APPENDIX O

Biological Assessment

Federal Energy Regulatory Commission
Office of Energy Projects
Washington, DC 20426

Alaska LNG Project

Biological Assessment

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ACRONYMS AND ABBREVIATIONS

ADF&G	Alaska Department of Fish & Game
AFSC	Alaska Fisheries Science Center
AGDC	Alaska Gasline Development Corporation
ATBA	Areas to be Avoided
BA	Biological Assessment
BIA	biologically important areas
BLM	Bureau of Land Management
CFR	Code of Federal Regulations
CGF	Central Gas Facility
CIGGS	Cook Inlet Gas Gathering System
dB	decibels
dBA	decibels on the A-weighted scale
dB_{rms}	decibels root mean square
dB re 1 µPa (rms)	decibels relative to 1 microPascal root mean square
DCH	Designated Critical Habitat
DMT	direct micro-tunneling
DPS	Distinct Population Segment
EEZ	Exclusive Economic Zone
EIS	Environmental Impact Statement
ESA	Endangered Species Act of 1973
ESU	Evolutionarily Significant Unit
FAA	Federal Aviation Administration
FERC	Federal Energy Regulatory Commission
FR	Federal Register
GTP	Gas Treatment Plant
HLV	heavy lift vessel
IMO	International Maritime Organization
ITR	Incidental Take Regulations
IWC	International Whaling Commission
LAA	likely to adversely affect
LNG	Liquefied Natural Gas
LOA	Letters of Authorization
L_{pk}	peak pressure levels
µPa	microPascal
MGS	major gas sales
mi^2	square miles
MLLW	mean lower low water
MLV	mainline valve
MMPA	Marine Mammal Protection Act
MOF	material offloading facility
MP	milepost
NA	Not available
N/A	Not applicable
NLAA	not likely to adversely affect
NMFS	National Marine Fisheries Service
NMFS Technical Guidance	*Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing—Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts*
NOAA	National Oceanic and Atmospheric Administration

PBOSA	Prudhoe Bay Operations Staging Area
PBTL	Prudhoe Bay Unit Gas Transmission Line
PBU	Prudhoe Bay Unit
PCE	primary constituent element
PLF	Product Loading Facility
Polar Bear and Walrus Plan	Draft Project Polar Bear and Pacific Walrus Avoidance and Interaction Plan
Procedures	Project Wetland and Waterbody Construction and Mitigation Procedures
Project	Alaska LNG Project
PSO	protected species observer
PTMP	Point Thomson Unit as Transmission Line milepost
PTTL	Point Thomson Unit Gas Transmission Line
PTU	Point Thomson Unit
SEL	sound exposure level
Service	U.S. Fish and Wildlife Service and/or National Marine Fisheries Service
SOPEP	Shipboard Oil Pollution Emergency Plan
SPCC	Spill Prevention, Control, and Countermeasures
SPL	sound pressure level
SSV	sound source verification
SWPPP	Stormwater Pollution Prevention Plan
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

1.0 INTRODUCTION

Federal agencies, in consultation with the U.S. Fish and Wildlife Service (USFWS) and/or National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS), are required by the Endangered Species Act of 1973 (ESA) Section 7(a)(2) to ensure that any action authorized, funded, or carried out by the agency would not jeopardize the continued existence of a federally listed threatened or endangered species or species proposed for listing, or result in the destruction or adverse modification of designated critical habitat. As the lead federal agency for the proposed Alaska Liquefied Natural Gas (LNG) Project (Project), the Federal Energy Regulatory Commission (FERC) is responsible for consulting with the USFWS and/or NMFS to determine whether any ESA-listed endangered or threatened species or any of their designated critical habitats are near the proposed action, and to determine the proposed action's potential effects on those species or critical habitats.

