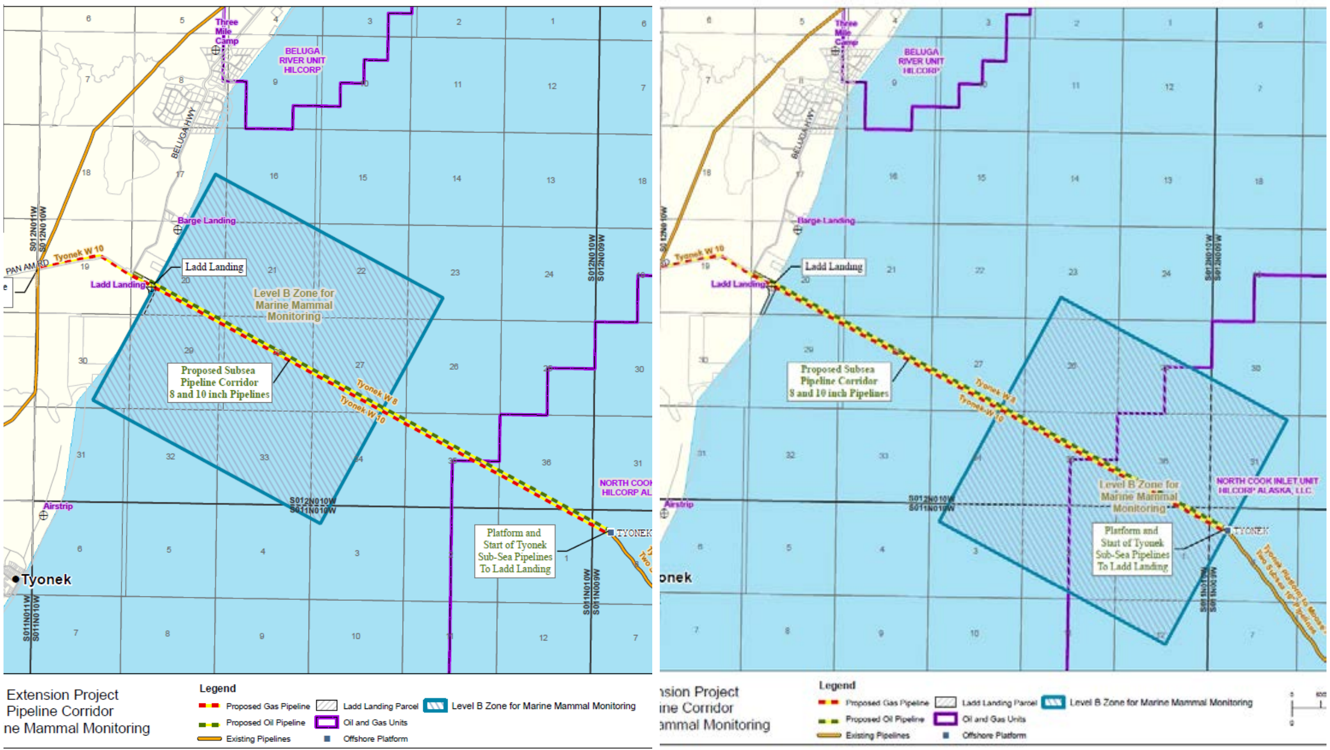

Figure 4. Action area and Level B monitoring zone for the proposed project.

3.0 APPROACH TO THE ASSESSMENT

Section 7(a)(2) of the ESA requires Federal agencies, in consultation with NMFS, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitat. The jeopardy analysis considers both survival and recovery of the species. The adverse modification analysis considers the impacts to the conservation value of the designated critical habitat.

To “jeopardize the continued existence” of a listed species means “to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species” (50 CFR § 402.02). As NMFS explained when it promulgated this definition, NMFS considers the likely impacts to a species’ survival as well as likely impacts to its recovery. Further, it is possible that in some circumstances, impact to the rate of recovery may result in a jeopardy biological opinion (51 FR 19926, 19934; June 3, 1986).

Under NMFS’s regulations, the destruction or adverse modification of critical habitat “means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species”; such “alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features” (50 CFR § 402.02).

In accordance with our interim guidance (Wieting 2016), NMFS interprets the term "harass" pursuant to the ESA in a manner similar to the USFWS regulatory definition for non-captive wildlife:

> Create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering.

By comparison, Level B harassment is defined in the Marine Mammal Protection Act (MMPA) (16 U.S.C. § 1362(18)(A)(ii)) and in NMFS' MMPA regulations (50 CFR 216.3) to mean:

> Any act of pursuit, torment, or annoyance which has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering . . . .

4.0. LISTED SPECIES CONSIDERED IN THIS BIOLOGICAL OPINION

Four ESA-listed marine mammals under NMFS's jurisdiction may occur in the action area. The action area also includes critical habitat for the Cook Inlet beluga whale. This opinion considers the effects of the proposed action on the following species (Table 2). We concur that this project is not likely to adversely affect Cook Inlet beluga whale critical habitat. Our analysis of project effects on critical habitat appears in section 6.4.

Table 2. Marine mammals and critical habitat considered in this opinion.

Species	Status	Listing	Critical Habitat
Cook Inlet beluga whale (*Delphinapterus leucas*)	Endangered	73 FR 62919, October 22, 2008	76 FR 20180, April 11, 2011
Mexico DPS humpback whale (*Megaptera novaeangliae*)	Threatened	81 FR 62260, September 8, 2016	N/A
Western North Pacific DPS Humpback whale (*Megaptera novaeangliae*)	Endangered	81 FR 62260, September 8, 2016	N/A
Western DPS Steller sea lion (*Eumatopias jubatus*)	Endangered	62 FR 24345, May 5, 1997	58 FR 45269, August 27, 1993

4.1 Western North Pacific DPS Humpback Whale

As explained in section 4.4 in this Opinion, humpback whales are very uncommon in upper Cook Inlet. NMFS Alaska Region has only a few records of humpback whales (ninety percent of which would have been from the non-listed Hawaii DPS) in upper Cook Inlet, and NMFS Alaska Region has no records of humpback whales observed in the action area, although it is possible that the few humpback whales seen in upper Cook Inlet (north of the action area) traveled through or near the action area unobserved. Therefore, few humpbacks have occurred in upper Cook Inlet, and none are known to have occurred in the action area. As shown in Table 3, individual humpback whales in the Gulf of Alaska summer feeding area (which includes Cook Inlet) have only a 10.5% and 0.5% probability of being from the threatened Mexico DPS and endangered Western North Pacific DPS, respectively (Wade *et al*. 2016, NMFS 2016a). Listed humpback whales are only anticipated to represent a small fraction of the total humpback whales that could be present in the action area during the limited duration of this project and the limited geographic scope of the action area. Further, due to the very small expected percentage of Western North Pacific DPS humpback whales in the Gulf of Alaska DPS (Table 3), if any listed humpback whale were to occur in the action area, which is not likely in and of itself, it is more likely to belong to the Mexico DPS and is very unlikely the humpback whale would belong to the Western North Pacific DPS (0.5% probability). The action agencies determined that this project would have no effect upon Western North Pacific DPS humpback whales.

4.2 Cook Inlet Beluga Whale

Background

The endangered Cook Inlet beluga whale is the listed species most likely to be affected by this project, primarily from noise. In this opinion, we focus on aspects of beluga whale ecology that are relevant to the effects of this project.

Beluga whales inhabiting Cook Inlet are one of five distinct stocks found in Alaska (Muto *et al.* 2017). The Cook Inlet stock is the most isolated of the five stocks; it is separated from the others by the Alaska Peninsula and resides throughout the year in Cook Inlet (Laidre *et al.* 2000; Goetz *et al.* 2012). The Cook Inlet beluga whale stock was designated as depleted under the MMPA (65 FR 34590, May 31, 2000), and on October 22, 2008, NMFS listed Cook Inlet beluga whales as endangered under the ESA (73 FR 62919, October 22, 2008).

A detailed description of the Cook Inlet beluga whales' biology, habitat and extinction risk factors may be found in the endangered listing rule for the species (73 FR 62919, October 22, 2008), the Conservation Plan for the Cook Inlet beluga whale (NMFS 2008), and the Recovery Plan (NMFS 2016b). Additional information regarding Cook Inlet beluga whales can be found on the NMFS AKR web site at:
http://alaskafisheries.noaa.gov/protectedresources/whales/beluga.htm.

Population Trend

The best available historical abundance estimate of the Cook Inlet beluga whale population was from a survey in 1979, which resulted in an estimate of 1,293 whales (Calkins 1989). NMFS began conducting comprehensive and systematic aerial surveys of the beluga population in 1993. These surveys documented a decline in beluga abundance from 653 whales in 1994 to 347 whales in 1998, a decline of nearly 50% (Figure 5). In response to this decline, in 2000, NMFS designated the Cook Inlet beluga whale population as depleted under the Marine Mammal Protection Act. Abundance data collected since 1999 indicate that the population did not increase, and the lack of population growth led NMFS to list the Cook Inlet beluga whale as endangered under the ESA on October 22, 2008 (73 FR 62919). The 2014 population abundance estimate was 340 whales, indicating a 10 year decline of 0.4 percent per year (Shelden *et al*.

2015). Our most recent (2016) population estimate is 328 (range of 279-386) Cook Inlet belugas. However further analyses are required to ascertain a valid population trend (NMFS, MML, Unpublished data, 2017).

Additional information on Cook Inlet beluga whale biology and habitat (including critical habitat) (Figure 6) is available at: http://alaskafisheries.noaa.gov/pr/ci-belugas.

Range and Behavior

Cook Inlet beluga whales generally occur in shallow, coastal waters during summer. Although they remain year-round in Cook Inlet, they demonstrate seasonal movements within the inlet. During the summer and fall, beluga whales are concentrated near the Susitna River mouth, Knik Arm, Turnagain Arm, and Chickaloon Bay (Nemeth *et al.* 2007). During the winter, they are more dispersed in deeper waters in the mid-inlet to Kalgin Island, and in the shallow waters along the west shore of Cook Inlet to Kamishak Bay. Some whales may also winter in and near Kachemak Bay.

During December 2015 -January 2016, Tyonek Platform personnel observed 200-300 Cook Inlet beluga whales, including calves, regularly. They appeared to be drifting by the platform on the afternoon tides, in the open water areas between ice sheets. One operator, working in Cook Inlet for 30 years, stated that he'd never seen them in the winter before the 2015-16 season (S. Callaway, pers. comm. 01/19/2016). Prior to the 1990s, belugas used areas throughout Cook Inlet during the spring, summer, and fall (Huntington 2000; Rugh *et al*. 2010). The distribution has since contracted northeastward into upper Cook Inlet, which is especially evident in the summer (Figure 7) (Rugh *et al*. 2000; Speckman and Piatt 2000; Hobbs *et al*. 2008; Rugh *et al*. 2010; Shelden *et al.* 2015). Whereas Cook Inlet belugas formerly made more extensive summer use of the waters off of the Kenai and Kasilof Rivers, they now make little to no use of this salmon-rich habitat during summer salmon runs (Castellote *et al*. 2016). This represents a substantial reduction in usage of summer prey.

The Susitna River Delta area (including the Beluga and Little Susitna Rivers) has become the core summer habitat for Cook Inlet belugas, with additional high use areas in Knik and Turnagain Arms. Little is known about late fall, winter, or early spring habitat use, although we know that belugas make use of the Kenai River when salmon runs (and various salmon fisheries) are not underway. The distributional shift coincided with the decline in abundance, and suggests the remaining belugas are congregating in preferred habitat, particularly in the Susitna Delta area (Moore *et al*. 2000; Goetz *et al*. 2012; NMFS 2016b). Groups of over 200 individuals, including adults, juveniles, and neonates, have been observed in the Susitna Delta area alone (Maguire *et al*. 2014). NMFS seeks to minimize human activity in this summer-fall habitat area of extreme importance to Cook Inlet beluga whale survival and recovery.

Beluga whales are extremely social and often interact in close, dense groups. Most calving in Cook Inlet is assumed to occur from mid-May to mid-July (Calkins 1989; NMFS unpublished data). The only known observed occurrence of calving occurred on July 20, 2015, at 5:15 pm. on the Susitna Delta (T. McGuire, pers. comm. March 27, 2017). 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).

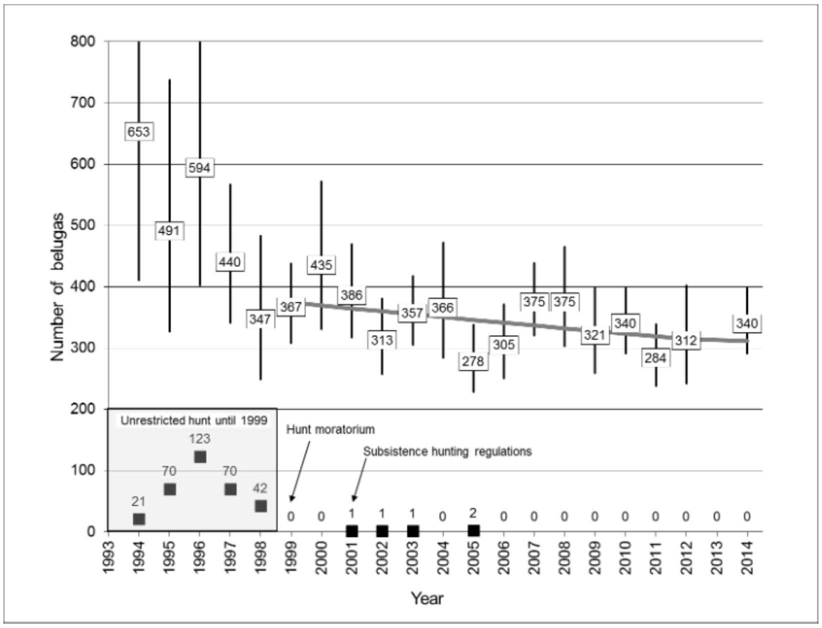

Figure 5. Annual abundance estimates of beluga whales in Cook Inlet, Alaska, 1994-2014 (Hobbs *et al*. 2015; Sheldon *et al*. 2015).

Critical Habitat

Cook Inlet beluga whale critical habitat (Figure 6) includes two geographic areas in Cook Inlet comprising 7,809 km^2 (3,013 mi^2). The action area for this project extends about 1 km into Cook Inlet Beluga Whale Critical Habitat Area 2, and is almost entirely within the southwestern-most portion of the "Susitna Delta Exclusion Zone (Figure 8).[16]

Hearing Ability

Like other odontocete cetaceans, beluga whales produce sounds for two overlapping functions: communication and echolocation. For their social interactions, belugas emit communication calls with an average frequency range of about 0.2 to 7.0 kHz (Garland *et al.* 2015) (well within the human hearing range), and the variety of audible whistles, squeals, clucks, mews, chirps, trills, and bell-like tones they produce have led to their nickname of "sea canaries" (ADFG 2008). At the other end of their hearing range, belugas use echolocation signals (biosonar) with peak frequencies at 40-120 kHz (Au 2000) to navigate and hunt in dark or turbid waters, where vision is limited. Belugas and other odontocetes make sounds across some of the widest frequency bands that have been measured in any animal group. Beluga whales are one of five non-human mammal species for which there is convincing evidence of frequency modulated vocal learning (Eaton 1974; Payne and Payne 1985; Tyack 1999; Stoeger *et al*. 2012).

[16] The Susitna Delta Exclusion Zone, originally designed to exclude loud seismic activity from this very important area for belugas, includes the union of the areas defined by:
• a 10 mi (16 km) buffer of the Beluga River thalweg* seaward of the Mean Low Low Water (MLLW) line,
• a 10 mi (16 km) buffer of the Little Susitna River thalweg seaward of the MLLW line, and
• a 10 mi (16 km) seaward buffer of the MLLW line between the Beluga River and Little Susitna River.
• The buffer extends landward along the thalweg buffers to include intertidal areas up to Mean High High Water.
The seaward boundary has been simplified so that it is defined by lines connecting readily discernable landmarks.
*A thalweg is the line that defines the deepest channel along the length of a streambed.

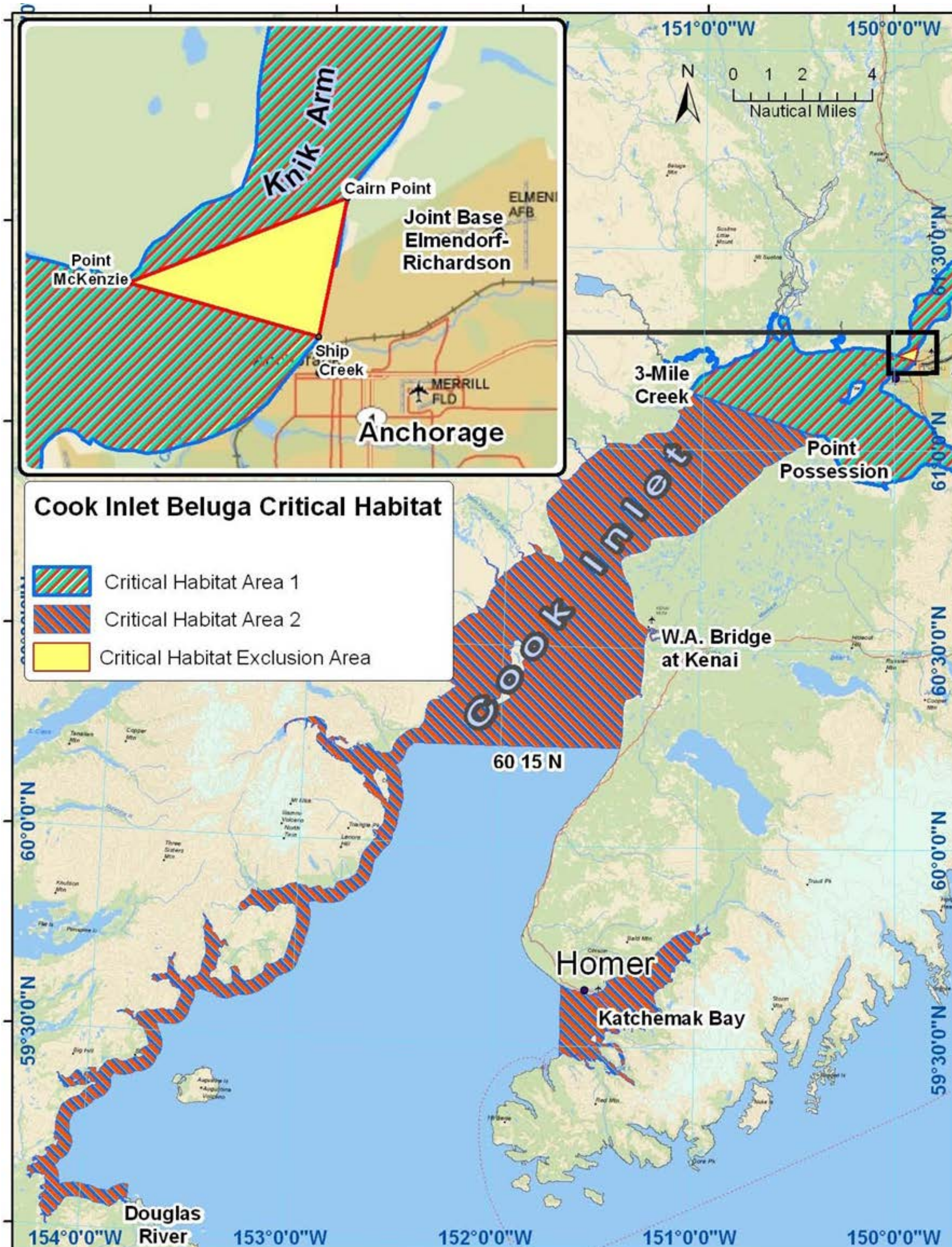

Figure 6. Cook Inlet beluga whale critical habitat.

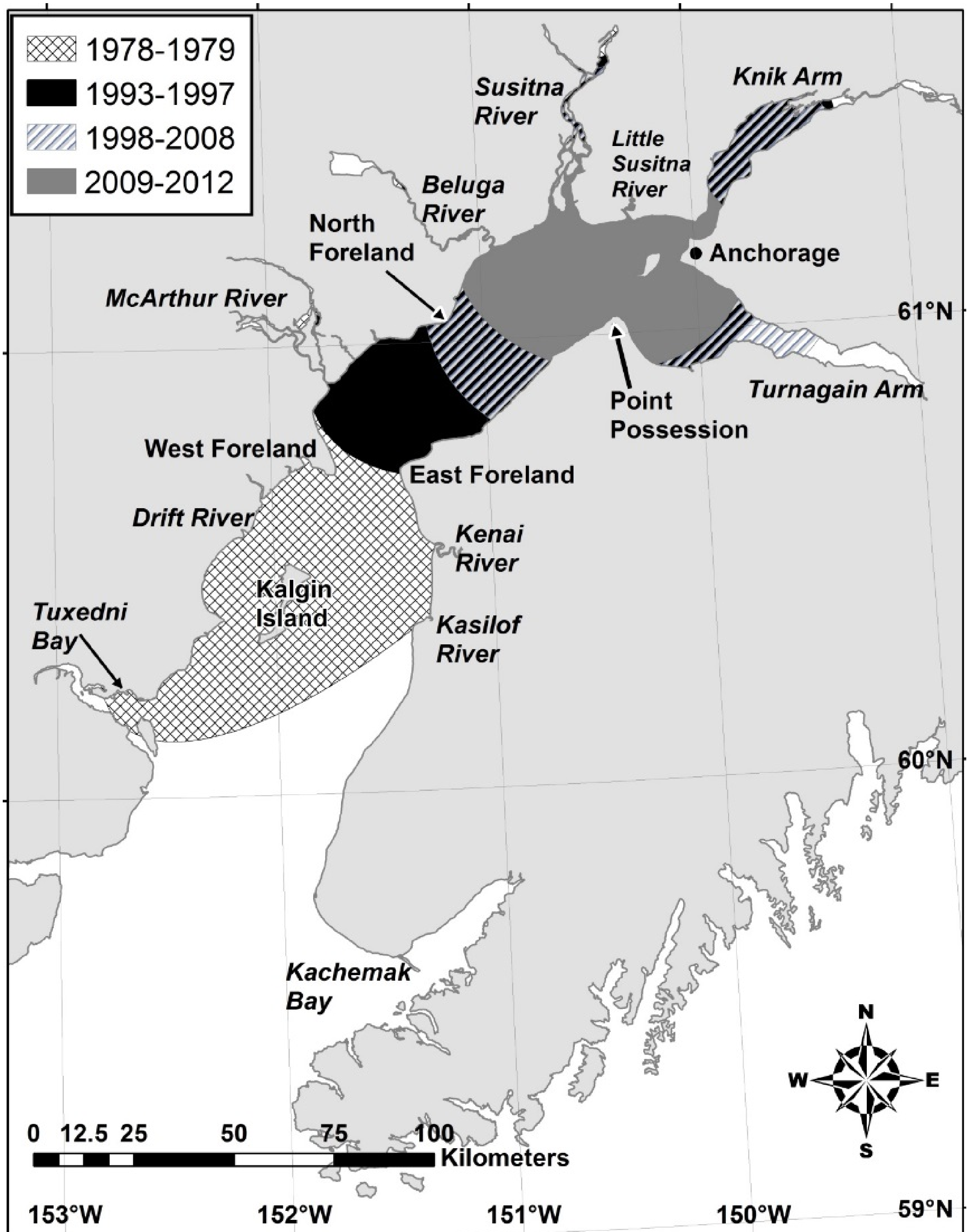

Figure 7. Summer range contraction over time as indicated by ADFG and NMFS aerial surveys. Adapted from Shelden *et al*. 2015.

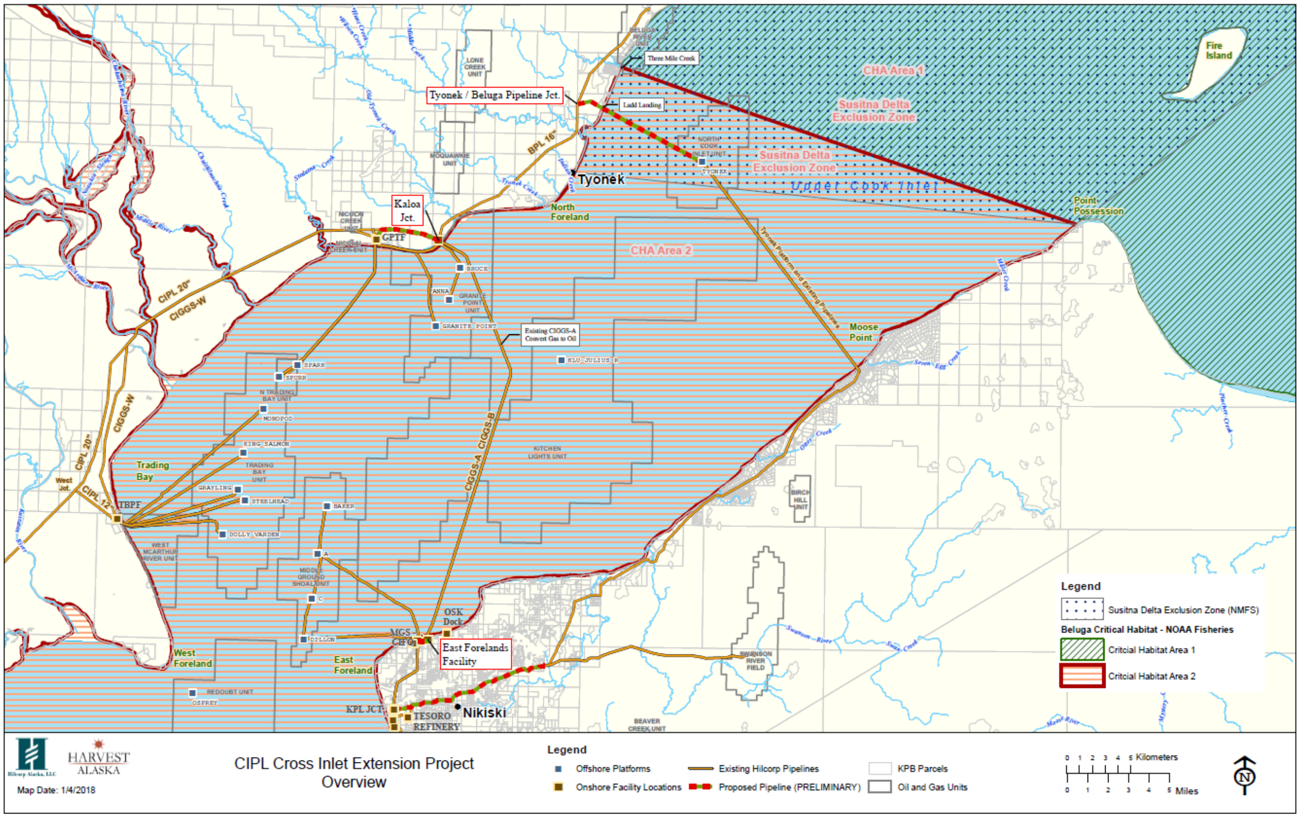

Figure 8. Location of CIPL Project relative to Cook Inlet beluga whale critical habitat and Susitna Delta Exclusion Zone.

Even among odontocetes, beluga whales are known to be among the most adept users of sound. It is possible that the beluga whale's unfused vertebrae, and thus the highly movable head, have allowed adaptations for their sophisticated directional hearing (NMFS 2017). Ridgway *et al*. (2001) measured hearing thresholds at various depths down to 984 ft (298 m) at frequencies between 500 Hz and 100 kHz and found that beluga whales showed unchanged hearing sensitivity at any measured depth.

Similar to other odontocetes, belugas have a "U-shaped" audiogram (Figure 9), with high sensitivities between about 30 kHz to just over 100 kHz (Awbrey *et al*. 1988, Klishin *et al*. 2000, Finneran *et al*. 2005). Most of previous studies measured beluga hearing in very quiet conditions. However, in Cook Inlet, tidal currents regularly produce ambient sound levels well above 100 dB (Lammers *et al.* 2013). In the first report of hearing ranges of belugas in the wild, results of Castellote *et al.* (2014) were similar to those reported for captive belugas, with most acute hearing at middle frequencies, about 10-75 kHz.

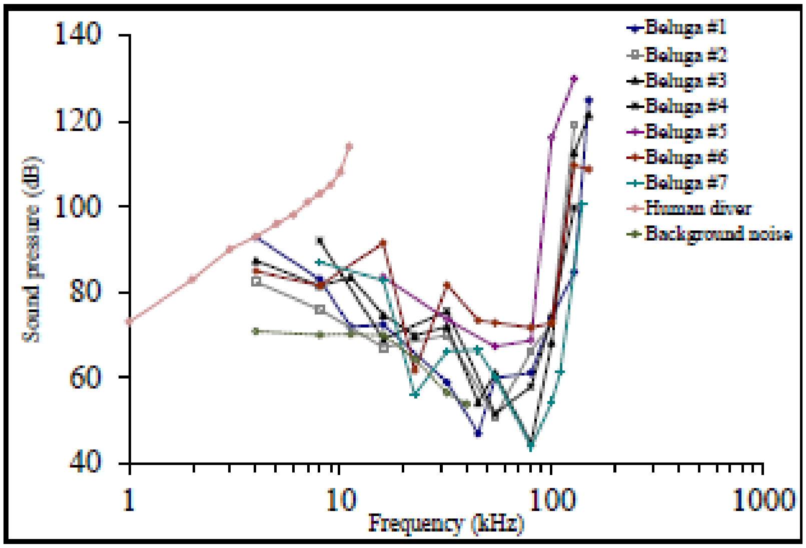

Figure 9. Audiograms of seven wild beluga whales; human diver audiogram and Bristol Bay background noise for comparison (from Castellote *et al.* 2014). Results indicate that beluga whales conduct echolocation at relatively high frequencies, where their hearing is most sensitive, and communicate at frequencies where their hearing sensitivity overlaps that of humans.

4.3. Western DPS Steller Sea Lions

Western DPS Steller sea lions occur in the action area, but in very low numbers (on the order of a few animals reported per year, and often no animals reported in a given year). Information on Steller sea lion biology, threats, and habitat (including critical habitat) is available online at: http://alaskafisheries.noaa.gov/protectedresources/stellers/default.htm and in the revised Steller Sea Lion Recovery Plan (NMFS 2008), which can be accessed at: http://alaskafisheries.noaa.gov/protectedresources/stellers/recovery/sslrpfinalrev030408.pdf . In this opinion, we focus on aspects of Steller sea lion ecology that are relevant to the effects of this project.

Description

Steller sea lions belong to the family Otariidae, which includes fur seals (*Callorhinus ursinus*). Steller sea lions are the largest otariid and show marked sexual dimorphism; males are 2-3 times larger than females (Figure 10). On average, adult males weigh 566 kg (1,248 lbs.) and adult females are much smaller, weighing on average 263 kg (580 lbs.) (Calkins and Pitcher 1982).

Status

The Steller sea lion was listed as a threatened species under the ESA on November 26, 1990 (55 FR 49204). In 1997, NMFS reclassified Steller sea lions as two DPSs based on genetic studies and other information (62 FR 24345). At that time, the eastern DPS was listed as threatened, and the western DPS was listed as endangered. On November 4, 2013, the eastern DPS was removed from the endangered species list (78 FR 66140).


Figure 10. From right to left, male, female, and pup Steller sea lions.

The western stock of Steller sea lions decreased from an estimated 220,000 to 265,000 animals in the late 1970s to less than 50,000 in 2000 (Kenyon and Rice 1961; Loughlin *et al.* 1984; Braham *et al.* 1980; Merrick *et al.* 1987). Since 2000, the abundance of the western stock has increased, but there has been considerable regional variation in trend (Muto *et al*. 2017). The 2016 Stock Assessment Report for the western DPS of Steller sea lions indicates a minimum population estimate of 50,983, including pups and non-pups for the U.S. portion of the western stock of Steller sea lions (Muto *et al*. 2017).

Data collected through 2015 provides strong evidence that non-pup and pup counts of western stock Steller sea lions in Alaska increased at ~2% per year between 2000 and 2015 (Fritz *et al.* 2015b in Muto *et al.* 2017). However, there are strong regional differences across the range in Alaska, with positive trends east of Samalga Pass (~170°W, Gulf of Alaska and eastern Bering Sea) and negative trends to the west in the Aleutian Islands (Muto *et al.* 2017). In the region of this project (considered the Central Gulf of Alaska region), the population of non-pup Steller sea lions is increasing at an estimated 2.68 percent per year, while the number of pups counted are increasing at some 2.82 percent per year, based on 2000-2015 data. (Muto *et al.* 2017).

Distribution

The range of the Steller sea lion extends across the rim of the North Pacific Ocean, from northern Japan, the Kuril Islands, and the Okhotsk Sea, through the Aleutian Islands and Bering Sea, along Alaska's southern coast, and as far south as the California Channel Islands (NMFS 2008). The eastern DPS includes sea lions born on rookeries from California north through Southeast

Alaska; the western DPS includes those animals born on rookeries from Prince William Sound westward, with an eastern boundary set at 144ºW (Figure 11). The western DPS of Steller sea lion is the only population anticipated to be in the action area.

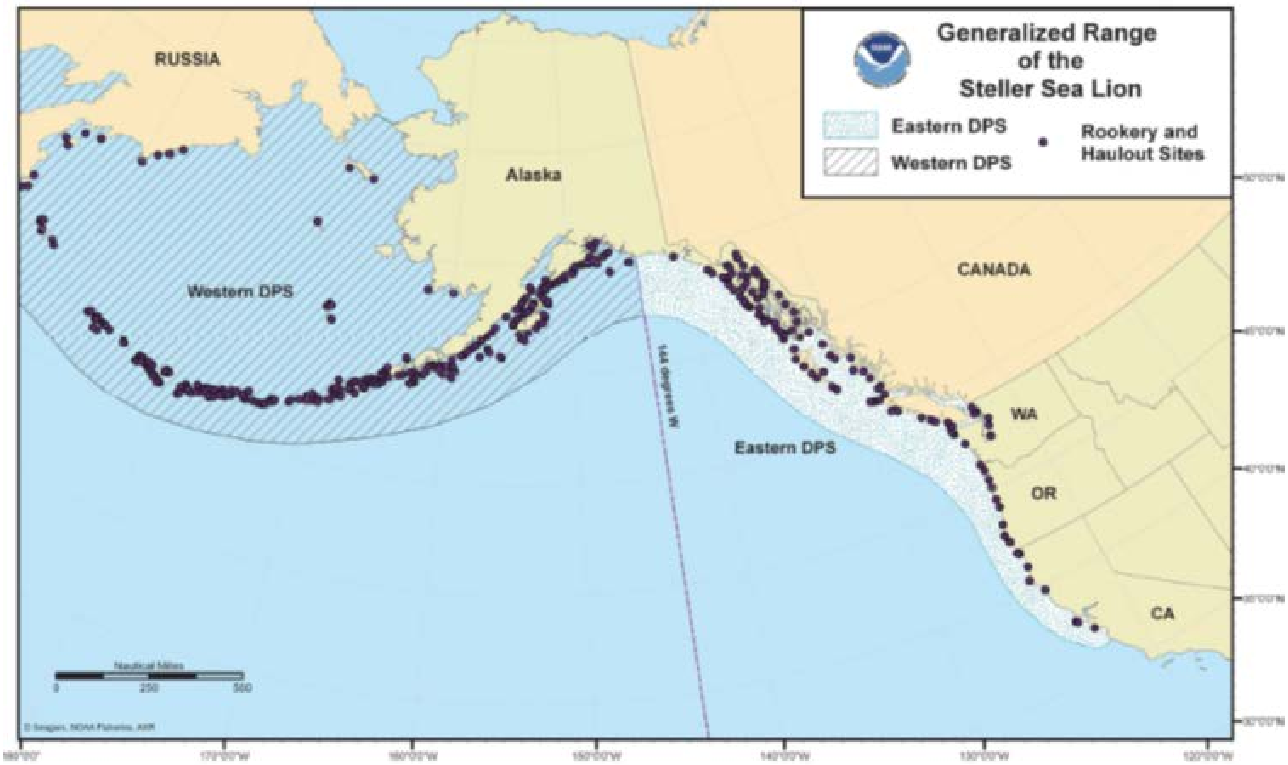

Figure 11. Range of Steller sea lions, with haulouts and rookeries noted by black dots.

Rugh *et al.* (2005) and Shelden *et al.* (2013) noted counts of Steller sea lions in lower Cook Inlet, with concentrations on Elizabeth Island, Shaw Island, Akumwarvik Bay, and Iniskin to Chinitna Bays. The closest haulout to the action area is over 100 miles (161 km) to the south of the action area; Steller sea lion haulouts do not occur in upper Cook Inlet. Based on past studies and the NMFS aerial data in Cook Inlet, the majority of Steller sea lions are expected to be found south of the forelands, which are located about 42 miles (68 km) to the south of the Tyonek platform. Sea lion sightings north of the Forelands are rare, no more than a few individuals per year.

Although Steller sea lions are typically found in the lower Inlet south of the action area, there have been verified sightings in the upper inlet near the Port of Alaska (POA). Six Steller sea lions were observed in 2016 during the POA Test Pile project (CH2M 2016). Although opportunistic sightings reported to NMFS have sporadically documented single Steller sea lions in Knik or Turnagain Arms, these are likely individual animals occasionally wandering into Cook Inlet river mouths during spring and summer periods to seek seasonal runs of eulachon or salmon.

Critical Habitat

Steller sea lion critical habitat (Figure 12) includes a 20 nautical mile buffer around all major haulouts and rookeries, as well as associated terrestrial, air, and aquatic zones, and three large offshore foraging areas (50 CFR 226.202). The proposed project is located about 80 miles (129 km) north of the nearest Steller sea lion critical habitat, and there are no recognized haul-outs or rookeries in the action area. Steller sea lions are rarely observed in the action area, with sightings reported to NMFS on the order of a few individuals per year.

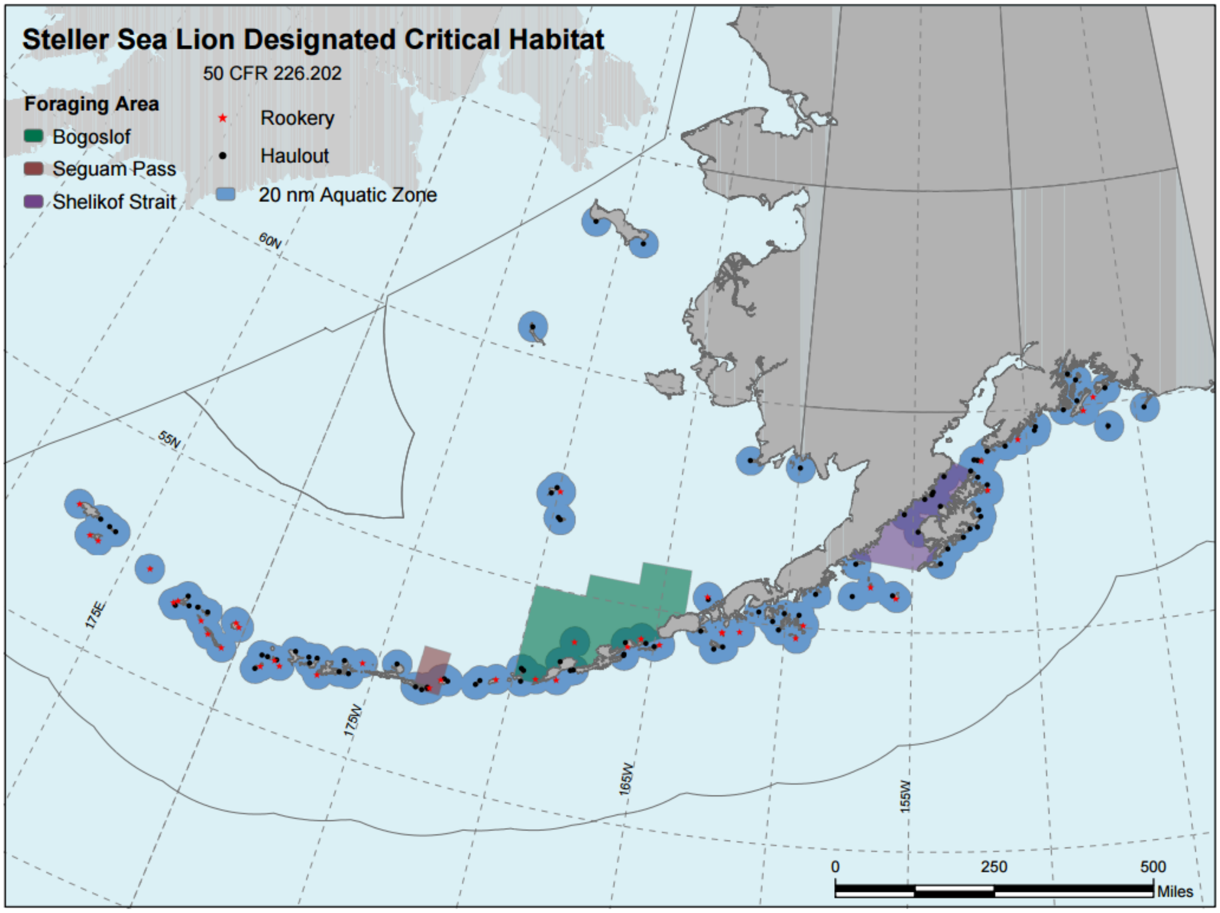

Figure 12. Steller sea lion designated critical habitat.

Hearing Ability

The ability to detect sound and communicate underwater is important for a variety of Steller sea lion life functions, including reproduction and predator avoidance. NMFS categorizes Steller sea lions in the otariid pinniped functional hearing group, with an applied frequency range between 60 Hz and 39 kHz in water (NMFS 2016c). In-air and underwater hearing of captive Steller sea lions have indicated typical U-shaped mammalian audiograms, with best hearing between 4-11 kHz (Muslow and Reichmuth 2010, Kastelein *et al.* 2005, Reichmuth and Southall 2011).

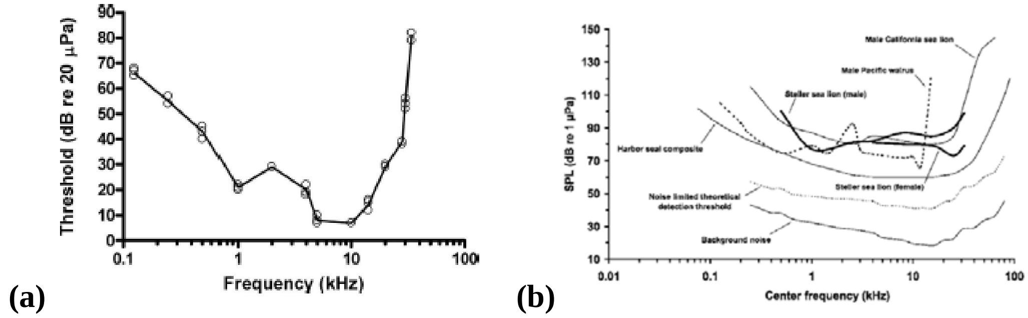

Figure 13. Underwater and in-air audiograms for Steller sea lions: (a) Muslow and Reichmuth (2010) for juvenile (air); (b) Kastelein *et al*. 2005 for adult male and female, underwater [audiograms of harbor seal, California sea lion and walrus for comparison].

4.4. Humpback Whale

The humpback whale is distributed worldwide in all ocean basins, with a total population of at least 80,000. Humpback whales are found in all oceans of the world with a broad geographical range from tropical to temperate waters in the Northern Hemisphere and from tropical to near-ice-edge waters in the Southern Hemisphere. Nearly all populations undertake seasonal migrations from their tropical calving and breeding grounds in winter to their high-latitude feeding grounds in summer. Humpbacks may be seen at any time of year in Alaska, but most animals winter in temperate or tropical waters near Mexico, Hawaii, and in the western Pacific near Japan. In the spring, the animals migrate back to Alaska, where food is abundant. They tend to concentrate in several areas, including Southeast Alaska, Prince William Sound, Kodiak, the mouth of Cook Inlet, and along the Aleutian Islands (Zimmerman and Karpovich 2008).

Additional information on humpback whale biology and natural history is available at:
http://www.nmfs.noaa.gov/pr/species/mammals/whales/humpback-whale.html
http://alaskafisheries.noaa.gov/pr/humpback
http://www.fisheries.noaa.gov/pr/sars/pdf/stocks/alaska/2015/ak2015_humpback-cnp.pdf

Status

In 1970, the humpback whale was listed as endangered worldwide, under the Endangered Species Conservation Act of 1969 (35 FR 8491; June 2, 1970), primarily due to overharvest by commercial whalers. When the ESA was enacted in 1973, humpback whales were included in the List of Endangered and Threatened Wildlife and Plants as endangered and were considered "depleted" under the MMPA.

Following the cessation of commercial whaling, humpback whale numbers increased. NMFS recently completed a global status review of humpback whales (Bettridge *et al.* 2015). After analysis and extensive public review, NMFS published a final rule on September 8, 2016 (81 FR 62260), recognizing 14 DPSs, designating four of these as endangered and one as threatened, with the remaining nine not warranting ESA listing status. Wade *et al.* (2016) provides information on the basis for DPS designation in the Pacific Ocean and the status of each DPS.

Based on an analysis of migration between winter mating/calving areas and summer feeding areas using photo-identification, Wade *et al.* (2016) concluded that whales feeding in Alaskan waters belong primarily to the Hawaii DPS (recovered), with small numbers from the Western North Pacific DPS (endangered) and Mexico DPS (threatened) individuals. In the action area of the CIPL Project (which is considered part of the Gulf of Alaska summer feeding area for purposes of estimating probability of DPSs), we consider Hawaii DPS individuals to comprise 89 percent of the humpback whales present, Mexico DPS individuals to comprise 10.5 percent, and Western North Pacific DPS individuals to comprise 0.5 percent (Table 3).

Whales from these three DPSs overlap on feeding grounds off Alaska, and are visually indistinguishable. All waters off the coast of Alaska may contain ESA-listed humpbacks.

Table 3. Probability of encountering humpback whales from each DPS in the North Pacific Ocean (columns) in various feeding areas (on left). Adapted from Wade *et al*. (2016).

Summer Feeding Areas	**North Pacific Distinct Population Segments**			
	Western North Pacific DPS (endangered)[1]	Hawaii DPS (not listed)	Mexico DPS (threatened)	Central America DPS (endangered)[1]
Kamchatka	100%	0%	0%	0%
Aleutian I/ Bering/Chukchi Seas	4.4%	86.5%	11.3%	0%
Gulf of Alaska	0.5%	89%	10.5%	0%
Southeast Alaska / Northern BC	0%	93.9%	6.1%	0%
Southern BC / WA	0%	52.9%	41.9%	14.7%
OR/CA	0%	0%	89.6%	19.7%

[1] For the endangered DPSs, these percentages reflect the 95% confidence interval of the probability of occurrence in order to give the benefit of the doubt to the species and to reduce the chance of underestimating potential takes.

Distribution in the Project Vicinity

In recent years, humpback whales have been observed in lower and mid Cook Inlet, especially in the vicinity of Elizabeth Island, Iniskin and Kachemak Bays, and north of Anchor Point (Shelden *et al.* 2013). Of a total 83 humpback whales observed by NMFS during Cook Inlet beluga aerial surveys conducted from 1993-2012, only 5 were observed as far north as the Anchor Point area (Shelden *et al.* 2013), which is about 90 miles south of the action area. Shelden *et al.* (2015) observed four humpbacks, all in lower Cook Inlet (well south of the action area) during 2014 beluga surveys. During the 2014 Apache seismic surveys in Cook Inlet, which overlaps most, but not all of this project's action area, a total of six individuals were spotted by the marine mammal observers (Lomac-MacNair *et al*. 2014).

However, recent studies and monitoring events have documented humpback whales further north in Cook Inlet. Marine mammal monitoring conducted north of the Forelands in May and June of 2015 reported two humpback whales (Jacobs 2017). Shortly after these observations were made, a dead humpback was found in the same area, suggesting that this animal may have entered the area in a compromised state. PSOs observed two humpback whales near the mouth of Ship Creek, near Anchorage, some 31 miles (55 km) northeast of the Tyonek platform, in early September 2017 during dock renovation work (ABR 2017), indicating that humpbacks occasionally use the upper Inlet.

Hearing ability

Because of the lack of captive subjects and logistical challenges of bringing experimental subjects into the laboratory, no direct measurements of mysticete hearing are available. Consequently, hearing in mysticetes is estimated based on other means such as vocalizations (Wartzok and Ketten, 1999), anatomy (Houser *et al*., 2001; Ketten 1997), behavioral responses to sound (Edds-Walton 1997), and nominal natural background noise conditions in their likely frequency ranges of hearing (Clark and Ellison, 2004). The combined information from these and other sources strongly suggests that mysticetes are likely most sensitive to sound from an estimated tens of hertz to ~10 kHz. However, evidence suggests that humpbacks can hear sounds as low as 7 Hz (Southall *et al*. (2007) up to 24 kHz, and possibly as high as 30 kHz (Au *et al*., 2006; Ketten 1997). These values fall within the NMFS (2016c) generalized low-frequency cetacean hearing range of 7 to 35 kHz.

Because of their size, no audiogram has been produced for humpback whales. However, Helweg *et al*. (2000) and Houser *et al*. (2001) modeled a predicted audiogram based on the relative length of the basilar membrane (within the inner ear) of a humpback whale, integrated with known data on cats and humans. The result (Figure 14) shows sensitivity to frequencies from about 700 Hz to 10 kHz, with maximum relative sensitivity between 2-7 kHz. Because ambient

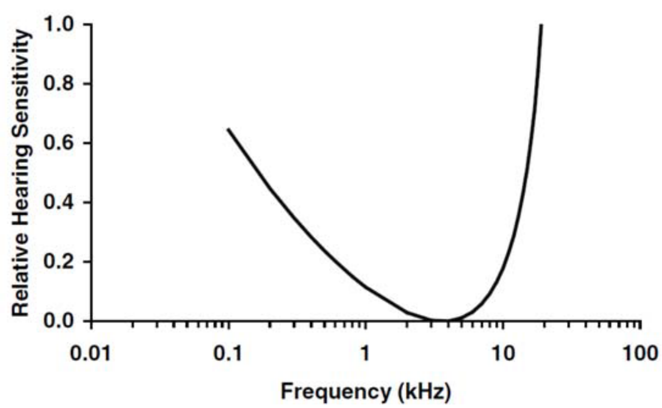

Figure 14. Predicted audiogram of humpback whale, derived by integrating the humpback frequency-position function with the sensitivity-position function derived from cat and human audiometric and anatomic data (see Houser *et al*. 2001).

noise levels are higher at low frequencies than at mid frequencies, the absolute sound levels that humpback whales can detect below 1 kHz are probably limited by increasing levels of natural ambient noise at decreasing frequencies (Clark and Ellison 2004).

5.0 ENVIRONMENTAL BASELINE

The "environmental baseline" includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

This section discusses the environmental baseline with respect to all species that may be adversely affected by the proposed action, with a particular focus on activities that may affect Cook Inlet beluga whales or their critical habitat, because that is the species most likely to be affected by the proposed action. Although some of the activities discussed below are outside the action area, they may still have an influence on listed species or their habitat in the action area.

Cook Inlet beluga whales, as well as other resident marine mammal species, may be impacted by a number of anthropogenic activities present in upper and mid-Cook Inlet. Over 65 percent of Alaska's human population (737,080) resides within southcentral Alaska or the Cook Inlet region (ADOLWD 2017). The high degree of human activity, especially within upper Cook Inlet, has produced a number of anthropogenic risk factors that marine mammals must contend with, including: coastal and marine development, ship strikes, noise pollution, water pollution, prey reduction, direct mortalities, and research, in addition to factors operating on a larger scale such as predation, disease, and environmental change. The species may be affected by multiple threats at any given time, compounding the impacts of the individual threats. Anthropogenic risk factors are discussed individually below.

5.1. Coastal Development

Beluga whales and Steller sea lions use nearshore environments to rest, feed, and breed and thus could be affected by any coastal development that impacts these activities. Coastline development can lead to both direct loss habitat loss from construction of roads, housing or other shoreline developments, or indirect loss associated with bridges, boat traffic, in-water noise, and discharges that affect water quality.

The overwhelming majority of Cook Inlet shoreline is undeveloped, but there are municipalities, port facilities, airports, wastewater treatment plants, roads, mixing zones, and railroads that occur along or close to the shoreline (Figure 15). Knik Arm supports the largest port and military base in the state. Construction in Cook Inlet associated with coastal development includes dredging (e.g., at the Port of Alaska[17]), and pile driving (e.g., at the Port of Alaska, Ship Creek boat launch, Port MacKenzie, Seward Harbor, and several small projects in the Kachemak Bay area). In this section, we describe the physical aspects of development; noise aspects of development are discussed in Section 5.3.

5.1.1 Road Construction

Alaska Department of Transportation undertook Seward Highway improvements from Mile 75 to 107 (along Turnagain Arm) beginning in 2015. These activities included geophysical and

[17] The Anchorage Assembly voted Oct. 24, 2017 to rename the Port of Anchorage as the Port of Alaska in a move to emphasize the importance of the infrastructure to the entire state rather than just its largest city.

geotechnical testing, on-shore blasting, pile removal and installation at stream crossings, fill placed into Turnagain Arm to facilitate roadway straightening, and construction of a boat ramp at Windy Point.

During marine mammal monitoring efforts, beluga whales were observed on 15 of the 16 days of monitoring at Twentymile Bridge from April 6 to April 23, 2015. Even though no in-water activities occurred at night (at Twentymile Bridge), roadway flaggers present throughout the night indicated they could hear beluga whales at the bridge site during nighttime hours. During the 2015 season, there were 18 observations of beluga whale groups, ranging in size from 3-30. Shutdowns typically occurred when beluga whales were at the mouth of Twentymile River to ensure the animals did not enter the harassment zone during in-water activities (HDR 2015).

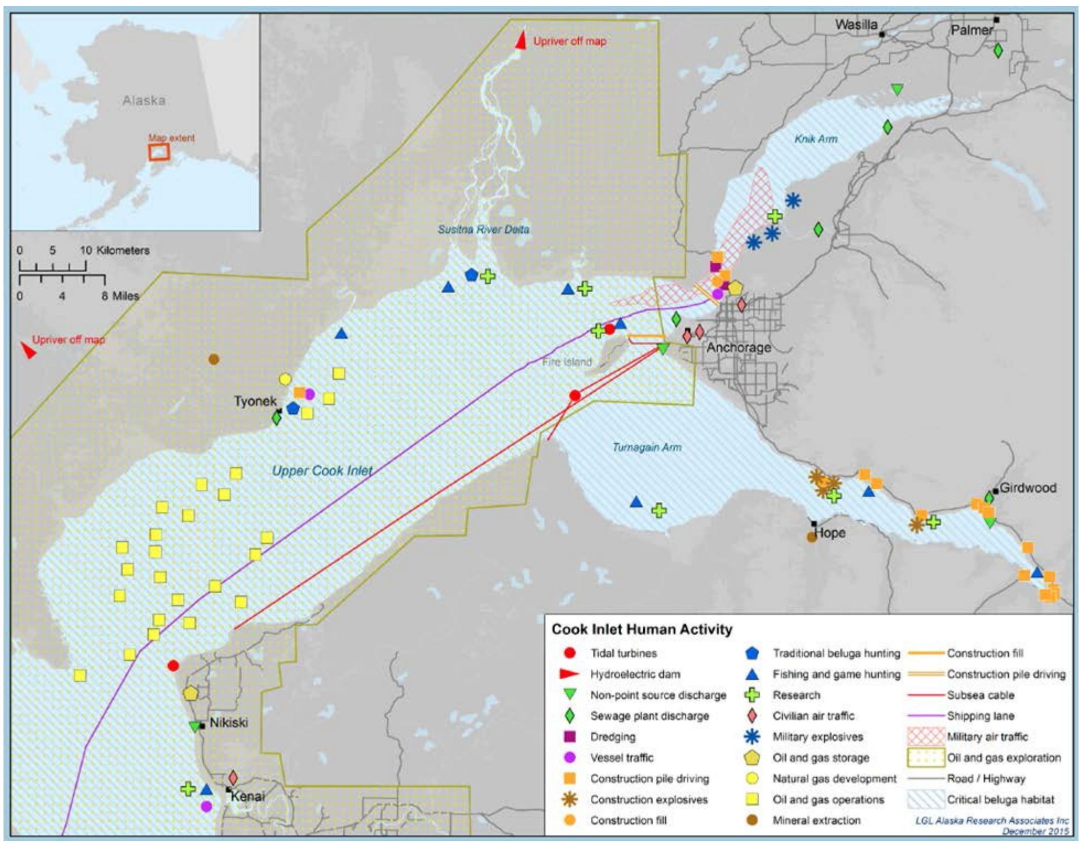

Figure 15. Development and anthropogenic activities in Cook Inlet (LGL 2015, unpublished data).

5.1.2. Port Facilities

Cook Inlet has port facilities at Anchorage, Point Mackenzie, Nikiski, Kenai, Homer, Seldovia, and Port Graham; barge landings are present at Tyonek, Drift River, and Anchor Point. Anchorage has a small boat ramp near Ship Creek, which was renovated in 2017. It is the only hardened public access boat ramp in Upper Cook Inlet. However, numerous other boat launch sites (e.g., beach launch at Tyonek, Captain Cook State Recreation Area, City of Kenai boat launch, multiple boat launch locations near the mouth of the Kenai River, and Kasilof River State Recreation Site) provide access to small boats in Cook Inlet.

Port of Alaska

The Port of Alaska (POA, until very recently referred to as the Port of Anchorage) is Alaska's largest seaport and provides 90 percent of the consumer goods for about 85 percent of all of Alaska. It includes three cargo terminals, two petroleum terminals, one dry barge berth, two railway spurs, and a small craft floating dock, plus 220 acres of land facility, located in Anchorage. About 450 ships or tug/barges call at the POA each year.

Operations began at the POA in 1961 with a single berth. Since then, the POA has expanded to a terminal with five berths that moves more than four million tons of material across its docks each year (POA 2009). The Port of Alaska is in the process of expanding. During the POA sheet pile driving activities between 2009 and 2011, 40 beluga whales were observed within the designated 160 dB disturbance zones, and a single Steller sea lion was sighted at the facility.

During 2016, the POA conducted a test-pile program to evaluate sound attenuation devices for potential use on the many piles they plan to drive during future port expansion efforts.[18] During the course of this project, belugas entered the Level B exclusion zone on 9 occasions. Only one 4-minute delay of start of operations was necessitated to avoid prohibited takes of belugas, and one authorized instance of Level B harassment occurred, affecting a single whale (Cornick and Seagars 2016). Shoreline stabilization in the northern port area is expected to begin in 2018 or 2019.

Maintenance dredging at POA began in 1965, and is an ongoing activity from May through November in most years, affecting about 100 acres of substrate per year. Dredging at the POA does not seem to be a source of re-suspended contaminants (USACE 2008), and belugas often pass near the dredge.

Castellote *et al*. (2015) reports that weekly mean of daily beluga detection-positive hours (DPH) from Cairn Point, Point MacKenzie, and Six Mile are very low compared to the DPH obtained in the upper part of Knik Arm. When assessing the effects of construction noise at the POA, Saxon Kendall (2013) offered several explanations for low beluga detections there:

- belugas might be displaced from the east side of the lower Knik Arm due to construction activities at the POA, or
- belugas might reduce their vocal activity when transiting through this area, or
- beluga acoustic signals might be masked by anthropogenic noise.

There is evidence of a decrease or even a cessation of acoustic activity by belugas in the presence of natural predators (i.e., killer whales) or engine noise disturbance. This acoustic response has been observed in both captive and free-ranging belugas and has been interpreted as a survival strategy to avoid detection by predators (Morgan 1979; Lésage *et al.* 1999; Castellote and Fossa 2006). Therefore, a reduction in acoustic detections could be plausible in areas of high anthropogenic noise, such as the lower Knik Arm. The very low rate of acoustic detection in this area compared to upper Knik Arm supports the hypothesis that anthropogenic sound may be contributing to reduced acoustic output from Cook Inlet belugas.

[18] The Port had plans to begin construction of a petroleum-cement terminal in 2018, but this project has been delayed until 2019.

Port MacKenzie
Port MacKenzie is along western lower Knik Arm. Coastal development at this site began in 2000 with the construction of a barge dock. Additional construction and bulkhead repair activity has occurred since then; Port MacKenzie currently consists of a 152 m (500 ft.) bulkhead barge dock, a 366 m (1,200 ft.) deep draft dock with a conveyor system, a landing ramp, and more than 8,000 acres of adjacent uplands. Current operations at Port MacKenzie may include dry bulk cargo movement and storage, depending on the current state of the port and existing demand for its facilities. The seawall to this port has failed twice (in the winter of 2015-2016 and 2016-2017), necessitating emergency pile driving and other repair measures to avoid additional loss of fill and damage to sheet piles. Emergency consultations occurred after much of the repair work had been completed. However, during April 2016, marine mammal monitoring occurred on site during pile driving operations. Observers recorded belugas in or near the pile driving exclusion zone on 12 occasions on 7 days from April 18-26. No pile driving was occurring during any of these close approaches, so no takes occurred and no shut-downs were ordered (Tutka LLC 2016).

Other Ports
The Drift River facility in Redoubt Bay is used primarily as a loading platform for shipments of crude oil. The docking facility there is connected to a shore-side tank farm and designed to accommodate tankers in the 150,000 deadweight-ton class. The Drift River Terminal had an original storage capacity of up to six million gallons of crude oil. In 2009, a volcanic eruption of Mt. Redoubt forced the evacuation of the terminal and a draw-down of oil stored on-site (Alaska Journal of Commerce, 2009). Hilcorp Alaska bought the facility in 2012 and, after numerous improvements, partially reopened the facility to oil storage and tanker loading operations. *One goal of the CIPL Project, related to the CIGGS Marine Pipeline Conversion component of the CIPL Project, is to decommission the Drift River Terminal entirely and eliminate cross-inlet tanker traffic from this location.*

Nikiski is home to several privately owned docks. Activity at Nikiski includes the shipping and receiving of anhydrous ammonia, dry bulk urea, liquefied natural gas, sulfuric acid, petroleum products, caustic soda, and crude oil. In 2014, the Arctic Slope Regional Corporation expanded and updated its Rig Tenders Dock in Nikiski, in anticipation of increased oil and gas activity in Cook Inlet and to accommodate oil and gas development in the Chukchi and Beaufort seas.

Ladd Landing Beach, located near Tyonek, serves as public access to the Three Mile subdivision and a staging area for various commercial fishing sites in the area. *This is also the staging site for the new pipelines out to the Tyonek Platform (the Cook Inlet Pipeline Cross-Inlet Extension Project), which is the subject of this consultation.*

5.2. Oil and Gas Development
Cook Inlet has a long history of oil and gas activities including seismic exploration, G&G surveys, exploratory drilling, increased vessel and air traffic, and platform production operation. Today, there are 17 offshore oil and gas platforms in Cook Inlet (Figure 15). These platforms and most of the associated infrastructure is more than 40 years old. Furie intends to drill up to 5 new wells in state waters of Cook Inlet in the Kitchen Lights Unit beginning in 2018, and Cook Inlet Energy intends to drill an additional well in Trading Bay in 2018. Active oil and gas leases in Cook Inlet total 234 leases encompassing approximately 490,335 acres of State leased land of

which 322,727 acres are offshore (Figure 16) (ADNR 2018). Figure 17 reflects the results of the most recent Bureau of Ocean Energy Management (BOEM) lease sale #244 in Cook Inlet. Hilcorp was the only company responding, submitting bids on 14 of 224 tracts/Blocks offered; their successful bids encompass 31,005 acres. Cook Inlet is estimated to have 500 million barrels of oil and over 19 trillion cubic feet of natural gas that are undiscovered and technically recoverable (Wiggin 2017).

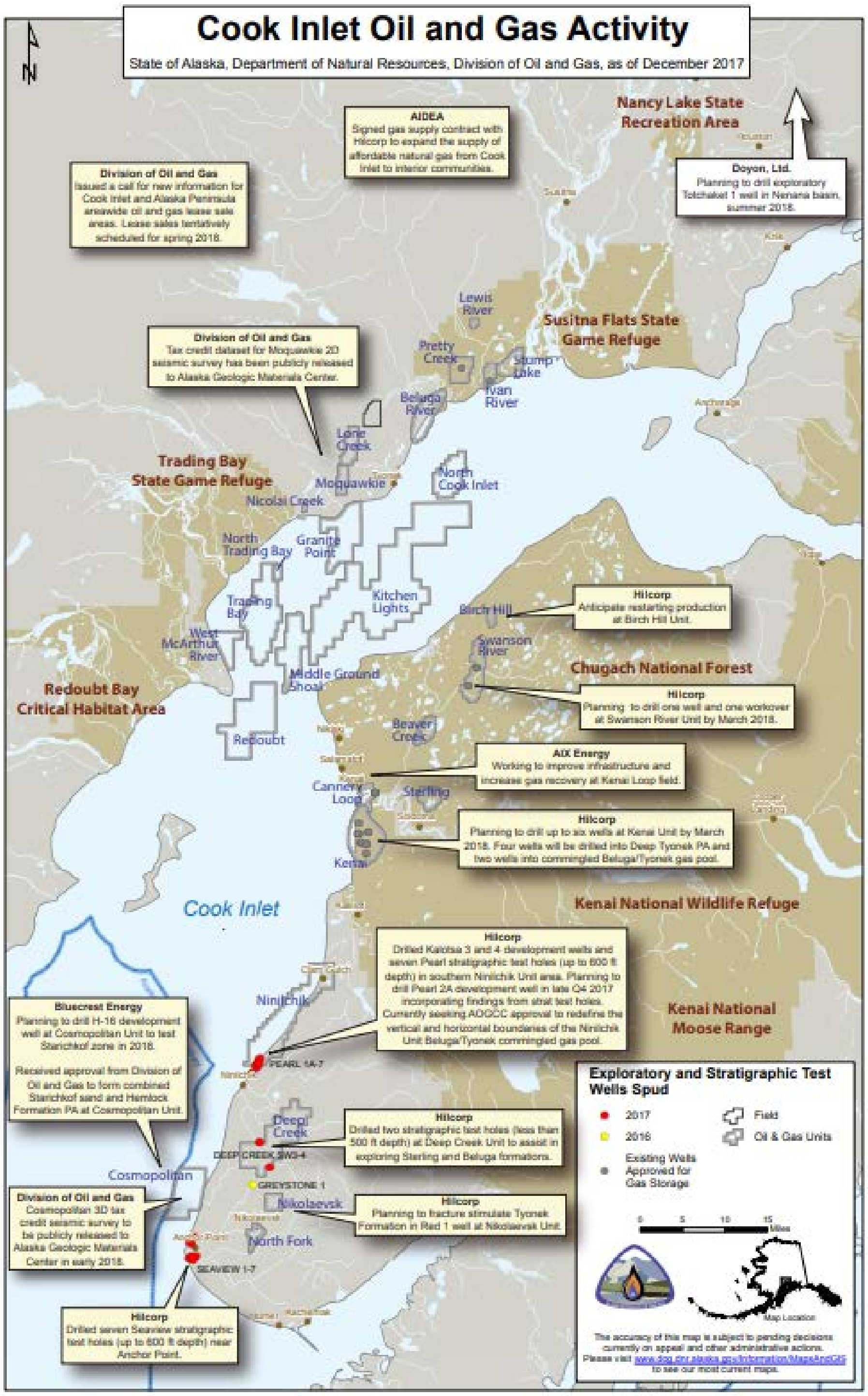

Figure 16. Oil and gas activity in Cook Inlet as of December, 2017.

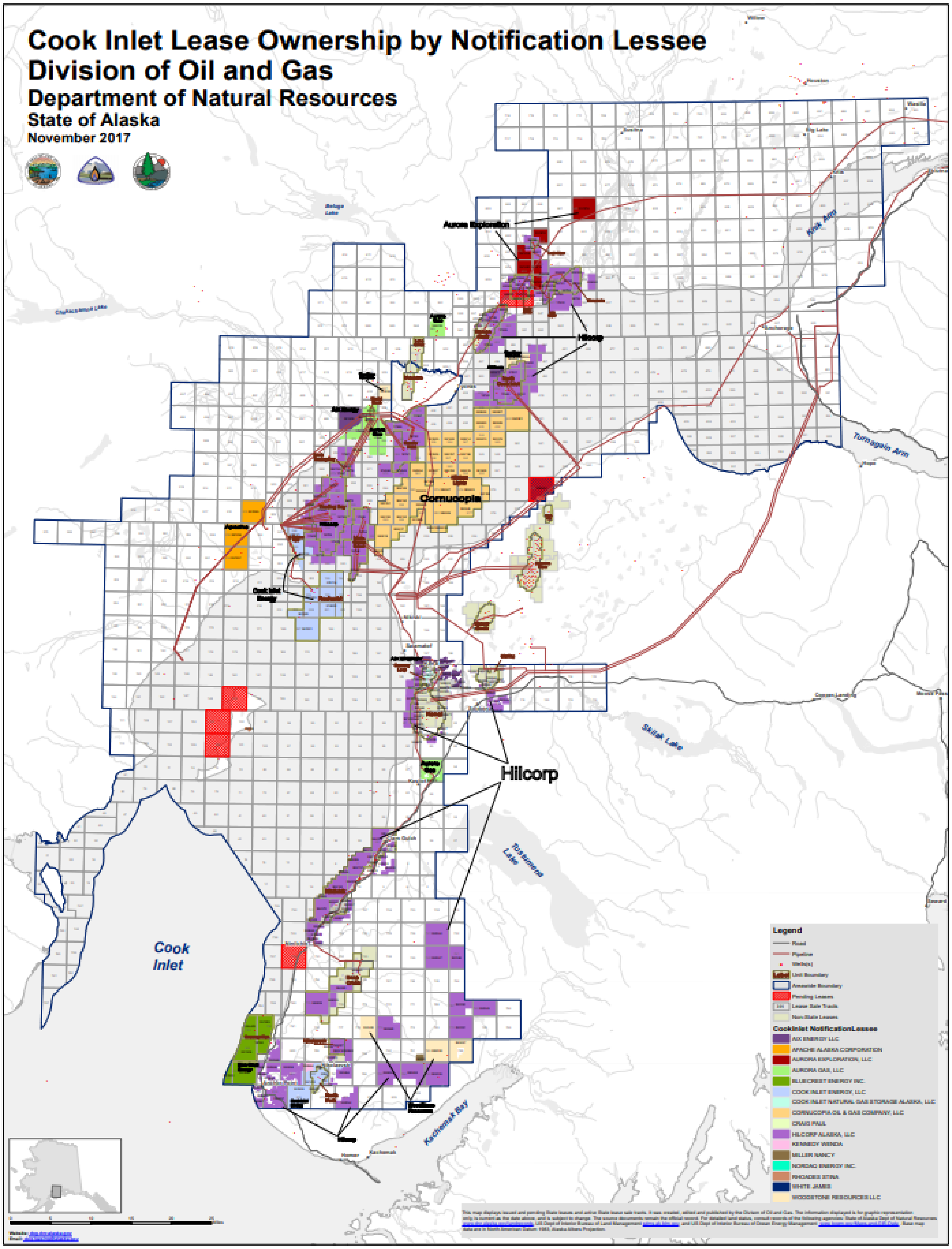

Figure 17. Cook Inlet Lease Ownership by Notification Lessee
http://dog.dnr.alaska.gov/Documents/Maps/CookInlet_NotificationLessee_Nov2017_Labeled.pdf.

All of Hilcorp/Harvest's high quality crude oil goes to the Tesoro Alaska refinery near Kenai, on the east side of Cook Inlet. Hilcorp/Harvest began 2017 producing 225,000 million cubic feet/day in January and expected to end at about the same rate at the end of December (D. Wilkins, quoted in Oil & Gas 360, 2017). Oil and gas development is preceded by an exploration phase, which often includes underwater seismic surveys, which transmit high intensity sounds. These are discussed in section 5.3.

The Alaska LNG (AK LNG) Project is being designed to carry natural gas from the North Slope to southcentral Alaska. Proposed infrastructure includes an 800-mile long, large diameter pipeline from the North Slope that may cross Cook Inlet north of the Forelands and terminate at a liquefaction facility proposed at the Nikiski area on the Kenai Peninsula.

The existing Kenai LNG liquefaction and terminal complex adjacent to the coast of Cook Inlet began operating in 1969. Until 2012, it was the only facility in the United States authorized to export LNG produced from domestic natural gas. However, with LNG shipments from the terminal declining, the terminal's owner announced in mid-2017 that it would put the plant in long-term shutdown (EIA 2017). The proposed AK LNG export terminal in the Nikiski area could eventually ship up to 2.4 billion cubic feet of LNG per day. However, low commodity prices continue to be a hurdle for the multi-billion-dollar pipeline project (Persily 2016).

Pipelines are an essential part of oil and gas activities in Cook Inlet. There are approximately 365 km (227 mi) of undersea pipelines in Cook Inlet, including 125 km (78 mi) of oil pipelines and 240 km (149 mi) of gas pipelines (ADNR 2017). The possibility of pipeline failures are always associated with oil and gas development, with the associated possibility of oil spills, gas leaks, or other sources of marine petrochemical contamination.

5.3. Ambient Noise and Noise Pollution

Because noise is a primary source of disturbance to marine mammals, and the category of disturbance most focused on in Incidental Harassment Authorizations, this Opinion considers it as a separate category of the Environmental Baseline, although it is generally attributable to other factors in the Baseline, such as coastal development or oil & gas development.

Underwater sound in Cook Inlet is categorized as physical noise, biological noise, and human-caused noise. Natural physical noise originates from wind, waves at the surface, currents, earthquakes, ice movement, tidal currents, and atmospheric noise (Richardson *et al.* 1995). Tidal influences in Cook Inlet are a predominant contributor of physical noise to the acoustic environment (BOEM 2016).

Biological noise includes sounds produced by marine mammals (particularly whales and dolphins, but also pinnipeds), fish (Maruska and Mensinger 2009; Baggaley 2016), and invertebrates (Price 2018). Human-caused noise includes vessel motor sounds, oil and gas operations, maintenance dredging, aircraft overflights, construction noise, and infrastructure maintenance noise. Much of upper Cook Inlet is a poor acoustic propagation environment due to shallow depths and sand and mud bottoms. In general, ambient and background noise levels within the action area in Cook Inlet are assumed to be less than 120 dB whenever conditions are calm, and exceeding 120 dB during environmental events such as high winds and peak tidal fluctuations (Blackwell and Greene 2003; Illingworth and Rodkin 2014).

5.3.1. Seismic Activity Noise in Cook Inlet

Seismic surveys use high energy, low frequency sound in short pulse durations to characterize subsurface geology (Richardson *et al*. 1995), often to determine the location of oil and gas reserves. Geophysical seismic activity has been described as one of the loudest human-made underwater noise sources (Broad 2012), with the potential to harass or harm marine mammals, including beluga whales.

From 2004-2014, some 725 line miles of 2D seismic and 660 square miles of 3D seismic were collected in the Cook Inlet area (Wiggin 2017). As shown in Figure 18, extensive seismic surveys have been conducted in Cook Inlet, particularly north of the Forelands.

In the past, large airgun arrays of greater than 3,000 in^3 were used for seismic exploration in Cook Inlet; these can produce source noise levels exceeding 240 dB re 1 μPa rms. However, smaller arrays are now being used in Cook Inlet because of the generally shallow water environment and the increased use of ocean-bottom cable and ocean-bottom node technology (Rigzone 2012).

There is evidence of belugas avoiding airgun arrays at a distance of 10-20 km (6.21 to 12.42 mi) (Miller *et al*. 2005). These operations used two arrays of 24 airguns per array with a larger displacement than arrays used recently within Cook Inlet. The recently-used smaller airgun arrays (1,760-2,400 in^3) have source levels of about 237 dB re 1 μPa rms, for which exclusion zones of 9.5 km radius have been established to avoid Level B take (NMFS 2016d).

Marine mammal surveys have been conducted in association with recent seismic work in Cook Inlet, including seismic surveys by AK LNG (2016), Apache 2012-2014, and SAE (2015). During the AK LNG surveys, two belugas were observed near Tyonek in April 2016 (Smultea 2016). During over 1,800 hours of Apache seismic activity in 2012 covering about 4,238 km^2 of upper Cook Inlet, the company experienced a number of delays, power-downs, shutdowns, and one speed and course alteration to avoid marine mammal takes (Lomac-MacNair *et al.* 2014). In 2014, however, despite implementing shut-downs and ramp up delays for marine mammals, observers recorded takes of 12 beluga whales and 2 humpback whales, and 15 other marine mammals from noise exposures (Lomac-MacNair *et al.* 2014).

SAE seismic operations took place in upper Cook Inlet, from May 15, 2015 through September 27, 2015. The vast majority of effort occurred between the East Forelands to the south and the North Forelands to the North, with this project action area overlapping the northeastern-most portion of SAE’s exploration activities. PSOs monitored from two source vessels and one mitigation vessel during all daylight seismic operations and most daylight non-seismic operations. Passive acoustic monitoring (PAM) was conducted during nighttime hours using a dipping or over-the-side hydrophone. Over 7,200 hours of visual and acoustic monitoring took place. The total of 932 sightings (i.e., groups) of approximately 1,878 marine mammals included observations of 8 beluga whale groups (~33 individuals), three individual humpback whales, and four Steller sea lions (Kendall *et al.* 2015).

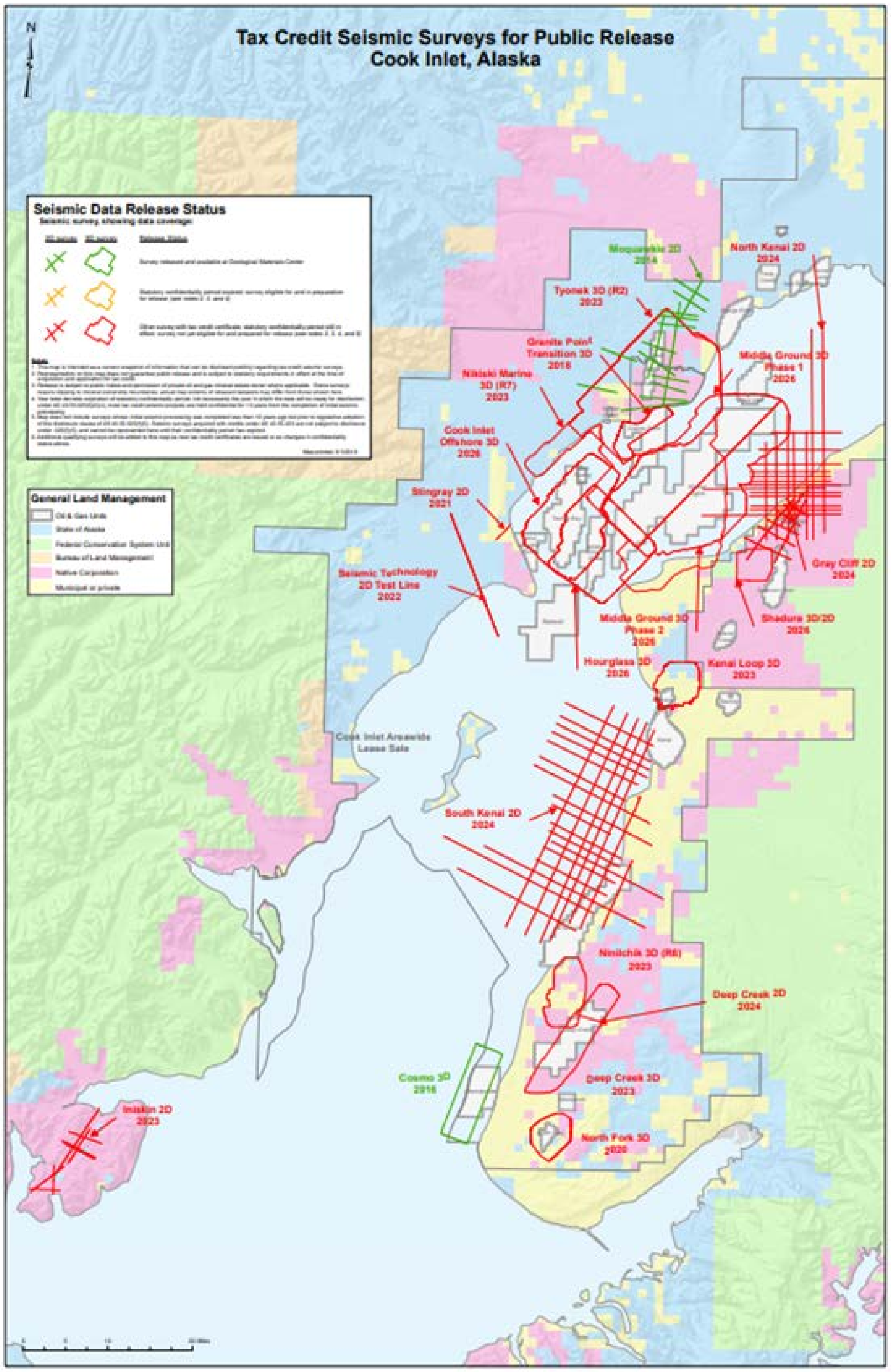

Figure 18. Seismic surveys in Cook Inlet. Dates indicate year technical data is scheduled for release. http://dog.dnr.alaska.gov/Documents/Programs/CookInletTaxCreditSeismicData.pdf.

SAE's passive acoustic monitoring occurred from July 1 to September 27 and yielded a total of 15 marine mammal acoustic detections including two beluga whales and 13 unidentified porpoises. Nine detections occurred during seismic activity and six during non-seismic activity. There were no acoustic detections of baleen whales or pinnipeds. A total of 207 marine mammals were confirmed visually or acoustically within the Level A and Level B exposure zones, resulting in 194 Level B and 13 Level A exposures of marine mammals, with 2 Level B exposures of beluga whales, and no Level A beluga exposures (Kendall *et al.* 2015).

5.3.2. Oil and Gas Drilling and Production Noise

Blackwell and Greene (2002) recorded underwater noise produced at Phillips A oil platform (now the Tyonek platform) at distances ranging from 0.3-19 km (0.2-12 mi) from the source. The highest recorded sound level was 119 dB at a distance of 1.2 km (0.75 mi). The greatest noise levels from drilling platforms originate from operating noises from the oil platform, not from the noise generated by drilling, with frequencies generally below 10 kHz. While much sound energy associated with rig and drilling noise is below the hearing thresholds for beluga whales, some noises between 2-10 kHz were measured as high as 85 dB as far away as 19 km (12 mi) from the source. Although audible to beluga whales, these frequencies are not within their most sensitive hearing range. Jack-up drilling rigs with the platform and generators located above the sea are relatively quiet compared to drill ships or semi-submersible drill rigs (Richardson *et al.* 1995).

5.3.3. Vessel Traffic Noise

Cook Inlet is a regional hub of marine transportation throughout the year, and is used by various classes of vessels, including containerships, bulk cargo freighters, tankers, commercial and sport-fishing vessels, and recreational vessels. Vessel traffic density in Cook Inlet is concentrated along the eastern margin of the Inlet between the southern end of the Kenai Peninsula and north to Anchorage (Figure 19). Oil produced on the western side of Cook Inlet is transported by tankers to the refineries on the east side. As stated earlier, Harvest's plans to decommission the Drift River Terminal would eliminate one substantial source of tanker traffic in Cook Inlet.

Two of the vessels that make regular calls to the POA, the Midnight Sun and the North Star, are 53,000-horsepower, 839-foot cargo ships that pass the CIPL Project action area at 15 to 20 knots four times per week, equaling 208 transits per year (Eley 2012). Blackwell and Greene (2003) observed that beluga whales "did not seem bothered" when the whales were travelling slowly within a few meters of the hull and stern of the moored cargo-freight ship *Northern Lights* in the Anchorage harbor area. They speculated that in areas where belugas are subjected to a lot of (perennial) boat traffic, they may habituate and become tolerant of the vessels. However, noises from ships and other activities in the POA area may cause a decrease or cessation of beluga vocalizations, or mask their vocalizations (Castellote *et al.* 2016).

5.3.4. Aircraft Noise

The airspace above Cook Inlet experiences significant levels of aircraft traffic. Anchorage Ted Stevens International Airport is directly adjacent to lower Knik Arm and receives high volumes of commercial air traffic. It is also the second largest air cargo hub in the U.S. Joint Base Elmendorf Richardson also has a runway near and airspace directly over Knik Arm. Lake Hood in Anchorage is the world's largest and busiest seaplane base and the only seaplane base with primary airport status in the U.S. (FAA 2016). Other small public runways are found at

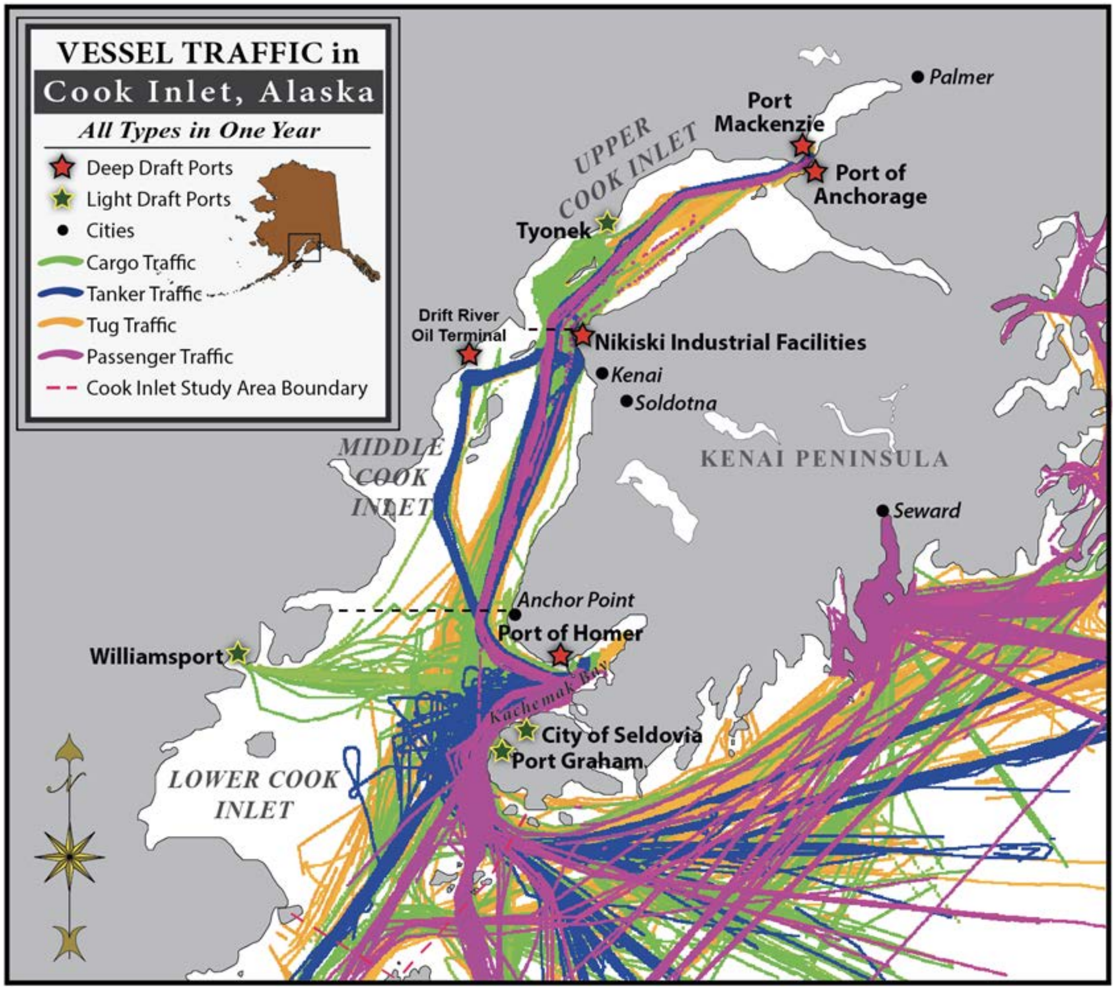

Figure 19. Annual vessel traffic in Cook Inlet by vessel type (from Cape International Inc. 2012).

Birchwood, Goose Bay, Merrill Field, Girdwood, the Kenai Municipal Airport, Ninilchik, Homer, and Seldovia. Oil and gas development projects often involve helicopters and fixed-winged aircraft, and aircraft are used for surveys of natural resources including Cook Inlet beluga whales. Airborne sounds do not transfer well to water because much of the sound is attenuated at the surface or is reflected where angles of incidence are greater than 13°; however, loud aircraft noise can be heard underwater when aircraft are within or near the 13^{o} overhead cone and surface conditions are calm (Richardson *et al*. 1995).

Richardson *et al*. (1995) observed that beluga whales in the Beaufort Sea will dive or swim away when low-flying (500 m (1640 ft)) aircraft pass above them. Observers aboard Cook Inlet beluga whale survey aircraft flying at approximately 244 m (800 ft.) report little or no change in swimming direction of the whales (Rugh *et al.* 2000). However, ground-based biologists note that Cook Inlet belugas often dive and remain submersed for longer than is typical when aircraft fly past at low altitudes or circle them (NMFS unpublished data). Individual responses of belugas may vary, depending on previous experiences, beluga activity at the time of the noise, and noise characteristics.

5.3.5. Construction and Dredging Noise

Pile driving and dredging are the primary sources of construction noise in Cook Inlet. The Port of Alaska is dredged annually and is in need of extensive renovation. Corroding piles and decades of damage from Cook Inlet ice have weakened Terminal 1, where in summer 2017, a 57,000-pound fender fell off the dock while a cruise ship was in port. The renovations will entail driving many new piles to support new Port structures. The Port has recently undertaken an outreach campaign to inform the public about the great need for repairs. Port Mackenzie, located just two miles away across Cook Inlet, has also undergone recent renovations, requiring pile driving, including removal and installation of sheet piles (NMFS 2017b).

The majority of such construction activities have taken place near Anchorage; therefore, most of the studies documenting construction noise in Cook Inlet have occurred outside of the action area. Moreover, these studies have focused almost exclusively on pile driving because of the concerns of potential harassment to beluga whales from this activity. As a result there is very little to no documentation of noise levels from other construction activity in Cook Inlet. Only a few studies have recorded dredging noise near the POA (URS 2007; USACE-DOER 2001).

Small and/or private docks also may utilize pile driving as a part of their expansions or repairs, e.g., the OSK dock in Nikiski was approved to be upgraded and expanded in 2012. Repair of sewage lines and construction of dock facilities occurred during the time that this project took place, activities that introduced noise to the marine environment, but there was no documentation of noise levels from this repair work.

5.4. Water Quality and Water Pollution

The Recovery Plan for the Beluga Whale (NMFS 2016b) states that exposure to industrial chemicals as well as to natural substances released into the marine environment is a potential health threat for CI belugas and their prey. An in-depth review of available information on pollution and contaminants in Cook Inlet is presented in the Recovery Plan.

The main sources of pollutants found in Cook Inlet likely include the 10 wastewater treatment facilities, stormwater runoff, de-icing compound runoff from airports, and discharge from oil and gas development (Moore *et al*. 2000). Ballast water discharge from ships is another source of potential pollution as well as potential release of non-indigenous organisms into Cook Inlet. Information on ballast water management in Cook Inlet can be found at:
https://www.circac.org/what-we-do/technical-review/projects-and-partnerships-tech/

5.4.1. Petrochemical spills

Given the amount of oil and gas production and vessel traffic, spills of petroleum products are a threat to marine mammals inhabiting Cook Inlet. Research indicates cetaceans are capable of detecting oil, but they do not seem to avoid it (Geraci 1990). Oil has been implicated in the deaths of pinnipeds (St. Aubin 1990). Effects to the marine mammals from spilled oils could include death or injury from swimming through oil (skin contact, ingestion of oil, respiratory distress from hydrocarbon vapors), contamination of food sources, or displacement from foraging areas.

On February 7, 2017, a Hilcorp helicopter flying between Nikiski and Platform A identified bubbles resulting from a natural gas leak in one of their pipelines. The gas leak was reported to the National Response Center and ADEC. Subsequent Hilcorp data revealed that the leak had been occurring since late December. The initial estimated leak rate was between 225,000 to 325,000 cubic feet per day from an eight-inch pipeline 80 feet below Cook Inlet waters (Hilcorp 2017b). The cause of the release was a large rock that caused a breach in the line.

Hilcorp worked closely with NMFS, PHMSA, ADEC, and other stakeholders to conduct mitigation and monitoring actions during the gas release and subsequent repair. Initially, Hilcorp significantly reduced gas flow through the line, but did not shut down the line completely for fear of residual oil leaking into the marine environment. Divers installed a temporary pipeline clamp on April 13, 2017, but due to weather and ice conditions, a permanent repair was not completed until May 19, 2017. Limited aerial surveys of wildlife in the vicinity of the leak did not indicate the presence of any marine mammals near the leak (Hilcorp 2017b).

On April 1, 2017, an oil spill was detected off the Anna Platform in Cook Inlet. Hilcorp reported the incident to ADEC on the same day. Documentation from Hilcorp indicates the release resulted from an accident on the Anna Platform production facility flare system. It was estimated a maximum of three gallons of oil was discharged into the marine environment.

Subsequent to these accidents, Hilcorp has updated their Integrity Management Plan (Hilcorp 2017a). Current pipeline operation and maintenance mitigation measures are described in Section 2.4 of this Opinion.

The Anna Platform experienced a diesel beam tank spill of 441 gallons on January 24, 2018. All the diesel was recovered and recycled. Hilcorp has also reported recent minor spills (≤ 200 gallons) of drilling mud from the Steelhead and Granite Platforms and a glycol spill from the Bruce Platform, with most or all spilled material recovered (ADEC 2018).

5.4.2. Pollution / Mixing Zones

Ten communities currently discharge treated wastes into Cook Inlet. As of 2007, the maximum permitted wastewater discharges for Anchorage were 44 million gallons per day, and the other communities had a range from 10 thousand to 1.6 million gallons per day. The impacts of discharge wastewater on the beluga whales are unknown. However, Cook Inlet beluga whale tissues have been found to contain relatively low levels of contaminants found in municipal discharge (NMFS, 2007).

In 2010, EPA consulted with NMFS on the approval of ADEC's Mixing Zone Regulation section [18 AAC 70.240], including most recent revisions, of the Alaska Water Quality Standards [18 AAC 70; WQS] relative to the endangered Cook Inlet beluga whale (NMFS 2010). This biological opinion concluded that there was insufficient information to conclude whether belugas could be harmed by the elevated concentrations of substances present in mixing zones, but that the action was not likely to jeopardize the continued existence of the species. NMFS is currently conducting formal consultation with EPA for this same action and its effects on designated Cook Inlet beluga critical habitat.

5.5. Fisheries

Commercial, personal use, recreational, and subsistence fisheries all occur within Cook Inlet. These have varying likelihoods of competing with beluga whales (and to a lesser extent Steller sea lions) for fish depending on gear type, species fished, timing, and fisheries location and intensity. The operation of watercraft near the mouths and deltas of rivers entering Cook Inlet, Turnagain Arm, and Knik Arm can affect beluga whales, hindering them from using these waters in pursuit of eulachon and salmon prey. Vessel strikes and gear interactions are also possible. In the spring of 2012, a young Cook Inlet beluga whale was found dead in an educational subsistence fishing net. While histopathology analysis determined the animal likely drowned, other health issues were documented that may have been a contributing factor to its entanglement or death (NMFS unpublished data). Other than this isolated interaction, NMFS is unaware of any beluga whale mortalities in Cook Inlet due to personal use, commercial, recreational, or subsistence fisheries.

Potential impacts from commercial fishing on Cook Inlet beluga whales include harassment, gear entanglement, ship strikes, reduction in prey, and displacement from important habitat. The likelihood of a lethal incidental take of a beluga whale from commercial fishing is unknown, but is thought to be low; however, there is a substantial likelihood of reduced prey availability and/or habitat displacement due to commercial fishing activity. While NMFS has numerous reports of beluga whales in the Kenai River prior to and after the summer salmon fishing season, they have not been observed in or near the river in recent times when salmon runs are strong and fishing activity (commercial, recreational, and personal use) is high (Shelden *et al.* 2015; Castellote *et al*. 2016).

There is strong indication that Cook Inlet beluga whales are dependent on access to relatively dense concentrations of high value prey species, particularly in the spring and throughout the summer months. Norman (2011) estimated that the total biomass of fish consumed by 350 Cook Inlet beluga whales during the summer would be approximately 1250 metric tons. Chum, coho, and other salmonid species constitute >54% of the Cook Inlet beluga whales' summer diet (Hobbs *et al.* 2008). In 2016, approximately 3.0 million salmon were harvested commercially in upper Cook Inlet, which is below the average annual harvest of 3.5 million from 1966-2016. Approximately 95.8 tons of smelt (100 tons is the maximum allowable harvest), 22.9 tons of herring, and 285,000 pounds of razor clams were commercially harvested from upper Cook Inlet in 2016 (Shields and Dupuis 2017). A significant reduction in the amount of available prey may impact the energetics for Cook Inlet beluga whales and delay recovery.

Whether fisheries reduce Steller sea lion prey biomass and quality at local and/or regional spatial scales, leading to a reduction in Steller sea lion survival and reproduction, has been a matter of considerable debate among the scientific community (NMFS 2008c). The most recent minimum total annual mortality of western DPS Steller sea lions associated with commercial fisheries is 31.5 individuals (NMFS 2014).

5.6. Direct Mortality

Within the proposed action area there are several potential sources of direct mortality, including shooting, strandings, fishery/gear/debris interactions, vessel collisions, predation, and research activities.

5.6.1. Subsistence Harvest

The effect from past subsistence harvests on the Cook Inlet beluga whale population was significant (Figure 20). While an unknown amount of harvest occurred for decades or longer, the subsistence harvest levels increased substantially in the 1980s and 1990s to unsustainable levels. Reported subsistence harvests during 1994-1998 probably account for the stock's decline during that interval. In 1999, beluga whale subsistence harvest discontinued as a result of both a voluntary moratorium by the hunters that spring, and Public Law 106-553, which required hunting of Cook Inlet beluga whale for subsistence uses be conducted pursuant to a cooperative agreement between NMFS and affected Alaska Native organizations. During 2000-2005, only five Cook Inlet beluga whales were harvested for subsistence purposes, and there has been no subsistence harvest since 2005. Subsistence hunting for Steller sea lions or humpback whales does not occur in the CIPL Project action area.

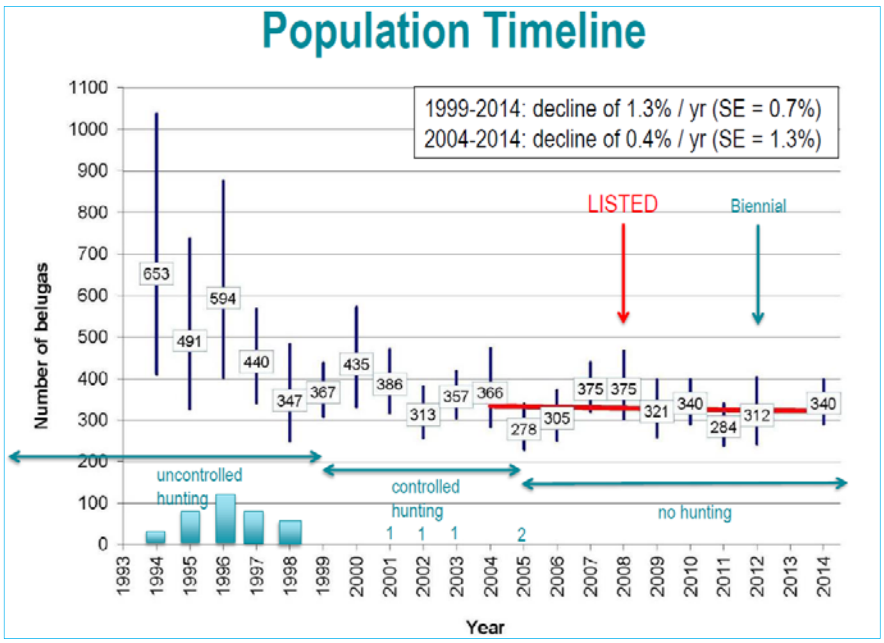

Figure 20. Population of Cook Inlet belugas when hunting was uncontrolled, controlled at very low harvest levels, and when hunting was not authorized. Blue bars and numbers along the X axis note known harvests of belugas during each year. Harvest methods used during the 1990s resulted in many struck and lost belugas.

5.6.2. Poaching and Illegal Harassment

Due to their distribution within the most densely populated region in Alaska and their approachable nature, the potential for poaching beluga whales in Cook Inlet exists. Although NMFS maintains an enforcement presence in upper Cook Inlet, effective enforcement across such a large area is difficult. No poaching incidents have been confirmed to date, although NMFS Enforcement has investigated several reported incidences of Cook Inlet beluga whale harassment. Steller sea lions are very rare in the CIPL Project action area, and illegal hunting of them is not known to occur there.

5.6.3. Stranding

Live stranding occurs when a marine mammal is found in waters too shallow to swim. Cook Inlet beluga whales are probably predisposed to stranding because they breed, feed, and molt in the shallow waters of upper Cook Inlet where extreme tidal fluctuations occur. However, stranding events that last more than a few hours may result in mortalities. Strandings can be intentional (e.g., to avoid killer whale predation), accidental (e.g., chasing prey into shallows then becoming trapped by receding tide), or a result of injury, illness, or death (NMFS 2015b). An estimated 876-953 live beluga strandings and a total of 214 dead beluga beachings have been documented in Cook Inlet from 1988 through 2015 (NMFS 2016b, NMFS unpbl. data). Beluga whale stranding events may represent a significant threat to the conservation and recovery of this stock. Live strandings do not often occur among sea lions, which have mobility out of water, although pinniped strandings and mortality resulting from entanglement in fishing gear have been documented (e.g., Swails 2005).

5.6.4. Predation

Killer whales are the only natural predators for beluga whales and Steller sea lions in Cook Inlet (Muto *et al*. 2017). Beluga whale stranding events have also been correlated with killer whale presence, and Native hunters report that beluga whales intentionally strand themselves in order to escape killer whale predation (Huntington 2000). Killer whale sightings were not well-documented and were likely rare in the upper inlet prior to the mid-1980s. From 1982 through 2014, 29 killer whale sightings in upper Cook Inlet (north of the East and West Forelands) were reported to NMFS. It is not known which of these were mammal-eating killer whales (i.e., transient killer whales) that might prey on beluga whales or fish-eating killer whales (i.e., resident killer whales) that would not prey on beluga whales.

Between 9 and 12 beluga whale deaths during this time (1982-2014) were suspected to be a direct result of killer whale predation (NMFS 2016b). From 2011 through 2014, NMFS received no reports of killer whale sightings in upper Cook Inlet or possible predation attempts. Prior to 2000, an average of one Cook Inlet beluga whale was killed annually by killer whales (Shelden *et al*. 2003). During 2001-2012 only three Cook Inlet beluga whales were reported as preyed upon by killer whales (NMFS unpublished data). This is likely an underestimate, however, as the remains of preyed-upon belugas may sink and go undetected by humans. Killer whale predation has been reported to have a potentially significant impact on the Cook Inlet beluga whale population (Shelden *et al*. 2003).

The risk to western DPS Steller sea lions from killer whale predation is considered potentially high (Muto *et al* 2017), and may be one of the causes contributing to past steep declines in population.

5.6.5. Vessel Strikes

Cook Inlet beluga whales may be susceptible to vessel strike mortality. To date, however, only one whale death, in October 2007, has been attributed to a potential vessel strike based on bruising consistent with blunt force injuries (NMFS unpublished data). Beluga whales may be especially susceptible to strikes from commercial and recreational fishing vessels (as opposed to cargo ships, oil tankers and barges) since both belugas and fishing activities occur where salmon and eulachon congregate. A number of beluga whales have been photographed with propeller scars (Maguire and Stephens 2014), suggesting that small vessel strikes are not rare, but such strikes are often survivable. Small boats are able to quickly approach and disturb these whales in their preferred shallow coastal habitat.

Although risk of vessel strike has not been identified as a significant concern for Steller sea lions, the recovery plan for this species states that Steller sea lions may be more susceptible to ship strike mortality or injury in harbors or in areas where animals are concentrated, e.g., near rookeries or haulouts (NMFS 2008).

5.6.6. Research

Research is a necessary endeavor to assist in the recovery of the Cook Inlet beluga whale population; however, research activities can also disturb these whales, especially when they include animal capture, collecting blood and tissue samples, or attaching tracking devices such as satellite tags. In the worst case, research can result in deaths of the animals. Shortly after a tagging event in 2002, a beluga whale was found dead; its tag had transmitted for only 32 hours. Another two beluga whales transmitted data for less than 48 hours, with similar dive patterns; it is unknown whether these whales, tagged in the same manner as the one that died, also perished, or were fitted with defective tags (NMFS, unpublished data). In 2015, an additional animal previously tagged by researchers washed up dead, with infection at the site of instrument attachment implicated as a possible cause of death.

Beluga surveys and research sometimes require boats, adding to the vessel traffic, noise, and pollution near the action area. Aerial surveys could also disturb Cook Inlet beluga whales, especially when circling at low-altitudes to obtain accurate group counts occurs. Boat based surveys, such as the photo-identification study, often require the boat to closely approach whales or whale groups. Deployment and retrieval of passive acoustic monitoring devices requires a boat, which temporarily increases noise in the immediate area. However, once the instruments are deployed, passive acoustic monitoring is noninvasive.

Although research may affect beluga whales, it is anticipated that research will continue to increase because there are many remaining data gaps on Cook Inlet beluga whale biology and ecology (NMFS 2016b). However, managers are cautious in permitting only minimally invasive research techniques.

5.7. Climate and Environmental Change

For many years, there has been widespread consensus within the scientific community that atmospheric temperatures are increasing at an unprecedented rate, a trend that is expected to continue for at least the next several decades (Oreskes 2004). There is also consensus within the scientific community that this warming trend will alter current weather patterns and patterns associated with climatic phenomena, including the timing and intensity of sea ice formation and duration, thermal events in both the atmosphere and marine system, precipitation, floods, droughts, and storms. Warming of the earth’s climate is unequivocal, as is evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and increases in global average sea level (IPCC 2014).

The Intergovernmental Panel on Climate Change (IPCC) estimated that average global land and sea surface temperature has increased by 0.6°C (±0.2°C, 1.1ºF ± 0.4ºF) since the mid-1800s, with most of the change occurring since 1976. This temperature increase is greater than what would be expected given the range of natural climatic variability recorded over the past 1,000 years (Crowley 2000). Based on its review, the IPCC concluded that natural phenomena are insufficient to explain the increases in land and sea surface temperature, and that most of the warming observed over the last 50 years is likely attributable to human activities (IPCC 2014), which poses a threat to most Arctic and subarctic ecosystems, including marine mammals. The IPCC is currently finalizing a 2018 special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways (http://www.ipcc.ch/report/sr15/).

Climate change is projected to have substantial direct and indirect effects on individuals, populations, species, and the structure and function of marine, coastal, and terrestrial ecosystems in the foreseeable future (Houghton 2001; McCarthy 2001; NASEM 2017). Climate change would result in increases in atmospheric temperatures, changes in sea surface temperatures, increased ocean acidity, changes in patterns of precipitation, and changes in sea level (Stocker *et al*. 2013).

The strongest warming is expected in northern latitudes, exceeding the estimate for mean global warming by a factor of 3, due in part to the "ice-albedo feedback," whereby as the reflective areas of Arctic ice and snow retreat, the earth absorbs more heat, accentuating the warming.

The physical environment of Cook Inlet is shifting towards increasingly long ice-free seasons. Alaska has experienced the greatest warming of any region in the United States (Karl *et al*. 2009), and Cook Inlet has experienced a reduction in duration of seasonal sea ice. In Cook Inlet, mesozooplankton biomass increased each year from 2004 to 2006; however, sampling from late 2006 to early 2007 suggests biomass values are decreasing (Batten and Mackas 2007), a change the authors suggest was driven by changes in climate. Changes in temperature affect zooplankton abundance, which in turn may influence fish species composition, and hence, the quality and types of fish available for beluga whales.

Cook Inlet is a very dynamic environment that experiences continual change in its physical and structural composition; there are extreme tides, strong currents, and a tremendous volume of silt input from glacial scouring. Beluga whales seasonally breed and feed in nearshore waters during the summer, but are ice-associated during the remaining part of the year. Ice floes can offer protection from predators and, in some regions, support prey, such as ice-associated cod. It has been suggested that the evolutionary replacement of the dorsal fin with a tough dorsal ridge capable of breaking through ice is a specific adaptation of belugas to ice conditions (Friedman 2006). Belugas in Cook Inlet rely heavily on a diet of salmon, which, in turn require cold water temperatures to maintain viability (Jeffries *et al*. 2012).

Environmental change in beluga habitat could lead to include changing prey composition, increased killer whale predation due to lack of ice refuge, increased susceptibility to ice entrapment due to less predictable ice conditions, and increased competition with co-predators. Specific to Cook Inlet beluga whales, the greatest climate change risks would result from climate-driven changes in salmon and eulachon abundance, and any increase in winter susceptibility to killer whale predation. In addition, more rapid melting of glaciers might significantly alter the silt deposition in the Susitna Delta, potentially altering habitat for prey (NMFS 2016b). In addition to direct environmental change, regional warming may increase human activity. Less ice may lead to increased vessel activity with an associated increase in noise, pollution, and risk of ship strike.

Climate-driven changes in glacial melt are presumed to have profound effects on seasonal streamflow within the Cook Inlet drainage basin, affecting both anadromous fish survival and reproduction in unpredictable ways. Changes in glacial outwash will also likely affect the chemical and physical characteristics of Cook Inlet's estuarine waters, possibly changing the levels of turbidity in the inlet. Whether such a change disproportionately benefits or harms marine mammals, their prey, or their predators is unknown.

6.0 EFFECTS OF THE ACTION

"Effects of the action" means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

This biological opinion relies on the best scientific and commercial information available. We try to note areas of uncertainty, or situations where data is not available. In analyzing the effects of the action, NMFS gives the benefit of the doubt to the listed species by minimizing the likelihood of false negative conclusions (concluding that adverse effects are not likely when such effects are, in fact, likely to occur).

The inclusion of an oil transmission line in the CIPL Project is actually interdependent with the *future* action of developing oil transmission from the Tyonek Platform. However, we consider it here, as it is taking place concomitant with construction of the gas transmission pipeline from the Tyonek Platform, for practical (construction-related logistic) reasons. The probability and timing of oil transmission from the Tyonek Platform is uncertain, but if it occurs and if it is authorized by a federal agency, that action will be evaluated independently under the ESA and therefore is not a part of this action. Conversely, although neither the Corps nor NMFS PR1 are directly authorizing gas-to-oil conversion of the existing CIGGS cross-inlet pipeline (the CIGGS Marine Pipeline Conversion Project), it is one component of Harvest LLC's current, overall CIPL Project, and we therefore consider it in this Opinion.

Section 3(18) of the MMPA defines Level A harassment (for non-military activities) as "any act of pursuit, torment, or annoyance which has the potential to *injure* a marine mammal or marine mammal stock in the wild." Level B harassment means any such act that "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."

The IHA proposal identifies elements of the Cook Inlet Pipeline Cross-Inlet Extension component of the CIPL Project that may result in harassment of marine mammals, pursuant to the MMPA, based on estimated exposure of marine mammals to certain sound levels (as defined in section 7.1) In this biological opinion, we try to estimate the responses of exposed listed marine mammals to these harassing elements ("stressors") and to assess the risk of "take," as defined by the ESA, from exposure to the stressors. We rely on the best scientific and commercial information available, noting areas of uncertainty, or situations where data are not available.

A stressor is defined as any physical, chemical, or biological entity that can induce an adverse response. Based on our review of the data available, the proposed CIPL Project may result in the following stressors (direct effects) to listed marine mammals and critical habitat for beluga whales:

1. Significant disruption of behavior caused by sound fields produced by continuous noise sources from tugs towing, dive boats, supply and other support vessels and aircraft;
2. Behavioral disruption from non-acoustic disturbances, including vessel movement and in-water activities, particularly during slack tide;
3. Risk of vessel strike or entanglement;
4. Seafloor disturbance from pipeline construction and stabilization; and
5. Pollution from unauthorized spills.[19]

6.1 Direct Acoustic Effects of CIPL Project Operation

The major source of sound associated with the CIPL Project is generated by tugs, which produce non-impulsive sounds that are above the 120 dB harassment criterion (Table 4). Thus, project-related tug noise could result in MMPA Level B harassment of marine mammals.

Table 4. Estimated source levels of project-related noise sources.[1]

Noise Source	Source Level dB re 1µPa @ 1 m (rms)
Dive boat (70'-80')	170
Sonar boat (30')	168
Tugs (120' and up to 5400 HP)	170
Pipe[2]	169
Barge Anchoring (see tug noise)	NA
Backhoe trenching in transition zone	167
Underwater Tools (hydraulic wrench, grinder, and pressure washer)	~159

[1] Source: SLR (2017)
[2] Estimated bottom impact sounds during pipe pull are assumed to be similar to impact noise of bucket dredging (~179 dB peak). Continuous sounds associated with pipe pulling are estimated to be at least 10 dB less than the impact noise of bucket dredging,(i.e.,169 dB).

[19] Although we are not consulting on oil spills and they are not a direct effect of the action, we consider their possibility in association with the proposed action and try to assess the probability of their occurrence and potential risk to marine mammals.

The loudest of these sounds, the 170 dB source level for tugs and the dive boat, is well below NMFS Level A harassment acoustic thresholds (NMFS 2016c). As indicated above, NMFS Permits Division does not propose to authorize any MMPA Level A harassment for this project. The loudest and most prevalent sounds associated with the CIPL Project are non-impulsive in nature. Therefore, PR1 uses the 120 dB threshold in determining exposure (section 7.2).

Potential acoustic effects of project-generated underwater sound could include masking, hearing impairment, and behavioral responses, which could cause MMPA Level B and/or ESA harassment. These effects are considered below.

6.1.1. Masking

The concept of acoustic interference is familiar to anyone who has tried to have a conversation in a noisy restaurant or at a rock concert. In such situations, the collective noise from many sources can interfere with one's ability to understand, recognize, or even detect sounds of interest. Masking from anthropogenic noise sources may disrupt marine mammal communication when sound frequencies overlap communication frequencies used by marine mammals. Studies have shown that cetaceans' response may be similar to that of humans speaking louder to communicate in a noisy situation. Holt *et al*. (2009) found that Southern Resident killer whales in Puget Sound near Seattle increased their call amplitude by 1 dB for every 1 dB increase in background noise levels.

Other reactions may include cessation of calling or changes in frequency. For their social interactions, belugas emit communication calls with an average frequency range of about 0.2 to 7.0 kHz (Garland *et al.* 2015), and use echolocation signals (biosonar) with peak frequencies at 40-120 kHz (Au 2000). Tugs produce dominant sound frequencies below 1 kHz (HEMMERA 2014), which overlaps with the lower-frequency end of belugas' communication frequency band. While this does leave some bandwidth for communication, some interference is likely. In a study of the response of beluga whale vocalizations to vessel traffic in the St. Lawrence River, Lesage *et al*. (1999) found that belugas stopped calling when they first became aware of approaching vessels, increased specific call repetitions when vessels were within 1 km, and shifted the mean frequencies of their vocalizations from 3.6 kHz to 5.2-8.8 kHz when ferries were close to the whales. Acoustic masking of belugas near the Port of Anchorage at Cairn Point occurs in all months, peaking in August, and exceeds the intensity of masking reported for belugas in Saguenay Fjord, St. Lawrence estuary, Canada (Castellote et al., 2016).

Tug noises from this project are not expected to mask belugas' echolocation clicks, and it is possible that these are the primary vocalizations used by beluga whales as they travel through the pipe-pulling area. While noise associated with the CIPL Project will occur within a very limited portion of the belugas' geographical range in an area of relatively low beluga density, some masking of vocal communication signals could occur.

A study of humpback whale calls in the presence of ships at the Port of Vancouver found that call rates declined when a ship was transiting, compared to call rates in the 30-minute period prior to the ship transit, and call rates remained low for the 30- minute period after a ship had passed. Because there was no visual observation or tagging during the underwater noise recordings, it was not possible to determine if the lower call rate during and after ship transit was because the whales changed their behavior (i.e. actually called at a lower rate, stopped calling or left the area) or because the ship noise masked whale calls (ECHO 2017).

Humpback whales are expected to occur in very low densities in upper Cook Inlet and especially in nearshore areas where the CIPL Project is located, and are therefore unlikely to experience masking of any significance to their vocalizations. Also, most if not all humpback whales in the action area likely would be from the non-listed Hawaii DPS. Steller sea lions are also rare in the action area, and although underwater vocalizations of sea lions may vary depending on social interactions (Schusterman *et al.* 1966), pinnipeds are generally believed to be less dependent on underwater vocalizations than are cetaceans.

The probability of acoustic masking due to the CIPL Project occurring among humpback whales, including Mexico DPS humpbacks, or western DPS Steller sea lions is considered very small, and thus adverse impacts to these species are extremely unlikely to occur. Belugas may experience some masking of vocal communication from noise generated by the CIPL Project, but the consequences would be limited due to the relatively small area affected by the action and the fact that belugas would not be expected to remain in the action area for long; past observations suggest that belugas primarily transit through this area on their way to foraging areas to the north and east. Given the size of the action area and the typical cruising speed for undisturbed belugas, we expect exposure to project sounds would not exceed about 15 minutes. We would also expect that disturbed belugas would remain in the action area for even less time.

6.1.2. Acoustic Disturbance

Exposure to high-intensity sounds repeatedly or for prolonged periods can cause hearing threshold shifts, which is the loss of hearing sensitivity at certain frequency ranges. Threshold shift can be permanent (PTS), in which case the loss of hearing sensitivity is not recoverable (Yost 2007), or temporary (TTS), in which case the animal's hearing threshold recovers over time (Southall *et al*. 2007). Such impacts are of great concern to both pinnipeds (Kastak *et al.* 2005) and cetaceans, which depend on acoustic cues for orientation, communication, finding prey, and avoiding predators (Weilgart 2007). PTS is not known to have been induced in captive marine mammals despite some hearing threshold studies exposing beluga whales to pulses up to 208 dB (Finneran *et al.* 2002). TTS in cetaceans can last from minutes to days (Weilgart 2007); however, even this temporary loss in frequency-specific hearing can lead to injuries or fatalities in the wild if TTS prevents detection of a predator or other significant hazard.

In assessing noise effects of this project on marine mammals, NMFS Permits Division used the reported source level of 170 dB measured at 1 m (estimated tug noise), a practical spreading loss model (15logR), and the weighting factor adjustment (WFA) for vibratory pile driving (2.5 kHz) as a proxy for vessels. Entering these parameters into the User Spreadsheet (NMFS 2016c) indicates that humpbacks, belugas, and Steller sea lions would have to remain within 14.3 m, 1.3 m, and 0.6 m respectively from a tug for 12 hours to experience PTS. Beluga whales are expected to be transiting through the action area as they head to or from foraging areas near the Beluga River, Susitna Delta, and Knik and Turnagain Arms. Similarly, humpback whales and Steller sea lions are not expected to remain in the area. Based on these results, NMFS PR1 does not anticipate auditory injury (Level A harassment) will occur. The likelihood of Cook Inlet beluga whales, humpback whales, including Mexico DPS Humpback whales, or western DPS Steller sea lions remaining within a few meters of any project-related sound source for long enough to experience PTS or TTS is extremely small.

Studies of both captive and wild beluga whales demonstrate that they may be behaviorally and physiologically disturbed by seismic pulses (Finneran *et al.* 2002). Romano *et al.* (2004) found that a captive beluga whale exposed to airgun sounds produced stress hormones with increasing sound pressure levels, and some hormone levels remained high as long as an hour after exposure. The CIPL Project will produce sound levels much lower than these seismic exposures. However, these studies demonstrate the species' susceptibility to loud noises can potentially result in physiological effects or lead to restricted use of available habitat.

Depending on habitat, demography, prior experience, activity, resource availability, sound transmission characteristics, behavioral state, and individual variability, the response of beluga whales can range from the most sensitive reported for any species to ignoring of intentional harassment. In the Canadian high Arctic where vessel traffic is rare, beluga whales exhibited rapid swimming from ice-breaking vessels up to 80 km (49.7 mi) away, and showed changes in surfacing, breathing, diving, and group composition (Cosens and Dueck 1988; Finley *et al*. 1990). However belugas that fled icebreaker noise at received levels of 94-105 dB rms re 1 µPa returned in 1-2 days to the area where received icebreaker noise was 120 dB rms re 1 µPa (Finley *et al.* 1990). The low icebreaker sound levels that evoked intense responses of Arctic beluga whales (Cosens and Dueck 1988) contrast sharply with the high levels required to evoke responses in captive beluga whales (Finneran and Schlundt, 2004).

Kendall *et al*. (2014) noted some changes in beluga group composition and more rapid passage past the POA during pile-driving activities in 2008-2009, as compared with pre-construction observations. Similar to the POA, the CIPL Project action area is not believed to be an important concentration area for beluga prey. However, increased travel speed (migration) through the area, would indicate disturbance. Similarly, resting animals in the area may be compelled to leave the area, at least temporarily.

Because belugas are likely transiting through the area on their way to, from, or between feeding areas, noise exposure from the CIPL Project is expected to be brief but, in combination with the actual presence of working equipment, may result in animals shifting pathways around the work site, increasing energy expenditures to reach their feeding areas, increasing swimming speed or dive duration, or ceasing or changing vocalizations. In the IHA proposal, NMFS PR1 notes that belugas regularly pass by industrialized areas such as the Port of Alaska without abandoning their transiting route. In studying the reactions of Cook Inlet beluga whales around the POA before and during pile driving activities, Kendall (2010) found that the animals traveled through the area more quickly and in more densely packed groups (although group size did not change significantly) during pile driving. Although tug sounds generated by the CIPL Project have a lower source level and lack the sharp onset of pile driving sounds, they are loud enough when at full-power to result in behavioral disturbance. PR1 anticipates that when tug engines are in "stand-by" mode, belugas may be able to hear them, but their reactions are not expected to rise to the level of MMPA Level B harassment.

Throughout their range, western DPS Steller sea lions are exposed to noises that exceed the NMFS disturbance criteria during use of tugboats and barges, and in many areas, Steller sea lions are attracted to fishing vessels as a food source. Western DPS Steller sea lions are rarely present in the action area, but over the course of an entire construction season, may occur within the action area's Level B isopleth. Western DPS Steller sea lions may occur in this zone in small numbers, and up to six may be acoustically harassed due to project-related noise.

Humpback whales are very uncommon in upper Cook Inlet. Mexico DPS humpback whales are, at most, extremely rare visitors to the action area. We have only a few records of humpback whales (ninety percent of which would have been from the non-listed Hawaii DPS) in upper Cook Inlet, and we have no records of humpback whales observed in the action area, although it is possible that the few humpback whales seen in upper Cook Inlet (north of the action area) traveled through or near the action area unobserved. Because so few humpbacks have occurred in upper Cook inlet, and none are known to have occurred in the action area, and because only about 1 in 10 humpbacks in the area are expected to be from the threatened Mexico DPS, project-related noise is expected to have an adverse effect upon no more than one Mexico DPS humpback whale.

6.1.3. Noise Effects on Prey

Data on acoustic effects to prey resources are limited. Christian *et al.* (2004) studied seismic energy impacts on male snow crabs (*Chionoecetes* sp.) and found no significant increases in physiological stress due to exposure to high sound-pressure levels. No acoustic impact studies have been conducted to date on the fish species most likely present during the open water months in Cook Inlet, but studies have been conducted on Atlantic cod (*Gadus morhua*) and sardine (*Clupea* sp.). Davis *et al.* (1998) cited various studies and found no effects to Atlantic cod eggs, larvae, and fry when received levels were 222 dB. Effects observed were to larval fish within about 5.0 m (16 ft), and from air guns with displacement volumes between 49,661 and 65,548 cm^3 (3,000 and 4,000 in^3). Similarly, effects to sardine were greatest on eggs and two-day larvae, but these effects were greatest at 0.5 ft (1.6 ft), and again confined to 5.0 m (16 ft). Greenlaw *et al.* (1988) found no evidence of gross histological damage to eggs and larvae of northern anchovy (*Engraulis mordax*) exposed to seismic air guns, and concluded that noticeable effects would result only from multiple, close exposures. This suggests that acoustic injury to prey results from particle motion (which is highly localized, on the order of meters) rather than from sound waves. Noise effects on beluga prey are also considered in section 6.4.1.

McCauley *et al*. (2017) conclude that marine seismic surveys can have significant negative impacts upon zooplankton populations, upon which some prey species of Cook Inlet beluga whales, humpback whales, and western DPS Steller sea lions rely, and upon which humpback whales rely directly. However, noise from this project is expected to result in sound-induced adverse impacts that are far less than those observed in association with seismic surveys. Therefore, the impact of noise on the prey of Cook Inlet beluga whales, humpback whales including Mexico DPS humpback whales, and western DPS Steller sea lions is very minor, and thus adverse effects to Cook Inlet beluga whales, humpback whales including Mexico DPS humpback whales, and western DPS Steller sea lions will be immeasurably small.

6.2. Quantifying Potential for Noise-induced Exposure of Marine Mammals

6.2.1. Background – Acoustic Harassment Criteria

On August 4, 2016, NMFS (2016c) promulgated comprehensive technical guidance on sound levels likely to cause Level A harassment to marine mammals (81 FR 51694). NMFS has not yet completed guidance for marine mammal behavioral disruption (Level B harassment). Until such guidance is available, NMFS uses generic sound exposure thresholds promulgated in 2005 (70 FR 1871, January 11, 2005) to determine the levels of sounds with the potential to result in Level B harassment of marine mammals. NMFS currently uses a Level B harassment threshold for impulsive sounds of 160 dB re 1 μPa $_{rms}$[20] (hereafter, 160 dB). For non-impulsive (sometimes referred to as "continuous") sounds, the Level B harassment threshold is 120 dB re 1 μPa $_{rms}$[21] (hereafter, 120 dB). As indicated above, NMFS Permits Division does not anticipate and is not proposing to authorize any Level A harassment for this project.

6.2.2. Calculating Marine Mammal Acoustic Harassment from the CIPL Project

NMFS PR1 estimated the instances of exposure for each species to received levels of non-impulsive sound ≥120 dB rms by considering:

(1) the area or volume of water that will be ensonified above this level in a day;
(2) the density or occurrence of marine mammals within these ensonified areas; and
(3) the number of days of activities.

The distance out to which Level B harassment may occur is calculated by the following formula:

Received level = Source Level- [Transmission Loss x (Log_{10}) Radius)]

As shown in Table 4, tugs produce the loudest source level (170 dB) generated by the CIPL Project. Applying the 120 dB harassment threshold for non-impulsive sounds and a practical spreading loss of 15 (NMFS 2012):

120 dB = 170 dB -15 (Log r) yields a Level B harassment distance radius of 2,154 meters.

In the IHA proposal, PR1 estimates the ensonified area to be a rectangle centered along the pipeline corridor encompassing all in-water equipment and a buffer around the outside of the cluster of activities constituting a conservative distance of 2,200 m to the 120 dB threshold from one tug (*i.e.,* 2,200 m). Assuming tugs would be spaced approximately 0.5 km from the barge/pipeline corridor and could be on opposite sides of the corridor, NMFS PR1 (NMFS 2018) calculated an ensonified area of 24.03 km^2, which will shift along the pipeline corridor as pipe-laying progresses (Figure 4).

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[20] Sound pressure is the sound force per unit micropascals (μPa), where 1 pascal (Pa) is the pressure resulting from a force of one newton exerted over an area of one square meter. Sound pressure level is expressed as the ratio of a measured sound pressure and a reference level. The commonly used reference pressure level in acoustics is 1 μPa and the units for underwater sound pressure levels are decibels (dB) re 1 μPa.

[21] Root mean square (rms) is the square root of the arithmetic average of the squared instantaneous pressure values.

For all marine mammals except belugas, NMFS (2018a,b) estimated the number of animals taken by acoustic harassment as:

> Take of species Y = (ensonified area) x (density of species Y) x (project duration)
>
> Where ensonified area = 24.03 km2, project duration is 108 days, and density of species is as described below.

The density estimates for Steller sea lions and humpback whales were based on Cook Inlet-wide NMFS aerial surveys 2001-2016 (Shelden *et al*. 2013, 2015, 2017), which covered an area of 87,123 km^2 (NMFS 2018a,b). Actual counts of Steller sea lions from these surveys averaged 741; however, NMFS (2018a,b) recognized that this species almost exclusively inhabits the lower inlet south of the Forelands with rare sightings in the northern inlet north of the Forelands (with anecdotal reports of up to a few animals observed per year in Upper Cook Inlet). Therefore, NMFS (2018a,b) adjusted the number of Steller sea lions observed during the NMFS surveys to 1/10 predicted density to account for this spatially skewed distribution. Although humpback whales also occur primarily in lower reaches of the Inlet, a similar adjustment was not made for them because, unlike Steller sea lions, humpback whale distribution is not anchored to a geographic location such as a haulout or rookery. Unprecedented oceanic conditions, however unlikely, could result in movement of humpbacks towards Upper Cook Inlet in previously unobserved numbers. NMFS (2018a,b) estimated densities for these species as:

Species	Average # per km^2	Area (km^2)	Density
Humpback whale	204	87,123	0.0023
Steller sea lion	741/10	87,123	0.00085

Based on these densities, the project duration, and the size of the ensonified zone, acoustic harassment calculations indicate take of 5.97 (= 6) humpback whales and 2.2 western DPS Steller sea lions. The estimated take of Steller sea lions was increased to 6, based on the potential for groups of 1-2 sea lions remaining in the area for multiple days (NMFS 2018b). An estimated 10.5 percent of the 6 humpback whales could represent the Mexico DPS (Wade *et al.* 2016), resulting in an estimated acoustic harassment of 0.626 (rounded to 1) Mexico DPS humpback whale.

In estimating take of Cook Inlet beluga whales, NMFS (2018a) originally proposed a take of 29 individuals, based on density estimates of Goetz *et al.* (2012) and more recent aerial surveys (Shelden *et al*. 2013, 2015, 2017), and taking into account the potential for one group of eight belugas per month or two groups of four animals per month to be affected in the action area. NMFS (2018b) increased the beluga take estimate to 40 to account for the possibility that belugas might be in the action area more frequently than originally assessed and to account for the potential for one to two large groups (up to 20 whales) to travel through the ensonified area during CIPL Project activities (J. Daly, *pers. comm*. March 13, 2018; NMFS 2018b).

In summary, NMFS (2018b) proposes to authorize Level B acoustic harassment of 40 Cook Inlet beluga whales, 1 Mexico DPS humpback whale, and 6 western DPS Steller sea lions.

6.3. Potential Non-Acoustic Direct Effects of CIPL Project

Although much of the analysis in the IHA proposal for the CIPL Project focuses on acoustic effects, there are other potential project effects associated with the CIPL Project. These include non-acoustic behavioral disturbance from vessel movement, diver presence and equipment use, as well as the potential for vessel strike and entanglement. Effects to Critical Habitat are also considered.

6.3.1. Non-Acoustic Behavioral Disturbance

Behavioral Disruption from Vessel Movement

Beluga whales' reactions to vessel traffic vary. Responses may not be detectable by observers, or may include a startle response, avoidance of the area, altered direction of travel or breathing pattern, or fleeing. In Cook Inlet and elsewhere, avoidance reactions have been observed in beluga whales when approached by watercraft, particularly small, fast-moving craft that are able to maneuver quickly and unpredictably; larger vessels that do not alter course or motor speed around these whales seem to cause little detectable reaction (NMFS 2008). See Section 7.1 of the Response Analysis for further description of such effects.

Based on available information, it is likely that any response exhibited by belugas to vessel movement associated with the CIPL Project will be temporary, resulting at most in either or both:

- increased energy expenditure if some animals circumvent the project area *en route* to preferred habitat, or
- increased stress level and associated physiological effects (see Section 7.3).

The probability of non-auditory effects of vessels disturbing humpback whales including Mexico DPS humpback whales and western DPS Steller sea lions is very small due to their infrequent occurrence in the action area, and thus adverse effects to Mexico DPS Humpback whales and western DPS Steller sea lions are extremely unlikely to occur.

Behavioral Disruption During Slack Tide

Most in-water CIPL Project activities (obstacle removal, pipeline repositioning, anchor handling, pipeline trenching, pipeline stabilization, cathodic protection) will occur during slack tide. The importance of the slack tide period to Cook Inlet belugas is not known. Existing evidence indicates that belugas tend to ride the rising tides up into rivers and falling tides back out into the bays or inlets (Fish and Vania 1971). Moore *et al*. (2002) reports that during flood tide, Cook Inlet belugas move into the upper reaches of the inlet, following narrow channels between the exposed tidal flats, and depart during ebb tide. It is possible that belugas may use the slack tide periods to rest or engage in other important life functions. Both of the two "probable mating behaviors" observed in April and May of 2014 in Trading Bay (Lomac-MacNair *et al*. 2016) occurred right around high slack tide. Although it is debatable whether these observations were actual mating behavior, it is undeniable that they were intensive social interactions, as indicated by the accompanying photographs (Lomac-MacNair *et al*. 2016).

Markowitz and McGuire (2007) report numerous groups of 3 to 10 belugas in the vicinity of the Port of Alaska, including 5 groups with calves, with almost all observations occurring at low ebb or low slack tides. Some of these groups remained in the Port area for an exceptionally long time, 19 to 117 minutes, during the low ebb or slack tide. The groups were reported as feeding, diving, or milling.[22]

Other than these suggestive observations, there is no hard evidence that slack tide is an important time period in Cook Inlet belugas' daily cycle. We have no evidence suggesting that slack tide in upper Cook Inlet is more important than other portions of the tide cycle to humpback whales including Mexico DPS humpback whales or western DPS Steller sea lions.

Behavioral Disruption Due To Scuba Divers

Scuba divers associated with this project may be a sufficiently novel source of disturbance in this environment that they may conceivably cause some behavioral effect in Cook Inlet belugas. However, the visual impact will be diminishingly small due to the opacity of Cook Inlet waters, and the acoustic impact of the divers will be limited to a very small radius around the divers during their very brief dives. The zone that is acoustically impacted by divers will always be completely contained within the larger acoustic impact zone from project vessels. While the actual effects of divers on beluga whales in Cook Inlet can be reasonably assumed to be small, we have no data supporting this assumption. To help assess the unknown, but presumably very small, effects of scuba divers on beluga behavior, Harvest LLC has agreed to report any opportunistic observations of belugas during diver activities (see mitigation measures). This effort will add to our knowledge base of Cook Inlet beluga whale ecology and behavioral response. Effects of divers on Mexico DPS humpback whales and western DPS Steller sea lions will be very small because the chance of divers encountering these very low density species will be extremely unlikely.

Adverse effects to Cook Inlet beluga whales, humpback whales including Mexico DPS Humpback whales, and western DPS Steller sea lions due to project-related divers are extremely unlikely to occur.

6.3.2. Vessel Strike

Ship strikes of cetaceans can cause major wounds, which may lead to the death of the animal. An animal at the surface could be struck directly by a vessel, a surfacing animal could hit the bottom of a vessel, or a vessel's propeller could injure or kill an animal below the water's surface.

On the Pacific coast, an estimated 2.7 humpback whales are killed every year by ship strikes (Muto *et al*. 2016). Between 1978 and 2011, there were 108 reports of whale-vessel collisions in Alaska waters. Of these, 93 involved humpback whales (Neilson *et al*. 2012). During 2001, one dead humpback whale came into the POA on the bulbous bow of a ship traveling from Seattle. However, it was unclear where the initial strike occurred (NMFS Alaska Regional Office Stranding Database accessed May 2017). No vessel collisions or propeller strikes involving humpback whales have been documented in Cook Inlet.

[22] "Relaxing" is not a behavior that humans categorize – or even know exists - for belugas.

While humpback whales are among the marine mammal species most prone to ship strikes in Alaska, they are very uncommon in the action area, and the operational speeds of project vessels will help minimize the risk of collision for any humpback whales that may be present. An examination of all known ship strikes for large (baleen and sperm) whales from all shipping sources indicates vessel speed is a principal factor in whether a vessel strike results in death (Laist *et al.* 2001; Vanderlaan and Taggart 2007). In assessing records with known vessel speeds, Laist *et al.* (2001) found that most deaths occurred when a vessel was traveling in excess of 24.1 km/h (14.9 mph; 13 kts). Pipe pulling activities would occur at speeds of about 20 ft per minute or 0.2 knots. The tugs would be stationary during this time and other vessels would likely either be tethered to the barge or would traverse the Action Area at speeds less of than 13 knots. This, in combination with the low density of humpback whales in the CIPL Project action area, greatly decreases probability of project-related humpback whale vessel strikes. The probability of a Mexico DPS humpback whale being struck by a project vessel is extremely small (about 1/10th the probability of any humpback whale being so struck). There are no records of humpbacks being struck by vessels in Upper Cook Inlet.

Ship strikes of smaller cetaceans such as beluga whales are much less common, possibly due to their smaller size and more agile nature. Similarly, the agility of Steller sea lions is likely to preclude collision with vessels travelling as described in this action.

Based on the small number of vessels associated with the proposed activities, the limited number of sightings of humpback whales and Steller sea lions in action area, the slow vessel speeds, mitigation measures to minimize exposure to vessel activities, the rarity of collisions with marine mammals in Cook Inlet, and the lack of any known instances of humpback whale or Steller sea lion vessel strikes in Upper Cook Inlet, we conclude that the probability of a CIPL Project vessel striking a Cook Inlet beluga whale, a humpback whale including a Mexico DPS Humpback whale, or western DPS Steller sea lion is very small, and thus adverse effects to these species are extremely unlikely to occur.

6.3.3. Entanglement

Entanglement can occur if wildlife becomes immobilized in survey lines, cables, nets, or other equipment that is moving through the water column. Most documented cases of marine mammal entanglement involve abandoned or lost fishing lines, nets, pots, or other gear (see https://alaskafisheries.noaa.gov/protectedresources/entanglement/ for more information).

Cables associated with the CIPL Project include those that will be attached to obstacles to be moved from the pipeline corridor (Section 2.2.2), those attached to each pipe section as it is being pulled into position by the winch on the barge (Section 2.2.3), and those anchoring the pull barge. All of these cables are stiff and when in the water will always be associated with ongoing human activity. They will therefore have very little potential to result in entanglement of marine mammals. Project mitigation measures include removing all cables from the CIPL Project area following their use.

Accordingly, the probability of entanglement occurring is very small, and thus adverse effects to Cook Inlet beluga whales, humpback whales including Mexico DPS humpback whales, and western DPS Steller sea lions due to entanglement are extremely unlikely to occur.

6.3.4. Seafloor Disturbance

The footprint of the 5.5 mile (8.9 km) length of the new pipelines is very narrow; it is no more than a few meters in most locations, with a maximum width of disturbance of about 50 feet (15 m). This swath of disturbance will extend from onshore to the existing Tyonek Platform. The benthic environment of Cook Inlet is highly dynamic due to extreme tidal fluctuations and high silt input from glacial streams. The seafloor disturbance caused by this project will therefore be very small in geographic extent and very temporary in nature. The impact of seafloor disturbance is very minor, and thus adverse effects to Cook Inlet beluga whales, humpback whales including Mexico DPS Humpback whales, and western DPS Steller sea lions will be immeasurably small.

6.3.5 Unauthorized Discharge of Petroleum Products

Vessel-Related Small Spills

Increased vessel activity in the action area will temporarily increase the risk of accidental fuel and lubricant spills from support vessels. Accidental spills may occur from a spilled container, vessel leak, or hull breach. The greatest threat to cetaceans from small spills is likely from the inhalation of the volatile toxic hydrocarbon fractions of fresh oil, which can damage the respiratory system (Hansen 1985, Neff 1990) and cause neurological disorders or liver damage (Geraci and St. Aubin 1982). However, potential impacts from such spills on humpback and beluga whales or Steller sea lions in the action area are small due to tidal currents and their ability to entrain spilled hydrocarbons. Risk of spills will be minimized by maintaining safe operational and navigational conditions. Small spills of refined hydrocarbons rapidly dissipate volatile toxic compounds within hours to a few days through evaporation. Residual components would rapidly disperse and become entrained in open waters.

In the highly unlikely event that individual belugas, humpbacks, or Steller sea lions were exposed to waters subjected to project-related small spills from vessels, the spills would likely have minimal effects on their health, due to rapid weathering, entrainment, dispersal, and evaporation. A small fuel spill would be localized, and would not have long term or measurable effects to whale prey populations (e.g., forage fish and zooplankton).

We conclude that, while small project-related spills from vessels may occur, the impact of these project-related small spills is very minor, and thus adverse effects to Cook Inlet beluga whales, humpback whales including Mexico DPS Humpback whales, and western DPS Steller sea lions will be immeasurably small.

Oil Pipeline Leaks, Oil Spills and Spill Response

A large spill (in excess of 50 barrels) could occur from an oil leak or spill from Harvest Alaska LLC infrastructure associated with the CIPL Project, including the pipeline proposed to be converted from gas to oil. From 1995-2012, 0.64 percent of spill incidents in Alaska were 50 barrels or greater in size (Reich et al., 2014). The probability of a large spill occurring in association with this particular project is likely far less than 0.64 percent because the pipelines will be carrying gas, and the source of large project-related spills would be due to vessel-related catastrophe, making large spills a very low probability, but high consequence event. A large oil spill could have disastrous consequences for Cook Inlet beluga whales. Although a large gas leak can have consequences for the atmosphere, given methane's effectiveness as a greenhouse gas, the impact of a gas leak on marine systems is far less consequential than is the impact of an oil spill. Leaked gas may create marine anoxic zones that are geographically small compared to an oil spill of similar magnitude.

ADEC is currently reviewing an amendment to Harvest Alaska LLC's Oil Discharge and Prevention Contingency Plan (see https://dec.alaska.gov/Applications/SPAR/PublicMVC/IPP/CPlansUnderReview). The revision includes a new section on response to subsea pipeline rupture in Cook Inlet in winter. Alaska law requires that ODPCPs must provide for the use by the applicant of the best technology that was available at the time the contingency plan was submitted or reviewed (Statute 46.04.030(e)). Some of the current sophisticated leak prevention and detection technologies are discussed in Section 2.4 of this Opinion. In addition, as indicated in section 2.5 of this opinion, all spill responses in Cook Inlet would be coordinated with CISPRI, whose recently updated Technical Manual (https://cispri.org/wp-content/uploads/2017/09/CISPRI-Technical-Manual-June-2017-Low.pdf) includes a specific section on oil recovery under ice.

Marine mammals could be exposed to short and long term human activity associated with spill response and post-event activities (e.g., increased vessel and aircraft traffic associated with reconnaissance and monitoring). These activities would be expected to be intense during the spill cleanup operations and may continue at reduced levels for years. Specific marine mammal mitigation would be implemented as the situation requires, and would be modified as warranted to accommodate the response effort. The response contractor would be expected to work with NMFS and state officials on wildlife management activities in the event of a spill. Oil spill response activities have been previously consulted on by NMFS as part of the *Unified Plan* (AKR-2014-9361) and more recently for BOEM lease sale 244 in Cook Inlet (AKR 2016-9580).

As discussed in section 2.4.2, Harvest LLC will include as part of this project advanced technology for detecting and controlling pipeline breaches and leaks. While the impact of a large oil spill and subsequent spill response associated with this action could be extremely large, the probability of a large project-related spill occurring is very small, and thus adverse effects to Cook Inlet beluga whales, humpback whales including Mexico DPS Humpback whales, and western DPS Steller sea lions are extremely unlikely to occur.

6.4. Effects to Critical Habitat

6.4.1. Cook Inlet Beluga Whale Critical Habitat

The final rule designating Cook Inlet beluga whale critical habitat (76 FR 20180) included five Primary Constituent Elements (PCEs, referred to in this opinion as Physical and Biological Features (PBFs)) that are deemed essential to the conservation of the Cook Inlet beluga whale. The PBFs are:

1. Intertidal and subtidal waters of Cook Inlet with depths <30 feet (MLLW) and within five miles 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 Cook Inlet 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 Cook Inlet beluga whales.

Cook Inlet beluga whale critical habitat includes two geographic areas in Cook Inlet (Figure 6) comprising 7,809 km^2 (3,013 mi^2). The CIPL Project area is located in Critical Habitat Area 2 (Figure 8). Based on dive behavior and analysis of stomach contents from Cook Inlet belugas, it is assumed that Area 2 habitat is a feeding area of heightened importance during fall and winter months, when there are no aggregations of anadromous prey near and within anadromous fish-bearing rivers and streams (see ESA listing final Rule, 73 FR 62919, October 22, 2008). However, we note that satellite tagging data indicate use of Area 2 by belugas in all months except April and May, and the indicated absence of April / May use is based on tagging data from only 2 whales (MML unpublished data, April, 2017).

Project effects to the physical and biological features defining Cook Inlet beluga critical habitat are as follows:

PBF 1: Intertidal and subtidal waters of Cook Inlet with depths <30 feet (MLLW) and within five miles of high and medium flow anadromous fish streams -- The action area is located more than 5 miles from any intertidal/subtidal waters associated with any anadromous fish stream. Further, the majority of the work associated with installation of the pipeline and connections at the platform would occur in waters greater than the 30 ft (9 m) depth specified in this PBF. However, trenching for pipeline burial will occur in waters less than 30 ft deep through the intertidal zone. The turbidity resulting from trenching is expected to be localized and largely indistinguishable from ambient turbidity. Trenching will occur for about 10 days, which is the amount of time we expect this activity may impact this PBF. We do not expect project acoustic effects will persist beyond the amount of time that vessels are present in the area. While small spills may occur after completion of the new pipelines, we expect the effects from small spills on this PBF will be very small for the reasons discussed in section 6.3.5. Also, as discussed in section 3.6.5, we expect that large spills are extremely unlikely to occur. Finally, because the combined pipeline corridor for both pipes will be approximately 50 feet wide and will run along the ocean floor, we do not expect the pipelines to adversely impact the intertidal or subtidal waters around them.

The impact of trenching and small spills is very minor, and thus adverse effects to PBF1 will be very small. Therefore, we conclude that the adverse effects from trenching and small spills on PBF 1 are insignificant.

The probability of a large spill occurring is very small, and thus adverse effects to PBF 1 are extremely unlikely to occur. Therefore, we conclude that the adverse effects from large spills to PBF 1 are discountable.

PBF 2: Primary prey species -- Little is known about how noise affects fish; salmon have been found to respond to low frequency sounds, but only at very short ranges, within distances of a few feet from the (pile driving) sound source (Popper and Hastings 2009). Although the CIPL Project does not include pile driving, the acoustic criteria for injury and physiological effects to fish based on studies of impact pile driving are our best available information for effects of loud noise on prey species. Recent experimental studies indicate that pile driving associated barotrauma (i.e., damage to internal tissues) of fish occurs at sound pressure levels of 205- 215 dB re: 1 μPa_{peak}, considerably greater than those expected from the CIPL Project (Halvorsen *et al*. 2012; Casper *et al.* 2012). Injury to fish depends more on the magnitude of particle motion than on sound levels as mammals perceive it (Popper and Hawkins 2018), and these effects upon fish due to seismic activity have been limited to just a few meters (Davis *et al.* 1998). Sound capable of causing barotrauma in fish will not occur during this project. Sound pressure levels generated by the CIPL Project may cause temporary behavioral changes of prey species at close range, such as a startle or stress response. Project-related vessel and pipe-pulling sounds are not expected to cause direct injury to fish, and will behaviorally affect fish only at close range, for a short period of time.

A very small proportion of primary prey species may be temporarily disturbed due to non-acoustic sources of disturbance (e.g., boat wakes, spinning propellers, divers, moving cables). They may also be disturbed during trenching operations, exhibiting a startled or flight response. These forms of disturbance would be temporary, with a geographic extent much smaller than the project action area. The risk of vessels striking prey species may exist, but vessels will be operating at speeds that will allow primary prey to avoid collisions. We expect no entanglement of prey species in project-related gear. Small unauthorized spills have the potential to affect prey species. However, small spills are expected to rapidly disperse due to tide-induced turbulence and mixing. We expect no project-related measurable change in primary prey in terms of prey population levels, distribution, or availability to belugas.

We expect the impact of project-related sound and other effects on primary prey will be very minor, and thus adverse effects to PBF 2 will be immeasurably small. Therefore, we conclude that the adverse effects on PBF 2 are insignificant.

PBF 3: Waters free of toxins or other agents of a type and amount harmful to Cook Inlet beluga whales -- The proposed project will not intentionally introduce any toxins or other harmful agent of a type or amount harmful to Cook Inlet beluga whales or other marine life into Cook Inlet. The project will comply with all requirements specified by ADEC. Best Management Practices (BMPs) will be followed to reduce or eliminate any materials from tugboats, support vessels, and equipment entering the water during pipe-pulling operations.

Contaminated sediments are not expected to occur in the vicinity of pipeline installation. Hydrocarbon concentrations in Cook Inlet sediments are comparable to values reported for background hydrocarbons in Alaska offshore coastal waters, and studies have found no evidence of heavy metal pollution in lower Cook Inlet (BOEM 2016). Because of the localized work areas, any increases in turbidity and resuspension of potentially contaminated sediments would be limited to the immediate vicinity and depth of the work site.

As discussed in section 6.3.5, the probability of large hydrocarbon spills occurring is very small and the impacts of small spills on this PBF will be very minor. While resuspension of sediments is likely to occur as a result of this action, the probability of these sediments being contaminated is very small, and the short duration of their re-suspension will render their effects very minor.

Therefore, we conclude that the adverse effects of this project on PBF 3 will be discountable (for large spills), insignificant (for small spills), or both (for activities that result in re-suspension of sediments).

PBF 4: Unrestricted passage -- Pipe laying activities are proposed to occur within a narrow corridor (approximately 50-foot width) that is 5.5 mile in length, and vessels associated with the pulling activities would move at slow speeds (maximum pulling velocity is 20 ft per minute or 0.2 knot). Anchors used to secure the tugs and barge will be kept tight; there will be no loose cables in the water that could restrict passage or cause entanglement. Passage of salmon species and other beluga whale prey will not be impacted by project activities. While belugas may choose to swim around areas subjected to in-water work, such potential detours will add only a few kilometers to their travel, and we expect no unrestricted passage of belugas within or between critical habitat areas to result from this work. Once construction is completed, the pipeline will run along the ocean floor to the existing Tyonek Platform, so the completed pipeline will not impede passage between the west shore and the platform.

The impact of in-water work on beluga passage will be very minor, and thus adverse effects to PBF 4 will be immeasurably small. Therefore, we conclude that the adverse effects from in-water work on PBF 4 are insignificant.

PBF 5: Waters with in-water noise below levels resulting in abandonment of critical habitat areas by Cook Inlet Belugas -- As described in Section 6.2, project-generated underwater noise from tugs, workboats and dive boats will elevate noise levels above Level B noise thresholds established by NMFS. Such noise will be short-term and sufficiently far from areas adjacent to the Susitna and Beluga River mouths where many belugas congregate during the summer months. In addition, mitigation measures described in Section 2.6 and the 4MP (Attachment 1) will further reduce the possibility of acoustic harassment.

While small numbers of beluga whales are expected to be acoustically harassed by project-related noise, we do not expect that such harassment will be sufficient to cause abandonment of any portions of critical habitat beyond the time during which in-water noise is occurring. We have no evidence that individual projects occurring in a single season result in belugas abandoning habitat. Furthermore, waters near the POA continue to be used by belugas despite the occurrence of noise across many years that is similar in magnitude to noise from this project.

The impact of noise from this project on PBF 5 is expected to be very minor, and thus adverse effects to PBF 5 will be immeasurably small. Therefore, we conclude that the adverse effects from project noise on PBF 5 are insignificant.

Accordingly, all effects from the CIPL Project are insignificant and/or discountable such that this project is not likely to adversely affect Cook Inlet beluga whale critical habitat.

6.4.2. Steller Sea Lion Critical Habitat

Steller sea lion critical habitat, designated on August 27, 1993 (50 CFR 226.202), includes a 20 nautical mile buffer around all major haulouts and rookeries (Figure 12), as well as associated terrestrial, air, and aquatic zones, and three large offshore foraging areas. The proposed project is located well outside designated Steller sea lion critical habitat, with the closest critical habitat approximately 80 miles south of the action area. The closest documented haulout, Flat, is located near English Bay, over 100 miles south of the action area (Figure 21), a haulout that has not been used since 2007 according to NMFS aerial surveys.

6.5. Indirect Effects

Indirect effects defined under the ESA are effects from the proposed action that occur later in time, but are still reasonably certain to occur. In the future, it is likely that Harvest Alaska LLC will propose future activities at the Tyonek platform and at other infrastructure locations in Cook Inlet (such as the future connection of the oil pipeline that is being installed but left unconnected, and the conversion of existing gas pipelines to oil pipelines). However, later work that requires additional federal authorization and permitting would trigger further ESA section 7 consultation.

Indirect effects related to connection and use of an installed, but unconnected, oil pipeline would result from disturbance caused by the act of pipeline connection operations and from unanticipated oil spills from that pipeline once it is operational. Disturbance caused by the act of connecting the pipeline are expected to be very minor and brief. The effects of an unanticipated oil spill from that pipeline and from gas pipelines converted to oil are discussed in sections 6.3.5 and 6.4.1.

Beneficial effects resulting from this project may include the planned decommissioning of the Drift River Terminal and cessation of tanker traffic associated with that facility (Section 2.1). The decommissioning of the Drift River Terminal will reduce overall vessel noise in Cook Inlet, and will eliminate the possibility of catastrophic oil spills from this terminal, which resides near the flanks of an active volcano. The Cook Inlet Regional Citizens Advisory Council, an organization tasked with protecting the area from oil spills, has indicated that a subsea crude oil transmission pipeline is the preferred long-term option for transporting oil from Cook Inlet west side production operations to the refinery on the east side of Cook Inlet (CIRCAC 2012). The Cook Inlet Risk Assessment (Nuka 2015) included a table indicating that a subsea pipeline, such as that which Harvest is proposing, would be expected to decrease potential crude oil spill volumes by >99 percent, as compared with those projected to occur from double-hulled crude oil tankers (Nuka 2015).

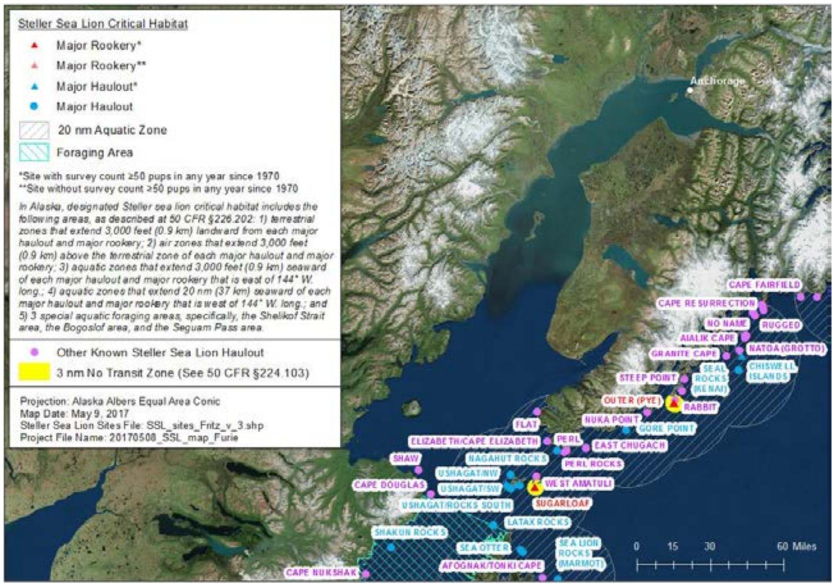

Figure 21. Steller sea lion designated critical habitat near Cook Inlet.

6.6. Summary of CIPL Project Effects to Listed Marine Mammals

We summarize the information presented in Section 6 of this Opinion as follows:

- The action of IHA issuance proposes authorizing exposure of 40 Cook Inlet beluga whales, 6 Steller sea lions, and 1 Mexico DPS humpback whale to Level B harassment (sound levels >120 dB) associated with the CIPL Project. This project is also proposed to be authorized by a Letter of Permission from the Corps of Engineers.
- Some beluga whale vocal communications could be masked by sounds associated with the CIPL Project. Adverse effects due to acoustic masking of Mexico DPS humpback whales and western DPS Steller sea lions are extremely unlikely.
- Noise generated by the CIPL Project is likely to cause adverse effects to Cook Inlet beluga whales, Mexico DPS humpback whales, and western DPS Steller sea lions.
- The CIPL Project is expected to have insignificant effects upon marine mammal prey.
- Some beluga whale behaviors could be disrupted by non-acoustic-related project activities, especially during slack tide periods. This concern does not extend to humpback whales or Steller sea lions.
- Adverse effects of vessel strikes and entanglement associated with the CIPL Project are extremely unlikely.
- Adverse effects due to project-related seafloor disturbance would be too small to detect or measure.
- Oil spills or other petrochemical or hydrocarbon releases are not a part of the action under review because these are not authorized activities. Although spills of these substances could occur, best available technologies, a suite of preventative measures, and agency oversight will be implemented to prevent spills. Should spills occur, a spill response plan is in place. Adverse effects of project-related large spills are extremely unlikely to occur while adverse effects of small spills are more likely but would be too small to measure.

- Effects of the CIPL Project to Cook Inlet beluga whale critical habitat PBFs are considered insignificant or discountable, and Cook Inlet beluga whale critical habitat is not likely to be adversely affected.
- Indirect effects of the overall CIPL Project may result in improvements for marine mammal habitat in Cook Inlet by reducing the surface transport of oil, and thereby dramatically reducing the volume that may be spilled in association with any unforeseen mishap.

Additionally, voluntary actions taken by Harvest LLC in association with the CIPL Project (acoustic monitoring, visual monitoring of beluga behavior during diver activities, PSO monitoring, and proposed monitoring by UAS) may serve to improve our understanding of the effects of future projects and how best to monitor them.

7.0 RESPONSE ANALYSIS

In this section we apply the best available scientific and commercial data to describe the species' expected responses to the effects of the action considered in Section 6 of this Opinion. In doing so, we recognize the distinction between Level B harassment, as defined by the MMPA, and "take" as defined by the ESA (see Section 3 of this Opinion).

7.1. Response to Masking of Vocal Communications

Vocalization measurements in the field have shown that animals change their behavior in response to increased background noise, by increasing the volume, or length, or shifting the frequency of the calls (e.g. Holt *et al*. 2009; Lesage *et al*. 1999).

Belugas have demonstrated additional sophisticated anti-masking strategies, both at echolocation and calling frequencies. Penner *et al*. (1986) reports that a captive beluga was able to enhance its target detection by using a surface-reflected path for its emitted and received echolocation signal, so that the target echo and masking noise came from different directions. A trained beluga also showed an ability to interpret conspecific calls that were partially masked by ice-cracking, propeller cavitation, and bubbler sounds (Erbe *et al.* 2016).

Such anti-masking strategies, however, may not extend to mother-calf pairs. Audio tags attached to humpback whales indicated that calves and mothers vocalize very quietly to each other. Such inconspicuous behavior likely reduces the risk of exposure to predators and to male humpback whale escorts who could compromise calf fitness by disrupting the time spent nursing and resting (Videson *et al.* 2017) The authors indicate that the weak calls between mother and calf are very sensitive to increases in noise from human encroachment, which could increasing the risk of mother– calf separation.

Such "whispering" behavior has not been definitively demonstrated for belugas, although it could be important in areas where killer whale predation risk or anthropogenic noise is high. Unpublished vocal development research at the Oceanografic and Vancouver Aquaria indicate that newborn beluga calf vocalizations are much quieter than the sounds produced by adults. The Canadian government has produced three video Public Service Announcements to educate boaters in the St. Lawrence about potential masking or other interference between mother-calf beluga pairs (e.g., https://www.youtube.com/watch?v=zHRa1EVhRMo). In the case of beluga responses to the CIPL Project, however, such masking effects are likely to be minimal. Although project work will be conducted during the calving season, the project is located sufficiently south of prime nursing and calving habitat to minimize the threat of acoustic masking.

7.2. Changes in Overt Behavioral Patterns

Typical changes in cetacean response to anthropogenic noise are summarized from several studies of bowhead whales and include shorter surfacings, shorter dives, fewer blows per surfacing, and longer intervals between successive blows (Richardson *et al*. 1995; Blane and Jaakson 1994). These subtle changes are often the only observable reaction of whales to reception of anthropogenic stimuli. However, bowheads have also been observed to alter their fall migration further offshore to avoid seismic survey activity when it was 35 miles away, with up to a 30 mile long detour (MMS 2008). In addition, nearly all bowheads avoided waters within 20 km of seismic surveys (Richardson *et al*. 1999).

Humpback whale reactions to approaching boats are variable, ranging from approach to avoidance (Payne 1978, Salden 1993). On rare occasions humpbacks "charge" towards a boat and emit loud vocalizations, possibly as a threat (Payne 1978). Humpbacks seem less likely to react to vessels when actively feeding than when resting or engaged in other activities (Krieger and Wing 1984). Mothers with newborn calves seem most sensitive to vessel disturbance (Clapham and Mattila 1993). Morete *et al.* (2007) reported that undisturbed humpback whale cows that were accompanied by their calves were frequently observed resting while their calves circled them (milling) and rolling interspersed with dives. When vessels approached, the amount of time cows and calves spent resting and milling respectively declined significantly.
Beluga whales' reactions to vessel traffic have also been shown to vary. In the St. Lawrence River where vessel traffic is common, beluga whales have been fairly tolerant of vessels, but some individuals (especially older animals) responded differentially to certain vessels and operating characteristics by reducing their calling rates (Blane and Jaakson 1994).

Beluga whales have been shown to react differently to different sounds. Belugas feeding on salmon in the Snake River (near Nome, AK) stopped feeding and moved downstream in response to the noise from outboard motorboats, whereas they were less responsive to the noise from fishing boats to which they may have habituated (Stewart *et al*. 1982, Awbrey and Stewart 1983)). These authors also report that the belugas did not appear to react strongly to playbacks of oil industry-related drilling noise at levels up to 60 dB above ambient, but some whales reacted by swimming away from the direction of sudden onset noises at distances up to 1.5 km.

Response to disturbance may also differ by location. In more pristine environments like the Canadian Arctic, beluga whales have been observed reacting to noise from ships underway at extremely long distances of 35-50 km (Finley *et al*. 1990; Cosens and Dueck 1993). By contrast, observations of beluga whales in Cook Inlet have reported very little response to industrial activities. Blackwell and Greene (2002) reported belugas traveling within a few meters of the hull of a vessel near the POA as tugs prepared to guide it out into Cook Inlet. Although belugas may have become habituated to industrial noises in Cook Inlet, studies have shown that in certain cases the whales will exhibit behavioral changes. Stewart (2012) studied the interactions between belugas and small boat noise in Knik Arm in an effort to document the belugas' responses to boat presence. On several occasions during this study, changes in group behavior of whales to small boats were observed; these include diving, increased travel speed, and reversing course. Anecdotal reports indicate that Cook Inlet beluga whales rapidly exited streams in upper Turnagain Arm when small watercraft approached them.

Shelden (1994) describes two types of breathing responses exhibited by belugas selected for pursuit and subsequent tagging. One response, termed the “slow roll,” is similar to typical beluga surfacing behavior, where the animal's head appears and recedes as the back appears and arches out of the water. In animals displaying a “head lift,” behavior, the head appears momentarily, and is not followed by appearance of the back or other body parts. The head-lift is seldom or never seen by PSOs monitoring non-harassed whales (B. Easley-Appleyard, *pers. comm*.) and suggests that the animal is taking a quick breath, then continuing to flee from the pursuing boat (in this case, the vessel carrying researchers intent on capturing the whale for tagging). Fifteen percent of the animals exposed to vessel pursuit and tagging attempts were observed to “slow roll” throughout their pursuit, while 59 percent exhibited only "head lift" behavior. The remaining 26 percent exhibited almost equal preference for the two types of surfacing behavior (Shelden 1994). This observation may indicate that some animals are more stressed than others by the pursuit vessel. However, because this head-lifting behavior has only ever been observed in belugas that were stressed, one can infer that head-lifting by belugas is an indicator of stress due to harassment (albeit not necessarily acoustic harassment).

Along the Kvichak River in the Alaska Peninsula, belugas feeding on red salmon (*Oncorhynchus nerka*) smolts continued to feed when surrounded by fishing vessels and resisted dispersal even when purposely harassed by motorboats or small explosive charges (Fish and Vania, 1971). The belugas may have learned to associate the fishing vessels with food reward and to tolerate annoying sounds in the presence of sufficient reward. However, when initially exposed to loud playbacks of killer whale sounds during incoming tides, these belugas turned immediately when the sound began and swam directly out of the river against the strong tide (Fish and Vania, 1971).

Results of the Fish and Vania (1971) playback experiments further indicate that free-living belugas are capable of rapid learning in response to novel sounds. By the 8th playback trial, about half of the ~100 whales exposed to playbacks of killer whale calls continued upstream, but on the opposite side of the river, along a shallow sandbar; the others turned and headed downstream. The authors speculate that some animals possibly learned from the previous transmissions to avoid the side of the river where the sound projector was located. They also report (from aerial reconnaissance) that numerous whales remained well down the river out of view during the transmissions. These results further illustrate individual variability of response of belugas in the same population.

In summary, belugas’ response to vessels can result in temporary displacement of some individuals. Belugas are capable of adapting quickly, and there is little evidence that belugas have abandoned significant portions of their range because of vessel traffic or in-water noise. It is worth noting, however, that belugas are observed in the Kenai River prior to and after, but not during, the summer salmon fishing season (Shelden *et al.* 2015; Castellote *et al*. 2016). This may be evidence of temporary habitat abandonment during a period of high fishing vessel presence.

Given the existing level of ship traffic in Cook Inlet and the action area (Figure 19), the additional physical disturbance from CIPL Project activities will not markedly add to the existing overall level of vessel disturbance, but would add to the level of vessel activity and human disturbance in the action area. Given the relatively stationary and prolonged (108 days) presence of CIPL Project activities in a beluga travel corridor, some beluga responses are likely to occur, including those that are not readily detectable by humans (see section 7.3). Similarly, the prolonged presence of noise-producing activities in one area increases the likelihood that Mexico DPS humpback whales and western DPS Steller sea lions, although rare in upper Cook Inlet, will encounter harassing levels of noise sufficient to cause a significant disruption in behavioral patterns (e.g., migration out of the area in a manner similar to that exhibited by bowhead whales [see section 7.2]).

7.3. Stress Response

In addition to observable responses to disturbance, more subtle changes may occur within marine mammals. Possibly the most important unobservable impacts arise from the prolonged or repeated activation of the stress response (Wright *et al*. 2009). Stress can be defined as a perturbation to homeostasis. When the perturbation is frequent or persistent (chronic), the stress response can be pathological. Chronic stress can lead to changes in the response to infectious, allergic, inflammatory, and autoimmune diseases (Webster *et al.* 1977) and can also suppress reproduction (Rabin *et al*. 1988), inhibit growth (Diegez *et al*. 1988), and alter metabolism (Mizrock 1995). Increasing levels of human activity in the marine environment could increase the likelihood of inducing chronic stress in cetaceans and other marine mammals. Coastal species will be especially vulnerable due to the concentration of human activity in these areas. As Wright *et al.* (2009) suggest, the possibility that endangered marine mammals might express chronic stress similarly to humans may explain, at least in part, why some species have not recovered after protective measures have been put into place.

Rolland *et al.* (2012) present clear evidence of an association between exposure to low-frequency ship noise and chronic stress in whales. Reduced ship traffic in the Bay of Fundy, Canada, following the events of September 11, 2001, resulted in a 6 dB decrease in underwater noise, with a significant reduction below 150 Hz. This noise reduction was associated with decreased baseline levels of stress-related fecal hormone metabolites (glucocorticoids) in North Atlantic right whales (*Eubalaena glacialis*).

CIPL Project activities that could induce a stress response include project-related noise and in-water human activities occurring at slack tide periods (section 6.3.1.). Due to its relatively short duration of project-related noise and in-water human activities, that will only occur during the 108-day construction period, the CIPL Project in and of itself is unlikely to induce chronic stress in Cook Inlet belugas or other marine mammals. However, it does contribute to the overall anthropogenic soundscape in Cook Inlet.

7.4. Habituation/Individual Variation

Habituation

"Habituation" has been defined as "the gradual weakening of a response to a recurring stimulus" (Domjan 2005). Marine mammals, like other mammals, show habituation to many signals that initially cause an overt reaction. However, it is possible for overt responses to weaken without an associated reduction in physiological response (Wright and Kuczaj 2007).

Some of the clearest evidence of behavioral habituation comes from attempts to use sound sources to keep marine mammals away from an area or a resource (Jefferson and Curry, 1996). Acoustical harassment devices have been used in an attempt to keep pinnipeds away from aquaculture facilities and fishing equipment. Although initially effective, over time some of the devices became less able to deter harbor seals (*Phoca vitulina*), presumably because of habituation (Mate and Harvey, 1987) but also because of a change in seal behavior in which the animals spend more time swimming with their heads out of the water when they are in intense sound fields. Seals and California sea lions (*Zalophus californianus*) even habituate to "seal bombs" that can have peak sound pressure levels of 220 dB re 1 µPa at 1 m (Mate and Harvey, 1987; Myrick *et al*., 1990). As stated above, belugas along the Alaska Peninsula resisted dispersal even when purposely harassed by motorboats or small explosive charges (Fish and Vania 1971).

In an experimental study of habituation in marine mammals, Cox *et al.* (2001) showed that when initially exposed to a 10-kHz pinger with a source level of 132 dB, harbor porpoises tended to react with avoidance at a distance of 208 m. This avoidance distance dropped by 50% within 4 days, and porpoise sightings within 125 m equaled control values within 10-11 days.

Habituation may vary among whale species. Watkins (1986) summarized 25 years of observations of whale responses near Cape Cod to whale-watching boats and other vessels. Minke whales (*Balaenoptera acutorostrata*) changed from frequent positive interest to generally uninterested reactions. Fin whales (*B. physalus*) changed from mostly negative to uninterested reactions. Humpbacks (*Megaptera novaeangliae*) changed dramatically from mixed responses that were often negative to often strongly positive reactions, and right whales continued the same variety of responses with little change. Gray whales wintering in San Ignacio Lagoon are less likely to flee from whale-watching boats later in the season than they are shortly after arriving in the lagoon (Jones and Swartz, 1984).

In all these examples, factors in addition to habituation could have contributed to the observed changes. For example, Richardson *et al*. (1987) report that bowheads return to the same areas of the Canadian Beaufort Sea year after year even though seismic surveys occur annually at the same time. Whether there are particularly dense concentrations of prey in these areas or whether the bowheads' response is simply historical philopatry is unknown. Recall, however, that fall migrating bowheads showed pronounced deflection from migratory routes during seismic activity in the Beaufort Sea off Alaska (Richardson *et al*. 1999) (see section 7.2). Research on killer whale (*Orcinus orca*) response to an acoustic harassment device to prevent long-line depredation indicated habituation to the device even though exposure to the sound it produces may result in potentially harmful hearing damage (Tixier *et al*. 2015). Western DPS Steller sea lions regularly use acoustically-degraded habitats within Kodiak Harbor, Kodiak, Alaska, and around Dutch Harbor on Unalaska Island in Alaska.

Individual Variation

Individual responses of marine mammals may vary depending on previous experiences, activity at the time of the noise, and noise characteristics. For example, Funk *et al*. (2010) noted behavioral variation in the responses of ringed and bearded seals in the Chukchi Sea to vessels. Forty percent of observed seals showed no response to a vessel's presence, slightly more than 40 percent swam away from the vessel, and 5 percent swam towards the vessel (the movements of 13 percent of the seals were unidentifiable). Twiss *et al*. (2012) reported that female grey seals (*Halichoerus grypus*) showed consistent individual differences in their responsiveness to pups, both with and without disturbing stimuli. Both "proactive" and "reactive" mothers also varied, but were individually consistent in their rates of pup-checking.

Beluga whales within a population have also shown individual variation in behavior. In studying responses of belugas to vessel traffic in the St. Lawrence River, Blane and Jaakson (1994) note older animals were more likely to react to vessels than younger ones. In Cook Inlet, three satellite-tagged beluga whales showed defined preferences for different locations within the Inlet throughout the study (Laidre *et al.* 2017). Belugas in the Beaufort Sea exhibit habitat segregation during the open-water season, according to sex, age, and reproductive status (Loseto *et al*. 2006). These characteristics of beluga social structure reflect differences in foraging ecology, risk of predation, and reproduction.

Although not studied in depth, gender differences in response to disturbance are likely to exist among cetaceans. Certainly, male-female differences in aggression have been documented for cetaceans, with females generally exhibiting less aggression (Scott *et al*. 2005; Fury *et al*. 2013; Baker and Herman 1984). Behavioral differences in feeding areas (sexual segregation) have also been noted for a number of cetaceans (Laidre *et al.* 2009; Fury *et al*. 2013; Subramanian *et al*. 1987).

In summary, behavioral and physiological responses to noise and other disturbances by marine mammals within a population may vary widely, depending on the animal's age, sex, reproductive status, resource requirements, previous experience, and perhaps even "personality."

8.0 CUMULATIVE EFFECTS

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area (50 CFR 402.02). Future Federal actions that may be related to the proposed action but will require separate consultation pursuant to section 7 of the ESA are not considered in this section.

Some continuing non-Federal activities are reasonably certain to contribute to global climate change within the action area. However, distinguishing climate change contributions to the environmental baseline versus future cumulative effects is nearly impossible. Therefore, all relevant future climate-related environmental conditions in the action area are described in the environmental baseline (Section 5.7).

8.1 Fisheries

Fishing, a major industry in Alaska, is expected to continue in Cook Inlet. As a result, there will be continued risk of prey competition, ship strikes, harassment, entanglement in fishing gear, and potential displacement from summer foraging habitat for Cook Inlet beluga whales (e.g., waters within and near the outlets of the Kenai and Kasilof Rivers during salmon season) (Castellote *et al*. 2016; Figure 22). ADF&G will continue to manage fish stocks and monitor and regulate fishing in Cook Inlet to maintain sustainable stocks. An important remaining unknown is the extent to which Cook Inlet beluga prey is made less available due to commercial, subsistence, personal use, and sport fishing either by direct removal of the prey or by human-caused habitat avoidance. Gathering data on this threat near the mouths of salmon and eulachon spawning streams is especially important.

8.2 Oil and Gas Development

It is very likely that oil and gas development will continue in Cook Inlet, with associated risks to marine mammals from seismic activity, vessel and air traffic, well drilling operations, wastewater discharge, habitat loss, and potential for oil spills, natural gas leaks, and well blowouts. Any such proposed development or response to oil spills and gas leaks would undergo ESA section 7 consultation. Therefore the associated effects are not "cumulative effects" pursuant to the ESA.

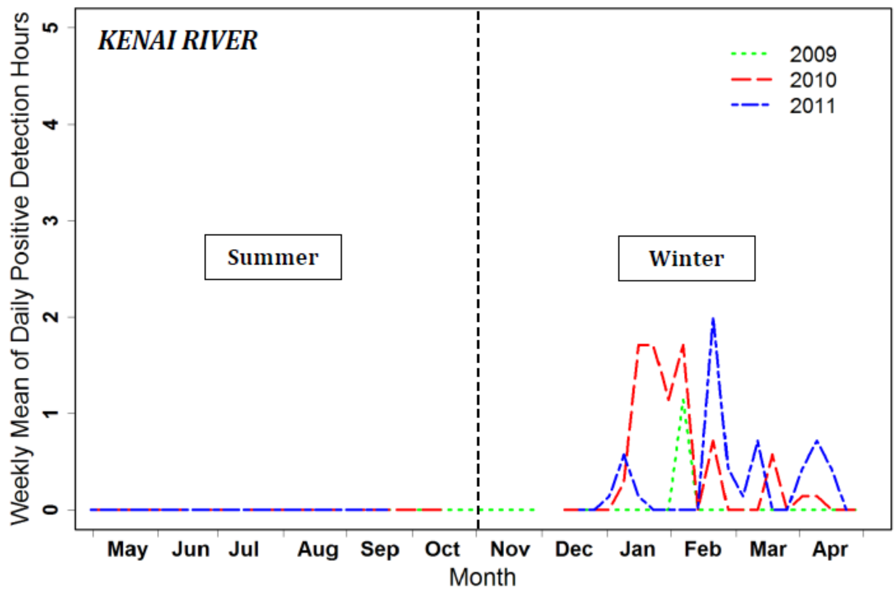

Figure 22. Acoustic detections of Cook Inlet belugas in the Kenai River from 2009 through 2011. From Castellote *et al*. (2016).

8.3 Coastal Development

Alaska population projections anticipate about a 34 percent growth in the populations of Anchorage/Mat-Su and the Kenai Borough over the next 30 years (Robinson *et al*. 2016). As the population continues to grow, coastal development will continue to result in the loss of habitat, increased vessel traffic, increased pollutants, and increased noise associated with construction and maintenance activities. Any projects requiring Federal authorization or funding (e.g., Chuitna Coal Mine, ORPC Tidal Energy Projects, POA expansions) will undergo section 7 consultation. However as populations in the area increase, coastal development with unspecified impacts to Cook Inlet are likely to occur.

A concomitant of increasing human population growth is projected increase in recreational fishing and boating in Cook Inlet. Watercraft have been observed to harass belugas in the Twentymile River during April. It is likely that such harassment also occurs during late summer coho salmon runs in the same area. NMFS is cooperating with partners to assess the degree to which such boating activities may be a cause for concern due to the associated potential reduction in beluga foraging opportunities.

8.4 Pollution

Pollutants entering Cook Inlet are likely to increase as the human population around the Inlet continues to grow. Hazardous materials may be released into Cook Inlet from vessels, aircraft, surface runoff, and wastewater facilities. Petrochemicals could spill from vessels traveling within the action area, or could migrate into the action area from nearby spills. Nonpoint sources of pollution, such as municipal runoff, can pass from streets, construction and industrial areas, and airports into Cook Inlet. However, the EPA and the ADEC will continue to regulate the amount of pollutants that enter Cook Inlet from point and nonpoint sources through NPDES/APDES permits. As a result, permittees will be required to verify they meet permit standards, and potentially upgrade facilities, in accordance with permit renewal requirements.

8.5 Tourism

There are no commercial whale-watching companies operating in upper Cook Inlet. The popularity of whale watching and the close proximity of beluga whales to Anchorage make it possible that such operations may exist in the future. Vessel-based whale-watching, should it occur, would likely stress the beluga population by increasing intrusion into beluga habitat not ordinarily accessed by many boats. The small size and low profile of beluga whales, and the poor visibility within the Cook Inlet waters, may increase the temptation for whale watchers to approach the beluga whales more closely than recommended for marine mammals. However, it is unlikely this industry will reach the levels of intensity seen elsewhere because of upper Cook Inlet's climate and navigation hazards (e.g., shallow waters, extreme tides, and currents). We are aware that some aircraft have circled around groups of Cook Inlet beluga whales, disrupting their diving and possibly feeding activities (NMFS, unpublished data). NMFS has undertaken outreach efforts to educate local pilots of the potential consequences of such actions, providing guidelines encouraging pilots to maintain altitudes of 1500 feet over belugas and not to circle over them.

8.6 Subsistence Hunting

Alaska Natives do not currently hunt Cook Inlet belugas, but can hunt harbor seals and Steller sea lions in Cook Inlet for subsistence purposes. Such hunts are typically boat-based and could temporarily increase noise in the environment and increase the potential for strikes of Cook Inlet belugas and other marine mammals. Any future hunts of Cook Inlet belugas will require a Federal authorization and are not considered under the ESA definition of cumulative effects. There is no subsistence harvest of humpback whales in Cook Inlet. Harvests of harbor seals and western DPS Steller sea lions occur under co-management agreements with NMFS, and occur at or well below sustainable levels of harvest.

9.0 INTEGRATION AND SYNTHESIS

In this section, we synthesize the direct and indirect effects of the CIPL Project on Cook Inlet beluga whales, Mexico DPS humpback whales, and western DPS Steller sea lions, and integrate these effects with the environmental baseline and cumulative effects. We then consider the implication of those effects on the continued existence of these species. In particular, we examine the scientific data available to determine whether there may be responses to the effects of the project that are likely to have consequences for the individual's growth, survival, and annual or lifetime reproductive success. Any reduction in these parameters for an individual whale or sea lion could incrementally affect the viability of the entire listed species.

In this Biological Opinion, we have used the best available scientific data to evaluate the consequences to listed marine mammals from the CIPL Project. Our assessment considers: (1) the status of the populations; (2) population trends; (3) the species' documented reactions to harassment; (4) the consequence of these reactions to individuals; (5) the impact of those individual reactions to the species; and (6) the degree of uncertainty in the relationship between harassment and changes in the species' probability of survival and recovery.

Cook Inlet beluga whale population viability analyses, using a suite of assumptions, predict a risk of extinction between 0-38% within 50 years and 1-71% within 100 years (Hobbs *et al*. 2015). Nearly all models projecting extinction within 50 years included an assumption of unusual mortality events occurring. Our lack of some basic life history parameters as input to these models hinders their accuracy and precision. The lack of basic life history also hinders our ability to determine the causes for the lack of recovery in this species, despite the removal of what is widely considered the cause of its severe population decline (unregulated subsistence hunting). The consequence of uncertainty is our inability to strategically target recovery efforts that would best promote the species recovery. In the absence of this information, a prudent management approach is to minimize or avoid Type II errors. Type II errors include errors of commission, such as concluding that an animal was not affected by a stressor when it was affected. In situations with many uncertainties, we minimize Type II errors by taking a precautionary approach. That is, we assume an effect that *may* occur actually *will* occur, and we then analyze whether the level of take that will occur from those effects is reasonably expected to impact the survival and recovery of the species.

9.1. Cook Inlet Beluga Whales

As we have detailed in previous biological opinions (e.g., NMFS 2016d, 2017c) and conservation documents (NMFS 2008a, 2016b), the baseline condition for Cook Inlet beluga whales is characterized by: (1) very low abundance; (2) lack of recovery; and (3) some degree of probability of extinction within the next 50-100 years under certain conditions (Hobbs *et al*. 2015). Very small additions to annual mortality can increase the likelihood of extinction or shorten the time to extinction. Concurrently, this population faces continuing natural and anthropogenic threats, and has displayed an unexpected lack of recovery despite the discontinuation of unregulated subsistence harvest.

Our review of the cumulative effects to Cook Inlet beluga whales found an unquantified intensity of threats from activities for which no ESA Section 7 consultation would occur. Unregulated harassment is likely occurring as a result of vessel traffic, aircraft overflights, and other actions by humans. However, there are no data available to quantify the effects of this harassment. As we discussed, vessel traffic may temporarily displace Cook Inlet beluga whales from important feeding habitat near the mouths of certain salmon streams, and may injure them by strikes with boat hulls or propellers. Ship strikes have been implicated as the cause of death for very few Cook Inlet beluga whales. Although many stranding investigations are inconclusive regarding cause of death, at least one stranded beluga showed trauma consistent with what one would expect from a collision with a boat hull (NMFS unpublished data).

While beluga whales are likely being subjected to take under the environmental baseline and through cumulative effects, such takes are thought to be mostly due to harassment and disturbance by noise. We are currently unable to quantify the effects of this harassment to extinction risk probabilities for this DPS. However, a reasonable impact assessment and jeopardy analysis can still be conducted by considering the status of the population, population trends, the species' reactions to harassment, and the consequence of that reaction to individuals, and by extension, to the DPS.

NMFS (2018b) anticipates that authorization of the activities associated with the proposed Cook Inlet Pipeline Cross-Inlet Extension Project, which is one component of the CIPL Project, may result in the exposure of 40 Cook Inlet beluga whales (about 12.2 percent of the population) to sounds above the MMPA Level B harassment threshold. The most likely manifestations of this take by harassment would be temporary changes in behavior (e.g., increases in diving rate, diversions around the project area) or physiological state (e.g., increased levels of stress hormones) from which animals would presumably return to their normal behavioral or physiological states shortly after cessation of exposure to harassing levels of noise. There are no known data to indicate whether these behavioral and physiological changes, should they occur, would have negative consequences to individual beluga whales' fitness (i.e., growth, survival, or reproductive success), which could result in population-level consequences to survival or recovery of this DPS; such data would be extremely difficult to gather for a wild population.

As previously indicated, factors that may affect beluga recovery include prey availability, access to foraging areas, contaminants, disease, direct mortality events (e.g., ship strikes, researcher induced take), stranding events, and killer whale predation. It is unlikely that the proposed CIPL Project will affect belugas due to non-acoustic behavioral disturbance, vessel strikes, entanglement, or seafloor disturbance because of the limited temporal and spatial nature of project-specific construction activities, the low likelihood of significant numbers of beluga whales using the action area during the construction activities, and, even if present, the implementation of mitigation and monitoring measures. Similarly, the effects of stressors resulting from this project on each of the five PBFs of Cook Inlet beluga whale critical habitat were found to be insignificant or discountable, and we concurred with the determination that the project was not likely to adversely affect Cook Inlet beluga whale critical habitat. Accordingly, potential non-acoustic effects from construction activities, as well as the long-term presence of the completed pipelines, are not likely to appreciably reduce the reproduction, numbers, or distribution of Cook Inlet beluga whales.

However, the CIPL Project may affect individual beluga whales through acoustic harassment from vessels and associated noise-producing activities because they will likely be exposed to acoustic stressors of a magnitude and duration that results in a response (startle, flight, elevation of deleterious hormone levels) that could significantly disrupt resting or migrating, but will not significantly disrupt breeding, feeding, or sheltering due to the project location.

On integrating the effects from the proposed CIPL Project on Cook Inlet beluga whales with the environmental baseline and cumulative effects, we expect that up to 40 beluga whales may be acoustically harassed by project activities (as per the Incidental Harassment Authorization's estimate of take associated with this project). Acoustic harassment associated with this project will likely result in short-term behavioral and/or physiological changes. Beluga whales are highly unlikely to be killed or injured by this project, and Level A take is not authorized, so a reduction in numbers is unlikely. Acoustic harassment is expected to be localized and temporary, and so a reduction in beluga whale distribution and reproduction is also not likely.

Take resulting from this project is not likely to have measurable population-level effects to the Cook Inlet beluga whale. Accordingly, we do not expect the proposed CIPL Project to affect survival or recovery of Cook Inlet beluga whales such that their continued existence is likely to be jeopardized.

Furthermore, the project includes additional experimental measures that will potentially provide net longer-term benefits to the species, including:

- development and testing of less impactful monitoring methods (UAS monitoring versus vessel-based monitoring), which may be effectively implemented in future projects;
- obtaining information on acoustic transmission of various project components and possibly beluga response (vocalizations) during project construction; and
- decommissioning of the Drift River Terminal and decrease of tanker traffic across Cook Inlet, as has been long recommended by the Cook Inlet Regional Citizens Advisory Council (Nuka 2015), which would reduce risks of associated spills from the storage terminal, in the event of a natural catastrophe, and from tanker spills crossing Cook Inlet.

9.2 Western DPS Steller Sea Lions and Mexico DPS Humpback Whales

NMFS (2018b) estimates that the CIPL Project could result in exposure of one Mexico DPS humpback whale and six western DPS Steller sea lions to acoustic harassment. In our effects analysis (Section 6) we conclude that project-caused adverse effects associated with hearing impairment, acoustic masking, vessel strike, entanglement, seafloor disturbance, and non-acoustic disturbance are not likely to be significant to humpback whales including Mexico DPS humpback whales and western DPS Steller sea lions.

However, the CIPL Project may affect up to one Mexico DPS humpback whale and up to six western DPS Steller sea lions through acoustic harassment from vessels and associated noise-producing activities because they will likely be exposed to acoustic stressors of a magnitude and duration that results in a response (startle, flight, elevation of deleterious hormone levels) that significantly disrupts resting or migrating, but will not significantly disrupt breeding, feeding, or sheltering due to the spatial separation of the project from known breeding sites or feeding habitat for both species.

In sum, due to the limited project footprint and duration during construction, the low likelihood of exposure from project activities to the species given their unlikely presence in the action area, and, even if present in the action area, the implementation of monitoring and mitigation measures, the CIPL Project is not likely to reduce the reproduction, numbers, or distribution of humpback whales including Mexico DPS humpback whales and western DPS Steller sea lions and therefore will not reduce appreciably the likelihood of survival and recovery of these species.

Although all three species considered in this Opinion could be adversely affected by petrochemical spills or other unauthorized discharges possibly resulting from the CIPL Project, such discharges are outside the scope of this Opinion. We note, however, that Harvest Alaska LLC plans to adhere to all provisions of their recently updated Oil Discharge Prevention and Contingency Plan, their recently revised Integrity Management Plan, and all ADEC permit requirements when conducting the CIPL Project. Harvest Alaska LLC intends to implement the best available spill detection and prevention technology (see section 2.4) for the CIPL Project on a continuing basis.

10.0 CONCLUSION

After reviewing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS's biological opinion that the proposed issuances of a Corps permit authorizing the Cook Inlet Pipeline Cross-Inlet Extension component of the CIPL Project and an IHA authorizing Level B harassment of 40 Cook Inlet belugas, five humpback whales (one of which could be a Mexico DPS individual), and six Steller sea lions is not likely to jeopardize the continued existence of the Cook Inlet beluga whale (*Delphinapterus leucas*), Mexico DPS humpback whale[23] (*Megaptera novaeangliae*), or western DPS Steller sea lion (*Eumetopias jubatus*). In addition, the proposed action is not likely to adversely affect designated Cook Inlet beluga whale critical habitat. The action agencies determined that their actions would not affect Western North Pacific DPS humpback whales or Steller sea lion critical habitat.

11.0 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA prohibits the take of endangered species unless there is a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity (50 CFR 402.02).

As discussed in the *Approach to the Assessment* section of this opinion NMFS interprets the ESA term "harass" in a manner similar to the USFWS regulatory definition for non-captive wildlife to mean: to "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns, which include, but are not limited to, breeding, feeding, or sheltering" (Wieting 2016).

Under the terms of Section 7(b)(4) and Section 7(o)(2) of the ESA, taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA, provided that such taking is in compliance with the terms and conditions of an Incidental Take Statement (ITS).

The MMPA defines Level B "harassment" as: any act of pursuit, torment, or annoyance which has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing,

[23]Although the IHA applies to five humpback whales, take authorized by the issuance of our Incidental Take Statement applies only to ESA-listed species. For humpback whales, authorized take applies only to Mexico DPS humpback whales.

breeding, feeding, or sheltering (16 U.S.C. § 1362(18)(A)(i)). For this consultation, PR1 and the Corps anticipate that any take will be by Level B harassment only. No Level A takes are contemplated or authorized.

Section 7(b)(4)(C) of the ESA provides that if an endangered or threatened marine mammal is involved, the taking must first be authorized by Section 101(a)(5) of the MMPA. Accordingly, the terms of this incidental take statement and the exemption from Section 9 of the ESA become effective only upon the issuance of MMPA authorization to take the marine mammals identified here. Absent such authorization, this incidental take statement is inoperative.

The terms and conditions described below are nondiscretionary. PR1 and the Corps have a continuing duty to regulate the activities covered by this ITS. If these agencies (1) fail to require Harvest Alaska LLC to adhere to the terms and conditions of the ITS and/or (2) fail to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

11.1 Amount or Extent of Take

ESA Section 7 regulations require NMFS to estimate the number of individuals that may be taken by proposed actions, or use a surrogate if we cannot assign numerical limits for animals that could be incidentally taken during the course of an action (50 CFR § 402.14(i)(1); see also 80 FR 26832 (May 11, 2015)).

This incidental take statement does not exempt take resulting from accidental oil spill or gas release.

The proposed IHA for the CIPL Project considers potential harassment from the collective activities of vessels, divers, and equipment working in a concentrated area for an extended period of time. Essentially, the action area will become a concentrated work area in an otherwise non-industrial setting. Unlike projects involving discrete noise sources with known potential to harass marine mammals (*e.g.*, pile driving, seismic surveys), both the noise sources and impacts from the CIPL Project are less well documented and may range from MMPA Level B harassment to exposures that do not result in harassment under the ESA.

In Section 6 of this Opinion, and summarized in Section 9, we conclude that only acoustic disturbance from the CIPL Project is expected to result in take of Cook Inlet beluga whales, Mexico DPS humpback whales, and western DPS Steller sea lions. All other project-related effects are not expected to be consequential to these species or to Cook Inlet beluga whale critical habitat.

Cook Inlet beluga whales are much more likely to occur in the action area than are Mexico DPS humpback whales or western DPS Steller sea lions. As indicated in the Response Analysis (Section 7 of this Opinion), beluga responses to vessels, noise, and other disturbing elements in their environment has been shown to vary widely, depending on location, previous experience, habituation, potentially gender, and physiological state. Therefore, it is likely that some individual Cook Inlet beluga whales may exhibit more significant behavioral disruptions than others in response to CIPL Project activities.

PR1 estimated, based on the best available information, that 40 Cook Inlet beluga whales, six western DPS Steller sea lions, and one Mexico DPS humpback whale will be exposed to activities from the CIPL Project that may cause harassment under the MMPA. As discussed in section 3.0 above, under the ESA we interpret the term "harass" as to "Create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." By comparison, Level B harassment is defined in the MMPA and associated regulations (50 CFR 216.3) to mean:

> "Any act of pursuit, torment, or annoyance which has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering."

We lack sufficient information to distinguish whether the proposed activities that have a potential to disturb listed marine mammals (per the MMPA definition of Level B harassment) are likely to significantly disrupt normal behavioral patterns (per the ESA definition of harass) for all of the marine mammals that PR1 estimates will be exposed to Level B harassment. In section 9.0, we indicated that for threatened and endangered species, taking a precautionary approach that minimizes Type II errors is warranted. Using the levels of take PR1 calculated for this project will minimize the chance of assuming that take will not occur when in fact it may occur. Therefore, we adopt PR1's take estimates in this ITS.

11.2 Effect of the Take

Although the biological significance of the expected behavioral responses of Cook Inlet beluga whales, Mexico DPS humpback whales, and Western DPS Steller sea lions remains unknown, this consultation has assumed that exposure to disturbances associated with the CIPL Project might disrupt one or more behavioral patterns that are essential to an individual animal's life history. However, any behavioral responses to project-associated disruptions are not expected to affect the reproduction, survival, or recovery of these species.

The taking of Cook Inlet beluga whales, Mexico DPS humpback whales, and Western DPS Steller sea lions will be by incidental (acoustic) harassment only.

In Section 10 of the Opinion associated with this Incidental Take Statement, we conclude that this level of take by harassment, in addition to other effects of the proposed action, is not likely to jeopardize the continued existence of Cook Inlet beluga whales, Mexico DPS humpback whales, or western DPS Steller sea lions.

11.3 Reasonable and Prudent Measures (RPMs)

"Reasonable and prudent measures" are nondiscretionary measures necessary or appropriate to minimize the amount or extent of incidental take (50 CFR 402.02). This Incidental Take Statement is valid only for the activities described in this biological opinion, and which have been authorized under section 101(a)(5) of the MMPA.

The RPMs included below, along with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. NMFS concludes that the following RPMs are necessary and appropriate to minimize or to monitor the incidental take of Cook Inlet beluga whales, Mexico DPS humpback whales, and western DPS Steller sea lions resulting from the proposed action.

1. The Corps and the Permits Division must require Harvest Alaska LLC to conduct operations in a manner that will minimize impacts to Cook Inlet beluga whales, Mexico DPS humpback whales, and western DPS Steller sea lions that occur within or in the vicinity of the project action area.

2. The Corps and the Permits Division must require Harvest Alaska LLC to implement a comprehensive monitoring program to ensure that Cook Inlet beluga whales, Mexico DPS humpback whales, and western DPS Steller sea lions are not taken in numbers or in a manner not anticipated by this biological opinion. The results of monitoring shall be provided to NMFS AKR in the form of robust and complete monitoring reports.

3. The Corps and the Permits Division must require Harvest Alaska LLC to provide all marine mammal monitoring data and metadata in a digital form that is readily accessible and compatible with industry standard software.

10.4 Terms and Conditions

"Terms and conditions" implement the reasonable and prudent measures (50 CFR 402.14). These must be carried out for the exemption in section 7(o)(2) to apply.

In order to be exempt from the prohibitions of section 9 of the ESA, NMFS Permits Division, the Corps, or Harvest Alaska LLC must comply with the following terms and conditions (T&Cs), which implement the RPMs described above, as well as the mitigation measures set forth in Section 2 of this Opinion. These measures are non-discretionary and must be a binding condition of the Permits Division's and Corps' authorizations for the exemption in section 7(o)(2) to apply. If these Federal agencies (1) fail to require the authorization holder to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the authorization, and/or (2) fail to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse. These terms and conditions constitute no more than a minor change to the proposed action; they are consistent with the basic design of the proposed action and are compatible with the 4MP submitted by Harvest Alaska LLC (Appendix 1).

To implement RPM #1:

A. The taking of Cook Inlet beluga whales, Mexico DPS humpback whales, and Western DPS Steller sea lions shall be by incidental (acoustic) harassment only. Taking by serious injury or death is prohibited and may result in the modification, suspension, or revocation of this ITS.
B. NMFS Permits Division and the Corps must require Harvest LLC to comply with all Best Available Technologies for leak detection and prevention, as summarized in Sections 2.4 of this Opinion and included in the Harvest Alaska LLC Integrity management Plan, as required by PHMSA.

C. NMFS Permits Division and the Corps must require Harvest Alaska LLC to comply with all components of their ODPCP for the project, when it is approved by ADEC.
D. UAS monitoring plans associated with the CIPL Project will be coordinated with NMFS PR1 and NMFS AKR prior to implementation, to ensure minimal effects to listed species.

To implement RPM #2*:*

A. NMFS Permits Division and the Corps must require Harvest Alaska LLC to comply with all mitigation and monitoring measures as outlined in Section 2 of this Opinion, and as specified in Appendix 1 to this Opinion and in the final IHA issued for the CIPL Project.
B. NMFS Permits Division and the Corps must require Harvest Alaska LLC to submit monthly observer reports, a final observer report, and completed marine mammal observation record forms during the project. Items 1.1 through 1.4 below provide details about what must be included in the reports.
   - 1.1. The reporting period for each monthly observer report will be the entire calendar month, and reports will be submitted by close of business on the 5th business day of the month following the end of the reporting period (e.g., the monthly report covering May 1 through 31, 2018, will be submitted to NMFS Alaska Region by close of business (i.e., 5:00 pm, AKST) on June 7, 2018).
     - 1.1.1. Completed and well-documented marine mammal observation records, in standard electronic format, must be provided to NMFS Alaska Region in monthly reports.
     - 1.1.2. Observer report data must include the following for each listed marine mammal observation (or "sighting event" if repeated sightings are made of the same animal[s]):
       - 1.1.2.1. Species, date, and time for each sighting event
       - 1.1.2.2. Number of animals per sighting event and number of adults/juveniles/calves/pups per sighting event
       - 1.1.2.3. Primary, and, if observed, secondary behaviors of the marine mammals in each sighting event
       - 1.1.2.4. Geographic coordinates for the observed animals, with the position recorded by using the most precise coordinates practicable (coordinates must be recorded in decimal degrees, or similar standard, and defined coordinate system)
       - 1.1.2.5. Time of most recent project activity prior to marine mammal observation
       - 1.1.2.6. Environmental conditions as they existed during each sighting event, including, but not limited to:
         - 1.1.2.6.1. Beaufort Sea State
         - 1.1.2.6.2. Weather conditions
         - 1.1.2.6.3. Visibility (km/mi)
         - 1.1.2.6.4. Lighting conditions
         - 1.1.2.6.5. Percentage of ice cover
     - 1.1.3. Observer report data must also include the following for each exposure of a marine mammal that occurs in the manner and extent as described in this Opinion:
       - 1.1.3.1. All information listed under Item 1.1.2, above

1.1.3.2. Cause of the exposure (e.g., Cook Inlet beluga whale observed within Level B harassment zone during CIPL Project activities)
1.1.3.3. Time the animal(s) entered the zone, and, if known, the time it exited the zone
1.1.3.4. Mitigation measures implemented prior to and after the animal entered the zone

1.2. A final technical report must be submitted to NMFS Alaska Region within 90 days after project completion. The report must summarize all project activities and results of marine mammal monitoring conducted during project activities. The final technical report must include all elements from Item 1.1, above, as well as:
1.2.1. Summaries that include monitoring effort (e.g., total hours, total distances, and marine mammal distribution through the study period, accounting for sea state and other factors that affect visibility and detectability of marine mammals)
1.2.2. Analyses on the effects from various factors that influences detectability of marine mammals (e.g., sea state, number of observers, fog, glare, etc.)
1.2.3. Species composition, occurrence, and distribution of marine mammal sightings, including date, water depth, numbers, age/size/sex categories (if determinable), group sizes, and ice cover
1.2.4. Species composition, occurrence, and distribution of marine mammal takes, including date, water depth, numbers, age/size/sex categories (if determinable), group sizes, and ice cover
1.2.5. Analyses of effects of project activities on listed marine mammals
1.2.6. Number of marine mammals observed and taken (by species) during periods with and without project activities (and other variables that could affect detectability), such as:
1.2.6.1. Initial sighting distances versus project activity at time of sighting
1.2.6.2. Observed behaviors and movement types versus project activity at time of sighting
1.2.6.3. Numbers of sightings/individuals seen versus project activity at time of sighting
1.2.6.4. Distribution around the action area versus project activity at time of sighting

1.3. If unauthorized take occurs, (i.e., Level B exposure of any ESA-listed species greater than that authorized in the IHA for the CIPL Project or Level A exposure of any listed marine mammal), it must be reported to NMFS AKR within one business day to the contact listed in Item 1.4, below. Observation records for ESA-listed marine mammals taken in a manner or to the extent described in this Opinion must include:
1.3.1. All information listed under Item 1.1, above
1.3.2. Number of listed animals taken
1.3.3. Date and time of each take
1.3.4. Cause of the take
1.3.5. Time the animal(s) entered the zone, and, if known, the time it exited the zone
1.3.6. Mitigation measures implemented prior to and after the animal entered the zone

1.4. NMFS Contacts:
Monthly and final reports and reports of unauthorized take must be submitted to:
NMFS Alaska Region, Protected Resources Division

Greg Balogh
Greg.balogh@noaa.gov
907-271-3023 or 907-271-5006

To implement RPM #3:

Digital records, including data required by term and condition 1.1-1.4, photos, maps, images and associated metadata, of observations made by PSOs associated with this project must be made available to NMFS. All data and associated metadata will be submitted to NMFS AKR in a form that can be directly imported into Excel or similar industry-standard spreadsheet software.

12.0 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

1. To the maximum extent practicable, NMFS PR1 and the Corps should encourage CIPL Project operators to schedule operations during daylight hours and conditions of good visibility.

2. To the maximum extent practicable, NMFS PR1 and the Corps should encourage CIPL Project PSOs to carefully note and report Cook Inlet beluga behavior (e.g., residency within a specific area, milling behavior, etc.) during slack tide periods. If possible, observations should be compared when in-water project activities (e.g., diver presence) are occurring versus when they are not.

3. Harvest Alaska LLC should continue their proactive collaboration with NMFS in gathering information on acoustic measurements of project-generated sounds and beluga vocalizations in the project vicinity. We encourage Harvest Alaska LLC to consider further in-depth analyses of these efforts as preliminary results become available.

In order to keep NMFS's Protected Resources Division informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, Harvest Alaska LLC should notify NMFS of any conservation recommendations they implement in their final action.

13.0 REINITIATION OF CONSULTATION

As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action on listed species or designated critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount of incidental take is exceeded, section 7 consultation must be reinitiated immediately.

14.0 DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

Section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-554) (Data Quality Act (DQA)) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

14.1 Utility

This document records the results of an interagency consultation. The information presented in this document is useful to two agencies of the federal government (NMFS and Corps), and the general public. These consultations help to fulfill multiple legal obligations of the named agencies. The information is also useful and of interest to the general public as it describes the manner in which public trust resources are being managed and conserved. The information presented in these documents and used in the underlying consultations represents the best available scientific and commercial information and has been improved through interaction with the consulting agency.

This consultation will be posted on the NMFS Alaska Region website http://alaskafisheries.noaa.gov/pr/biological-opinions/. The format and name adhere to conventional standards for style.

14.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

14.3 Objectivity

- ***Standards:*** This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the ESA Consultation Handbook, ESA Regulations, 50 CFR Part 402.
- ***Best Available Information:*** This consultation and supporting documents use the best available information, as referenced in the literature cited section. The analyses in this opinion contain more background on information sources and quality.
- ***Referencing:*** All supporting materials, information, data, and analyses are properly referenced, consistent with standard scientific referencing style.
- ***Review Process:*** This consultation was drafted by NMFS staff with training in ESA implementation, and reviewed in accordance with Alaska Region ESA quality control and assurance processes.

15.0 REFERENCES

ABR 2017. Protected-Species Monitoring Report. 2017 Ship Creek Boat Launch Repairs Project, Anchorage, Alaska. Final Report Prepared for R & M Consultants, Inc. 17+ pp.

Alaska Department of Fish & Game 2008. Beluga Whale. https://www.adfg.alaska.gov/static/education/wns/beluga_whale.pdf

Alaska Department of Environmental Conservation (ADEC) 2012. Pipeline Leak Detection Technology 2011 Conference Report. Final Report, March 2012. 30+ pp. https://dec.alaska.gov/spar/ppr/docs/Final%20PLD%20Technology%202011%20Conference%20Report%20March%202012%20-%20Revised%20041912.pdf

ADEC 2018. Spill Prevention and Response Database. Accessed 3/8/2018. http://dec.alaska.gov/Applications/SPAR/PublicMVC/PERP/SpillSearch

Alaska Department of Labor and Workforce Development. 2017. Research and Analysis: 2014 Population by borough/census area and economic region. Viewed 03/05/2018 at: http://live.laborstats.alaska.gov/pop/

ADNR. 2018. Active Oil and Gas Lease Inventory as of 3/4/2018. http://dog.dnr.alaska.gov/Documents//Leasing/PeriodicReports/Lease_LASActiveLeaseInventory.pdf

Apache. 2012. Monthly Monitoring Report for Cook Inlet 3D Seismic Program conducted in Trading Bay, Cook Inlet from June 1 – 30, 2012 by SAExploration. July 5, 2012.

Au, W. W. L. 2000. Hearing in whales and dolphins: An overview. Pages 1-42 *in* W. W. L. Au, A. N. Popper, and R. R. Fay, editors. Hearing by Whales and Dolphins. Springer-Verlag, New York.

Au, W. W. L., A. A. Pack, M. O. Lammers, L. M. Herman, M. H. Deakos, and K. Andrews. 2006. Acoustic properties of humpback whale songs. Journal of the Acoustical Society of America **120**:1103-1110.

Awbrey, F.T., and B.S. Stewart. 1983. Behavioral responses of wild beluga whales (*Delphinapterus leucas*) to noise from oil drilling. J. Acoustical Society of America. 74, S54 (1983); https://doi.org/10.1121/1.2021025

Awbrey, F.T., J.A. Thomas and R. Kastelein. 1988. Low-frequency underwater hearing sensitivity in belugas (Delhinapterus leucas). J. Acous. Soc. Amer. 84 (6):2273-5.

Baggaley, K. 2016. We Know Why The Midshipman Fish Sings. Pop. Sci. September 22, 2016. https://www.popsci.com/why-the-midshipman-fish-sings

Batten, S.D. and D.L. Mackas. 2007. A continuous plankton recorder survey of the North Pacific and southern Bering Sea. North Pacific Research Board. Final Report 601.

Bettridge, S., C. S. Baker, J. Barlow, P. J. Clapham, M. Ford, D. Gouveia, D. K. Mattila, R. M. Pace, III, P. E. Rosel, G. K. Silber, and P. R. Wade. 2015. Status review of the humpback whale (Megaptera novaeangliae) under the Endangered Species Act. U.S. Dep. Commer., NOAA Tech. Memo. NMFSSWFSC-540, 240+ pp.

Blackwell, S. B. and C. R. Greene. 2002. *Acoustic measurements in Cook Inlet, Alaska, during August 2001*. Report prepared by Greeneridge Sciences Inc., Santa Barbara, California for National Marine Fisheries Service, Anchorage Alaska.

Blane, J.M. and R. Jaakson. 1994. The impact of ecotourism boats on the St. Lawrence beluga whales. Environmental Conservation 21(3): 267-9.

Braham, H. W., R. D. Everitt, and D. J. Rugh. 1980. Northern sea lion decline in the eastern Aleutian Islands. J. Wildl. Manage. 44:25-33.

Broad W.J. 2012. A Rising Tide of Noise Is Now Easy to See. New York Times December 10, 2012. http://www.nytimes.com/2012/12/11/science/project-seeks-to-map-and-reduce-ocean-noise-pollution.html?pagewanted=all

Bureau of Ocean Energy Management (BOEM). 2016. Alaska OCS Region, "Draft Environmental Impact Statement, Vol. 1; Cook Inlet Planning Area, Oil and Gas Lease Sale 244, Cook Inlet Alaska; OCS EIS/EA BOEM 2016-004, June 2016. Anchorage, Alaska. 350 pp.

Calkins, D. G., and K. W. Pitcher. 1982. Population assessment, ecology and trophic relationships of Steller sea lions in the Gulf of Alaska. Outer Continental Shelf Environmental Assessment Program, U. S. Department of the Interior.

Calkins, D.G. 1989. Status of belukha whales in Cook Inlet. pp. 109-112 in Gulf of Alaska, Cook Inlet, and North Aleutian Basin information update meeting (L.E. Jarvela and L.K. Thorsteinson, eds.). Anchorage, AK, 7-8 1989. U.S. Department of Commerce, NOAA, Outer Continental Shelf Environmental Assessment Program.

Cape International Inc. 2012. Cook Inlet Vessel Traffic Study, Report to Cook Inlet Risk Assessment Advisory Panel. http://www.cookinletriskassessment.com/documents/120206CIVTSvFINAL.pdf

Casper BM, Popper A.N., F. Matthews, T.J. Carlson, and M.B. Halvorsen. 2012. Recovery of Barotrauma Injuries in Chinook Salmon, *Oncorhynchus tshawytscha* from Exposure to Pile Driving Sound. PLoS ONE 7(6): e39593.

Castellote M and Fossa F. 2006. Measuring acoustic activity as a method to evaluate welfare in captive beluga whales (*Delphinapterus leucas*). Aquatic Mammals 32(3): 325-333.

Castellote M., T.A. Mooney. L.T. Quackenbush, R.C. Hobbs, C. Goertz and E. Gaglione. 2014. Baseline hearing abilities and variability in wild beluga whales (*Delphinapterus leucas*). J.Exptl. Biol 217: 1682-91.

Castellote, M., R. J. Small, J. Mondragon, J. Jenniges, and J. Skinner. 2015. Seasonal Distribution and Foraging Behavior of Cook Inlet Belugas Based on Acoustic Monitoring. Final Wildlife Research Report ADF&G/DWC/WRR–2016–3. 45 pp.

Castellote, M., B. Thayre, M. Mahoney, J. Mondragon, C. Schmale, and R. J. Small. 2016. Anthropogenic noise in Cook Inlet beluga habitat: sources, acoustic characteristics, and frequency of occurrence. Alaska Department of Fish and Game, Final Wildlife Research Report, ADF&G/DWC/WRR-2016-4, Juneau.

CH2M. 2016. Anchorage Port Modernization Program, Test Pile Program Report of Findings. Final Report, October 2016. 56 pp.

Christian, J.R., A. Mathieu, and R.A. Buchanan. 2004. Chronic effects of seismic energy on snow crab (*Chionoecetes opilio*). Environmental Studies Research Funds Report No. 158, Calgary, AB.

CIRCAC (Cook Inlet Regional Citizens Advisory Council) 2012. Position paper on the future of Drift River Oil Terminal. July 11, 2012. https://www.circac.org/wp-content/uploads/councilpositionpaper7-12.pdf

Clark, C.W. and W.T. Ellison. 2004. Potential use of low-frequency sounds by baleen whales for probing the environment: Evidence from models and empirical measurements. Pages 564-589 in J.A.Thomas, C.F. Moss and M. Vater, eds.Echolocation in Bats and Dolphins. University of Chicago Press, Chicago, IL.

Colbeck. G.J., P. Duchesne, L.D. Postma, V. LeSage, M.O. Hammill and J. Turgeon. 2013. Groups of related belugas (*Delphinapterus leucas*) travel together during their seasonal migrations in and around Hudson Bay. Proc. Biol. Sci. v.280(1752); 2013 Feb 7. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3574313/

Cornick, L. and Seagars, D.J. 2016. Final Report: Anchorage Port Modernization Project Test Pile Program. Technical report by AECOM for Kiewit. 28pp.

Cosens, S.E., and L.P. Dueck. 1988. Responses of migrating narwhal and beluga to icebreaker traffic at the Admiralty Inlet ice-edge, N.W.T. in 1986. Pp. 39-54 in Port and Ocean Engineering Under Arctic Conditions, Volume II, W.M. Sackinger *et al*., eds. Geophysics Institute, University of Alaska, Fairbanks, 111 pp.

Crowley, T. J. 2000. Causes of climate change over the past 1000 years. Science 289:270-277.

Davis, .A., D. Thomson, and C.I. Malme. 1998. Environmental assessment of seismic exploration of the Scotian Shelf. Unpublished Report by LGL Ltd., environmental research associates, King City, ON and Charles I. Malme, Engineering and Science Services, Hingham, MA for Mobil Oil Canada Properties Ltd, Shell Canada Ltd., and Imperial Oil Ltd.

Eaton, R.L. 1974. A beluga whale imitates human speech. Carnivore. 2: 22–23.

ECHO 2017. An Analysis of Humpback Whale Calls in the Presence of Ships. ECHO Program Study Summary. 2 pp. https://www.portvancouver.com/wp-content/uploads/2017/01/Humpback-whale-calling-rates.pdf

ECO49 2018a. Request for Incidental Harassment Authorization: CIPL Cross Inlet Extension Project. Dated January 29, 2018, revised and re-submitted February 19, 2018. 98 pp.

ECO49 2018b. Biological Assessment: Cook Inlet Pipeline Project. February 2018. 87+ pp.

Edds-Walton, P. L. 1997. Acoustic communication signals of mysticete whales. Bioacoustics-the International Journal of Animal Sound and Its Recording **8**:47-60.

Eley D. W. 2012. *Cook Inlet Vessel Traffic Study*. Report to Cook Inlet risk assessment advisory panel. 3300 Foster Avenue, Juneau, Alaska.

Federal Aviation Administration (FAA) 2016. Alaskan Region Aviation Fact Sheet. January 2016. https://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/air_traffic_services/artcc/anchorage/media/Alaska_Aviation_Fact_Sheet.pdf

Finley, K.J., G.W. Miller, R.A. Davis, and C.R. Greene. 1990. Reactions of belugas, (Delphinapterus leucas) and narwhals (Monodon monoceros) to ice-breaking ships in the Canadian high arctic. Canadian Bulletin of Fisheries and Aquatic Science 224:97- 117.

Finneran, J.J., R. Dear, D.A. Carder, and S.H. Ridgway. 2002. Temporary shift in masked hearing thresholds in odontocetes after exposure to single underwater impulses from a seismic watergun. Journal of the Acoustical Society of America 111:2929-2940.

Finneran, J.J., D. A. Carder, R. Dear, T. Belting, J. McBain, L. Dalton, and S. H. Ridgway. 2005. Pure tone audiograms and possible aminoglycoside-induced hearing loss in belugas (*Delphinapterus leucas*). J. Acoust. Soc. Am. 117:3936-3943.

Finneran, J.J. and C.E. Schlundt. 2004. Effects of intense pure tones on the behavior of trained odontocetes. Report of the Space and Naval Warfare Systems Center, San Diego, California, 15pp

Fish, J.F. and J.S. Vania. 1971. Killer whale (Orcinus orca) sounds repel white whales (Delphinapterus leucas). Fishery Bulletin 69:531-535. https://www.st.nmfs.noaa.gov/spo/FishBull/69-3/fish.pdf

Friedman, W.R. 2006. Environmental Adaptations of the Beluga Whale (*Delphinapterus leucas*). http://pages.ucsd.edu/~johnson//text/Friedman_BelugaOverview.pdf

Garland, E.C., M. Castellote, and C.L. Berchok. 2015. Beluga whale (*Delphinapterus leucas*) vocalizations and call classification from the eastern Beaufort Sea population. J Acoust. Soc. Am. 137(6):3054.

Geraci, J.R. and D.J. St. Aubin. 1982. Study of the Effects of Oil on Cetaceans. Final Report. Washington, DC: USDOI, BLM. 274 pp.

Geraci, J.R. 1990.Physiological and Toxic Effects on Cetaceans. Chapter 6. Pp 167-197 In: Sea mammals and Oil: Confronting the Risks. Academic Press.

Goetz, K.T., R.A Montgomery, J.M. Ver Hoef, R.C. Hobbs, and D.S. Johnson. 2012. Identifying essential summer habitat of the endangered beluga whale *Delphinapterus leucas* in Cook Inlet, Alaska. End. Species Res. 16:135-147.

Greenlaw, C.F., D.V. Holliday, R.E. Pieper, and M.E. Clark. 1988. Effects of air gun energy releases on the northern anchovy. Journal of the Acoustical Society of America 84:S165.

Halvorsen, M.B., B.M. Caspar, C.M. Woodley, T.J. Carlson and A.N. Popper. 2012. Threshold for Onset of Injury in Chinook Salmon from Exposure to Impulsive Pile Driving Sounds. PLOS ONE, June 20, 2012. http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0038968

Hansen, D. J. 1985. The Potential Effects of Oil Spills and Other Chemical Pollutants on Marine Mammals Occurring in Alaskan Waters. USDOI, MMS, Alaska OCS Region, Anchorage, AK.

Helweg, D.A., D.S. Houser and P.W.B. Moore. 2000. An Integrated Approach to the Creation of a Humpback Whale Hearing Model. U.S. Navy, SSC San Diego Technical Report 1835. 11 pp.

HDR. 2015. Marine mammal monitoring report, Seward Highway MP 75-90 geotechnical activities, Turnagain Arm, Alaska, April 6-June7, 2015. 82 pp.

HEMMERA 2014. Roberts Bank Terminal 2 Technical Data Report. Underwater Noise: Ship Sound Signature Analysis Study. DRAFT December 2014. http://www.robertsbankterminal2.com/wp-content/uploads/RBT2-Ship-Sound-Signature-Analysis-Study-TDR.pdf

Hilcorp 2017a. Hilcorp Energy Company/Harvest Pipeline Company/ Hilcorp Alaska, LLC/ Harvest Alaska, LLC. Hazardous Liquids Pipeline Integrity Management Program (CONFIDENTIAL). July 20, 2017, Revision 10.

Hilcorp 2017b. Weekly Reports, Middle Ground Shoal Platform Natural Gas Pipeline Release, May-June 2017.

Hobbs, R.C., and K.E.W. Shelden. 2008. Supplemental status review and extinction assessment of Cook Inlet belugas (*Delphinapterus leucas*). AFSC Processed Report 2008-08. Alaska Fisheries Science Center, National Maine Fisheries Service, NOAA. 76 pp.

Hobbs, R. C., K. E. W. Shelden, D. J. Rugh, C. L. Sims, and J. M. Waite. 2015. Estimated abundance and trend in aerial counts of beluga whales, *Delphinapterus leucas*, in Cook Inlet, Alaska, 1994-2012. Mar. Fish. Rev. 77(1):11-31. DOI: dx.doi.org/10.7755/MFR.77.1.2.

Hobbs, R.C., P.R. Wade, and K.E.W. Shelden. 2015. Viability of a small, geographically-isolated population of beluga whale, Delphinapterus leucas: effects of hunting, predation, and mortality events in Cook Inlet, Alaska. Marine Fisheries Review. 77: 59-88.

Holt, M.M., D.P. Noren, V. Veirs, C.K. Emmons and S. Veirs. 2009. Speaking up: Killer whales (Orcinus orca) increase their call amplitude in response to vessel noise. J. Acoust. Soc. Am. 125: JASA Express Letters EL28-32.

Houser, D.S., D.A. Helweg and P.W.B. Moore. 2001. A Bandpass filter-bank model of auditory sensitivity in the humpback whale. Aquatic Mammals 27(2): 82-91.

Houghton, J. 2001. The science of global warming. Interdisciplinary Science Reviews 26:247-257.

Huntington, H.P. 2000. Traditional knowledge of the ecology of belugas, *Delphinapterus leucas,* in Cook Inlet, Alaska. Marine Fisheries Review 62(3):134–140.

Illingworth and Rodkin. 2014. *Cook Inlet Exploratory Drilling Program – underwater sound source verification assessment, Cook Inlet, Alaska*. Prepared for BlueCrest Energy, Inc. by Illingworth & Rodkin, Inc., Petaluma, California.

IPCC. 2014. Climate change 2014: Impacts, adaptation, and vulnerability. IPCC Working Group II contribution to AR5. Intergovernmental Panel on Climate Change.

Jacobs Engineering Group, Inc. 2017. Biological Evaluation for Offshore Oil and Gas Exploratory Drilling in the Kitchen Lights Unit, Cook Inlet, Alaska. Submitted March 2017. 157 pp.

Jeffries, K.M., S.G. Hinch,T. Sierocinski, T.D. Clark, E.J. Eliason, M.R. Donaldson, S. Li, P. Pavlidis and K.M. Miller. 2012. Consequences of high temperatures and premature mortality on the transcriptome and blood physiology of wild adult sockeye salmon (*Oncorhynchus nerka*). Ecol and Evol. 2(7): 1747–1764. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3434914/

Karl, T.R., J.M. Melillo, and T.C. Peterson (eds). 2009. Global climate change impacts in the United States. Cambridge University Press.

Kendall, L.S. 2010. Construction Impacts on the Cook Inlet Beluga Whale (*Delphinapterus leucas*) at the Port of Anchorage Marine Terminal Redevelopment Project. MS Thesis, Alaska Pacific University, May, 2010. 88pp.

Kendall, L.S., A. Sirovic, and E. H. Roth. 2014. Effects of construction noise on the Cook Inlet beluga whale (*Delphinapterus leucas*) vocal behavior. Canadian Acoustics **41**:3-13.

Kendall, L.S., K. Lomac-MacNair, G. Campbell, S. Wisdom, and N. Wolf. 2015. SAExploration 2015 Cook Inlet 3D Seismic Surveys Marine Mammal Monitoring and Mitigation Report. Prepared for National Marine Fisheries Service Permits and Conservation Division Office of Protected Resources 1315 East-West Highway Silver Spring, MD 20910, National Marine Fisheries Service, Alaska Region Protected Resources Division 222 W. 7th Ave, #43, Anchorage, AK 99513, and U.S. Fish and Wildlife Service 1011 East Tudor Rd. Anchorage, AK 99503. Prepared by Fairweather Science 301 Calista Court, Anchorage, AK 99518. 12.18.2015.

Ketten, D. R. 1997. Structure and function in whale ears. Bioacoustics-the International Journal of Animal Sound and Its Recording **8**:103-135.

Klishin, V. O., V. V. Popov, and A. Y. Supin. 2000. Hearing capabilities of a beluga whale, *Delphinapterus leucas*. Aquatic Mammals 26, 212-228.

Laidre, K. L., K. E. W. Shelden, D. J. Rugh, and B. Mahoney. 2000. Beluga, *Delphinapterus leucas*, distribution and survey effort in the Gulf of Alaska. Mar. Fish. Rev. 62(3):27-36.

Laist, D. W., A. R. Knowlton, J. G. Mead, A. S. Collet, and M. Podesta. 2001. Collisions between ships and whales. Marine Mammal Science **17**:35-75.

Lammers, M.O., M. Castellote, R.J. Small, S. Atkinson, J. Jenniges, A. Rosinski, J.N. Oswald, and C. Garner. 2013. Passive acoustic monitoring of Cook Inlet beluga whales (*Delphinapterus leucas*). Journal of the Acoustical Society of America 134:2497-25014.

Lésage V, Barrette C, Kingsley MCS and Sjare B. 1999. The effect of vessel noise on the vocal behavior of belugas in the St. Lawrence river estuary, Canada. Marine Mammal Science, 15(1): 65-84.

Lomac-MacNair, K., M.A. Smultea and G. Campbell. 2014. Draft NMFS 90-Day Report for Marine Mammal Monitoring and Mitigation during Apache's Cook Inlet 2014 Seismic Survey, 2 April – 27 June 2014. Prepared for Apache Alaska Corporation, 510 L Street #310, Anchorage AK 99501. Prepared by Smultea Environmental Sciences (SES), P.O. Box 256, Preston, WA 98050.

Lomac-MacNair, K.S., M.A. Smultea, M.P. Cotter, C. Thissen, and L. Parker. 2016. Socio-sexual and Probable Mating Behavior of Cook Inlet Beluga Whales, Delphinapterus leucas, Observed From an Aircraft. Marine Fisheries Review 77(2), 32-39.

Loughlin, T. R., D. J. Rugh, and C. H. Fiscus. 1984. Northern sea lion distribution and abundance: 1956-1980. J. Wildl. Manage. 48:729-740.

Markowitz, T., and T. McGuire, eds. 2007. Temporal-spatial distribution, movements and behavior of beluga whales near the Port of Anchorage, Alaska. Prepared for Integrated Concepts and Research Corporation and the U.S. Department of Transport Maritime Administration by LGL Alaska Research Associates, Inc., Anchorage, Alaska. 93 pp. https://alaskafisheries.noaa.gov/sites/default/files/poa2007tempspacialmovements.pdf

Maruska, K.P. and A.F. Mensinger. 2009. Acoustic characteristics and variations in grunt vocalizations in the oyster toadfish *Opsanus tau.* Environ Biol Fish (2009) 84:325–337.

McCarthy, J. J. 2001. Climate change 2001: impacts, adaptation, and vulnerability: contribution of Working Group II to the third assessment report of the Intergovernmental Panel on Climate Change. Cambridge University Press.

Merrick, R. L., R. Brown, D. G. Calkins, and T. R. Loughlin. 1995. A comparison of Steller sea lion, Eumetopias jubatus, pup masses between rookeries with increasing and decreasing populations. Fish. Bull., U.S. 93:753-758.

Moore, S.E., K.E.W. Shelden, L.K. Litzky, B.A. Mahoney, and D.J. Rugh. 2000. Beluga, *Delphinapterus leucas*, habitat associations in Cook Inlet. Alaska. Marine Fisheries Review 62(3):60–80.

Morgan DW. 1979. The vocal and behavioural reactions of the beluga whale, *Delphinapterus leucas*, to playback of its sounds. In (HE Winn and BL Olla, Eds.), Behaviour of marine animals: Current perspectives in research. Vol. 3: Cetaceans (pp. 311-343). New York: Plenum Press. 346 pp.

Murray, N.K. and F.H. Fay. 1979. The white whales or belukhas, *Delphinapterus leucas*, of Cook Inlet, Alaska. University of Alaska Fairbanks. Draft prepared for June 1979 meeting of the Sub-committee on Small Cetaceans of the Scientific Committee of the International Whaling Commission.

Muto, M.M., V.T. Herker, R.P. Angliss, B.A. Allen, P.L. Boveng, J.M. Breiwick, M.F. Cameron, P.J. Clapham, S.P. Dahle, M.E. Dalheim, B.S. Fadely, M.C. Ferguson, L.W. Fritz, R.C Hobbs, Y.V. Ivashchenko, A.S. Kennedy, J.M. London, S.A. Mizrock, R.R. Ream, E.L. Richmond, K.E.W. Sheldon, R.G. Towell, P.R. Wade, J.M. Waite and A.N. Zerbini. 2017. Alaska Marine Mammal Stock Assessments, 2016. NOAA-TM-AFSC-355. Revised 12/30/2016. Dated June 2017. http://www.nmfs.noaa.gov/pr/sars/pdf/ak_2016_final_sars_june.pdf

NASEM (The National Academies of Sciences, Engineering, and Medicine). 2017. *Review of the Draft Climate Science Special Report*. Washington, DC: The National Academies Press. doi: https://doi.org/10.17226/24712.

Neff, J. M. 1990. Composition and Fate of Petroleum and Spill-Treating Agents in the Marine Environment. Pages 1-33 *in* J. R. Geraci and D. J. St. Aubin, editors. Sea Mammals and Oil: Confronting the Risks. Academic Press, New York, NY.

Neilson, J. L., C. M. Gabriele, A. S. Jensen, K. Jackson, and J. M. Straley. 2012. Summary of reported whale-vessel collisions in Alaskan waters. Journal of Marine Biology:106282.

Nemeth, M.J., C.C. Kaplan, A.M. Prevel-Ramos, G.D. Wade, D.M. Savarese, and C.D. Lyons. 2007. Baseline studies of marine fish and mammals in Upper Cook Inlet, April through October 2006. Final report prepared by LGL Alaska Research Associates, Inc., Anchorage, Alaska for DRven Corporation, Anchorage, Alaska.

Neilson, J. L., C. M. Gabriele, A. S. Jensen, K. Jackson, and J. M. Straley. 2012. Summary of reported whalevessel collisions in Alaskan waters. J. Mar. Biol. 2012: Article ID 106282. 18 pp. https://www.hindawi.com/journals/jmb/2012/106282/

NMFS 2007. EA on the Issuance of IHAs to Conoco Phillips and Union Oil Company to take marine mammals incidental to seismic operations in northwestern Cook Inlet Alaska. https://alaskafisheries.noaa.gov/sites/default/files/analyses/seismicsurveyea033007.pdf

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

NMFS. 2010. Endangered Species Act Section 7 consultation on the U.S. Environmental Protection Agency's proposed approval of the State of Alaska's mixing zone regulation section of the State of Alaska Water Quality Standards. 75pp.

NMFS 2012. Guidance Document: Sound Propagation Modeling to Characterize Pile Driving Sounds Relevant to Marine Mammals. http://www.westcoast.fisheries.noaa.gov/publications/protected_species/marine_mammals/killer_whales/esa_status/characterize_sound_propagation_modeling_guidance_memo.pdf

NMFS. 2016a. Occurrence of Distinct Population Segments (DPSs) of Humpback Whales off Alaska. National Marine Fisheries Service, Alaska Region. Revised December 12, 2016. https://alaskafisheries.noaa.gov/sites/default/files/humpback_guidance.pdf

NMFS. 2016b. Recovery Plan for the Cook Inlet Beluga Whale (*Delphinapterus leucas*). National Marine Fisheries Service, Alaska Region, Protected Resources Division, Juneau, AK.

NMFS. 2016c. Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Dept. of Commer., NOAA. NOAA Technical Memorandum NMFS-OPR-55, 178 pp. Optional User Spreadsheet: http://www.nmfs.noaa.gov/pr/acoustics/Acoustic%20Guidance%20Files/march_v1.1_blank_spreadsheet.xlsx

NMFS 2016d. Endangered Species Act Section 7(a)(2) Biological Opinion for Seismic Surveys of Cook Inlet, Alaska, by Apache Alaska Corporation, 2016-2021. 159 pp.

NMFS 2017a. Beluga Whale (*Delphinapterus leucas*). NOAA Fisheries website. Updated January 5, 2017. http://www.nmfs.noaa.gov/pr/species/mammals/whales/beluga-whale.html

NMFS 2017b. Letter of Concurrence for Barge dock repair, Port MacKenzie, Matanuska-Susitna Borough, POA-1979-412, Upper Cook Inlet. May 15, 2017.

NMFS 2018a. Proposed incidental harassment authorization; request for comments: Taking Marine Mammals Incidental to the Cook Inlet Pipeline Cross Inlet Extension Project. 83

FR 8437- 8456. https://www.gpo.gov/fdsys/pkg/FR-2018-02-27/pdf/2018-03885.pdf
NMFS 2018b. Draft Final incidental harassment authorization: Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to the Cook Inlet Pipeline Cross Inlet Extension Project. Unpublished draft.Norman, S. A. 2011. Nonlethal anthropogenic and environmental stressors in Cook Inlet beluga whales (*Delphinapterus leucas*). Report prepared for NOAA Fisheries, National Marine Fisheries Service, Anchorage, Alaska. NMFS contract no. HA133F-10-SE-3639. 113 pp. https://alaskafisheries.noaa.gov/sites/default/files/sn_nonlethalstressors0911.pdf
Oil and Gas 360. 2017. Alaska Oil: Drilling the Cook Inlet Again. Closing bell Story, December 1, 2017. https://www.oilandgas360.com/alaska-oil-drilling-cook-inlet/
Oreskes, N. 2004. The scientific consensus on climate change. Science 306:1686-1686.
Payne, K., and R. Payne. 1985. Large scale changes over 19 years in songs of humpback whales in Bermuda. Zeitschrift fur Tierpsychologie **68**:89-114.
Persily, L. 2016. Weak market could delay Alaska LNG project. Aklaska Business, February 19, 2016. http://www.akbizmag.com/Oil-Gas/Weak-market-could-delay-Alaska-LNG-project/
Popper, A.N. and M.C. Hastings. 2009. The effects of human-generated sound on fish. Integ. Zool. 4: 43-52.
Popper, A.N. and A.D. Hawkins. 2018. The importance of particle motion to fishes and invertebrates. The Journal of the Acoustical Society of America 143: 470-488.
Price, M. 2018. Snapping shrimp close their claws so quickly, they create shock waves. Sci. Mag. Jan. 22, 2018. http://www.sciencemag.org/news/2018/01/snapping-shrimp-close-their-claws-so-quickly-they-create-shock-waves-video-reveals-how.
Reich, D.A., R. Balouskus, D.F. McCay, J Fontenault, J. Rowe, Z. Singer-Leavitt, D.S. Etkin, J. Michel, Z. Nixon, C. Boring, M. McBrien, and B. Hay. 2014. Assessment of marine oil spill risk and environmental vulnerability for the State of Alaska. NOAA Contract Number WC133F-11-CQ-0002. Prepared for the Department of Commerce, National Oceanic and Atmospheric Administration. 102p.
Reichmuth, C. and B.L. Southall. 2011. Underwater hearing in California sea lions (Zalophus californianus): Expansion and interpretation of existing data. Marine Mammal Science 28:358-393.
Richardson, W. J., C. R. Greene, Jr., C. I. Malme, and D. H. Thomson. 1995. Marine mammals and noise. Academic Press, Inc., San Diego, CA.
Ridgway, S. H., D. A. Carder, T. Kamolnick, R. R. Smith, C. E. Schlundt, and W. R. Elsberry. 2001. Hearing and whistling in the deep sea: depth influences whistle spectra but does not attenuate hearing by white whales (*Delphinapterus leucas*) (Odontoceti, Cetacea). J. Exp. Biol. 204, 3829-3841.
Rigzone 2012. Apache Deploying Wireless Seismic Technology in Alaska's Cook Inlet https://www.rigzone.com/news/oil_gas/a/120336/apache_deploying_wireless_seismic_technology_in_alaskas_cook_inlet/
Rolland, R.M., S.E. Parks, K.E. Hunt, M. Castellote, P.J. Corkeron, D.P. Nowacek, S.K. Wasser, and S.D. Kraus. 2012. Evidence that ship noise increases stress in right whales. Proc. Biol. Sci. 279: 1737. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3350670/
Romano, T.A., M.J. Keogh, C. Kelly, P. Feng, L. Berk, C.E. Schlundt, D.A. Carder, and J.J. Finneran. 2004. Anthropogenic sound and marine mammal health: measures of the nervous and immune systems before and after intense sound exposure. Canadian Journal

of Fisheries and Aquatic Sciences 61:1124-1134.
Ross, D. 1976. Mechanics of Underwater Noise. Pergamon Press, New York.
Rugh, D.J., K.E.W. Shelden, and B.A. Mahoney. 2000. Distribution of beluga whales, *Delphinapterus leucas,* in Cook Inlet, Alaska, during June/July 1993–2000. Marine Fisheries Review 62(3):6–21
Rugh, D. J., K. E. W. Shelden, C. L. Sims, B. A. Mahoney, B. K. Smith, L. K. Litzky, and R. C. Hobbs. 2005 (February). Aerial Surveys of Belugas in Cook Inlet, Alaska, June 2001, 2002, 2003, and 2004. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-AFSC-149.
Rugh, D.J., K.E.W. Shelden, and R.C. Hobbs. 2010. Range contraction in a beluga whale population. Endangered Species Research 12:69–75.
Saxon Kendall, LS, Širović A and Roth EH. 2013. Effects of construction noise on the Cook Inlet beluga whale (*Delphinapterus leucas*) vocal behavior. Canadian Acoustics. 41(3): 3-13.
Schusterman, R.J., R. Gentry and J. Schmook. 1966. Underwater Vocalization by Sea Lions: Social and Mirror Stimuli. Sci. 28 (154):540-542. http://science.sciencemag.org/content/154/3748/540
Shelden, K. E. W., D. J. Rugh, B. A. Mahoney, and M. E. Dahlheim. 2003. Killer whale predation on belugas in Cook Inlet, Alaska: implications for a depleted population. Mar. Mammal Sci. 19(3):529-544.
Shelden, K. E. W., D. J. Rugh, K. T. Goetz, C. L. Sims, L. Vate Brattström, J. A. Mocklin, B. A. Mahoney, B. K. Smith, and R. C. Hobbs. 2013 (December). *Aerial Surveys of Beluga Whales Delphinapterus leucas, in Cook Inlet, Alaska, June 2005 to 2012.* U. S. Department of Commerce, NOAA Technical Memorandum NMFS-AFSC-263.
Shelden, K. E. W, K. T. Goetz, D. J. Rugh, D. G. Calkins, B. A. Mahoney, and R. C. Hobbs. 2015. Spatio-temporal Changes in Beluga Whale, *Delphinapterus leucas*, Distribution: Results from Aerial Surveys (1977-2014), Opportunistic Sightings (1975-2014), and Satellite Tagging (1999-2003) in Cook Inlet, Alaska. Marine Fisheries Review 77:1-31.
Shelden, K. E. W., C. L. Sims, L. Vate Brattström, K. T. Goetz, and R. C. Hobbs. 2015. Aerial surveys of beluga whales (*Delphinapterus leucas*) in Cook Inlet, Alaska, June 2014. AFSC Processed Report 2015-03, 55 p. http://www.afsc.noaa.gov/Publications/ProcRpt/PR2015-03.pdf.
Shields, P., and A. Dupuis. 2017. Upper Cook Inlet Commercial Fisheries Annual Management Report, 2016. http://www.adfg.alaska.gov/FedAidPDFs/FMR17-05.pdf
SLR. 2017. Tyonek/Harvest Pipeline Project Underwater Noise Assessment March 13, 2017.
Smultea Environmental Sciences, LLC. 2016. Susitna Delta Exclusion Zone report for marine mammal monitoring and mitigation during ExxonMobile Alaska LNG LLC 2016 geophysical and geotechnical survey in Cook Inlet. 14pp.
Southall, B. L., A. E. Bowles, W. T. Ellison, J. J. Finneran, R. L. Gentry, C. R. Greene, Jr., D. Kastak, D. R. Ketten, J. H. Miller, P. E. Nachtigall, W. J. Richardson, J. A. Thomas, and P. L. Tyack. 2007. Marine mammal noise exposure criteria: initial scientific recommendations. Aquatic Mammals **33**:411-521.
Speckman, S.G., and J.F. Piatt. 2000. Historic and current use of lower Cook Inlet, Alaska, by belugas (*Delphinapterus leucas*). Marine Fisheries Review 62(3):22–26.
St. Aubin, D. J. 1988. Physiological and toxicologic effects on pinnipeds. Pages 120-142 *in* J. R. Geraci and D. J. St. Aubin, editors. Synthesis of Effects of Oil on Marine Mammals. U.S.

Department of the Interior, Minerals Management Service, Atlantic OCS Region, New Orleans, Louisiana.

Stewart, B.S., W.E. Evans, and F.T. Awbrey. 1982. Effects of man-made waterborne noise on behavior of belukha whales (Delphinapterus leucas) in Bristol Bay, Alaska. HSWRI Technical Report 82-145. Report from Hubbs/Sea World Research Institute, San Diego, CA, for the U.S. National Oceanic and Atmospheric Administration, Juneau, AK, 29 pp.

Stocker, T. F., Q. Dahe, and G.K. Plattner. 2013. Climate Change 2013: The Physical Science Basis. Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Summary for Policymakers (IPCC, 2013).

Stoeger, A.S., D. Mietchen, S. Oh, S. de Silva, C.T. Herbst, S. Kwon and W.T. Fitch. 2012. An Asian Elephant Imitates Human Speech. Report. Current Biology 22: 2144-48. http://www.cell.com/current-biology/pdf/S0960-9822(12)01086-X.pdf

Swails, K.S. 2005. Patterns of seal strandings and human interactions in Cape Cod, Massachusetts. Thesis submitted in partial fulfillment of the requirements for the Master of Environmental Management degree, Duke University. 24 pp.

Talberth, J. and E. Branosky. 2013. Oil & Gas Infrastructure in Cook Inlet, Alaska A Potential Public Liability? Center for Sustainable Economy, Preliminary Assessment of Cook Inlet DR&R Costs. http://sustainable-economy.org/potential-public-liability-for-fossil-fuel-infrastructure-in-cook-inlet/

Tixier, P., N. Gasco, G. Duhamel, and C. Guinet. 2015. Habituation to an acoustic harassment device (AHD) by killer whales depredating demersal longlines. ICES Journal of Marine Sci. 72(5):1673–1681. https://doi.org/10.1093/icesjms/fsu166

Tutka LLC. 2016. Port MacKenzie Dock Emergency Repair - Matanuska-Susitna Borough, Marine Mammal Monitoring Summary for April 2016. 2pp + Spreadsheet.

Tyack, P. L. 1999. Communication and cognition. In Biology of Marine Mammals. J.E. Reynolds III and S.A. Rommel eds. Smithsonian, Washington. pp. 287-323.

U.S. Army Corps of Engineers (USACE). 2008. Chemical Data Report, Anchorage Port Expansion Study, Anchorage Port Expansion, Anchorage, Alaska, NPDL WO#07-083, March 2008.

USACE-Dredging Operations and Environmental Research [DOER] 2001. Characterization of Underwater Sounds produced by Bucket Dredging Operations. https://alaskafisheries.noaa.gov/sites/default/files/erdc_dredge_noise_2001.pdf

U.S. Energy Information Administration (EIA). 2017. Alaska State Profile amd Energy Estimates Analysis. Last updated October 19, 2017. https://www.eia.gov/state/analysis.php?sid=AK

URS. 2007. Port of Anchorage Marine Terminal Development Project Underwater Noise Survey, Test Pile Driving Program, Anchorage, Alaska. December 2007. Prepared for Integrated Concepts & Research Corporation. 41+pp.

Vanderlaan, A. S. M., and C. T. Taggart. 2007. Vessel collisions with whales: The probability of lethal injury based on vessel speed. Marine Mammal Science **23**:144-156.

Wade, P. R., T. J. Quinn II, J. Barlow, C. S. Baker, A. M. Burdin, J. Calambokidis, P. J. Clapham, E. Falcone, J. K. B. Ford, C. M. Gabriele, R. Leduc, D. K. Mattila, L. Rojas-Bracho, J. Straley, B. L. Taylor, J. Urbán R., D. Weller, B. H. Witteveen, and M. Yamaguchi. 2016. Estimates of abundance and migratory destination for North Pacific humpback whales in both summer feeding areas and winter mating and calving areas. Paper SC/66b/IA21 submitted to the Scientific Committee of the International Whaling

Commission, June 2016, Bled, Slovenia..
Wartzok, D. and D.R. Ketten. 1999. Marine mammal sensory systems, pp. 117-175. In: J.E. Reynolds, II and S.A. Rommel (eds.), Biology of marine mammals. Smithsonian Institute
Weilgart, L.S. 2007. The impacts of anthropogenic ocean noise on cetaceans and implications for management. Canadian Journal of Zoology 85:1091-1116.
Wieting, D. 2016. Interim Guidance on the Endangered Species Act Term "Harass". National Marine Fisheries Service, Office of Protected Resources. Silver Spring, MD. October 21, 2016.
Wiggin, M. (Deputy commissioner ADNR) 2017. ALASKA'S OIL & GAS INDUSTRY Overview & Activity Update. Powerpoint presentation, June 9, 2017. http://dog.dnr.alaska.gov/Documents/ResourceEvaluation/CookInlet-InteriorBasinCommonwealth-20170609.pdf
Yost, W.A. 2007. Fundamentals of Hearing: An Introduction. New York: Academic Press.
Zimmerman, T and S. Karpovich. 2008. Humpback Whale. Alaska Department of Fish and Game Fact Sheet