For actions involving major construction activities with the potential to affect listed species or critical habitats, the lead federal agency must prepare a Biological Assessment (BA) for those species that may be affected. The lead federal agency must submit its BA to the USFWS and/or NMFS and, if it is determined that the action may adversely affect ESA-listed species, the lead agency must submit a request to the USFWS and/or NMFS for formal consultation to comply with Section 7 of the ESA. In response, the USFWS and/or NMFS issues a Biological Opinion as to whether the federal action would likely adversely affect or jeopardize the continued existence of a listed species, or result in the destruction or adverse modification of designated critical habitat. For the Project, we[1] have determined that ESA-listed species may be adversely affected, and are submitting this BA to the USFWS and NMFS.

Alaska Gasline Development Corporation (AGDC), acting as the FERC's non-federal representatives for the purpose of complying with Section 7(a)(2) of the ESA, informally consulted with the Fairbanks and Anchorage Alaska Field Offices of the USFWS and the Alaska Region of NMFS regarding ESA-listed threatened, endangered, candidate, or proposed species potentially occurring in or near the Project area. We have reviewed the data provided by AGDC and prepared this BA, which includes species accounts, potential impacts, conservation measures that AGDC would implement, and determinations of effect. Our BA also includes information gathered through additional research and consultation with the USFWS and NMFS. We have also made recommendations to AGDC for some species.

The Services (USFWS and NMFS) identified 1 previous candidate species and 31 federally listed, Distinct Population Segment (DPS),[2] or Evolutionarily Significant Unit (ESU)[3] species as potentially occurring in the Project area. Eight of the species or ESUs are under the jurisdiction of the USFWS, and the remainder are under the jurisdiction of NMFS. Section 5.0 of the BA lists all potentially affected ESA-listed or candidate species and designated critical habitat; indicates the Project facility that could occur in or near suitable or occupied habitat for the species; and provides our determinations of effect for each species.

Should a federally listed, proposed, petitioned, or candidate species be identified during Project construction that has not been previously identified during field surveys or assessed through consultation, and if Project activities could adversely affect the species, the applicants would be required to suspend the

1 The pronouns "we," "us," and "our" refer to the environmental staff of FERC's Office of Energy Projects.

2 DPSs are defined as a portion of a species' or subspecies' population or range.

3 ESUs are defined as a Pacific salmonid stock that is substantially reproductively isolated from other stocks of the same species and that represent an important part of the evolutionary legacy of the species.

construction activity and notify FERC and USFWS or NMFS of the potential effect. The construction activity could not resume until FERC completes its Section 7 consultation with the USFWS or NMFS.

Section 101(a)(5)(A) and (D) of the Marine Mammal Protection Act (MMPA) authorizes the Secretary of the Interior to authorize incidental taking of small numbers of marine mammals, upon request under Incidental Take Regulations (ITRs). The USFWS and/or NMFS can issue Incidental Harassment Authorizations for 1 year for harassment only (injury or disturbance), or a Letter of Authorization for activities that would result in harassment over multiple years or activities that would result in serious injury or mortality. AGDC has applied to NMFS and the USFWS for Incidental Take Authorizations for construction activities in Cook Inlet for takes of marine mammals, and has indicated that it has applied to NMFS for Incidental Take Authorizations for construction activities in Prudhoe Bay for takes of marine mammals.[4] AGDC has applied for Level A takes of humpback whales; and Level B takes of humpback whales, Cook Inlet beluga whales, and northern sea otters (non-ESA-listed species are discussed in section 4.6.3 of the Project environmental impact statement [EIS]). The polar bear and Pacific walrus (USFWS species) would be covered under the 2016−2021 Programmatic Beaufort Sea ITRs for construction activities in Prudhoe Bay. AGDC has committed to providing a final Polar Bear and Pacific Walrus Avoidance and Interaction Plan (Polar Bear and Walrus Plan) in accordance with the 2016–2021 Beaufort Sea ITR developed in consultation with the USFWS. As part of the ITR, AGDC has committed to providing a Marine Mammal Monitoring and Mitigation Plan to the USFWS for the Project each year construction activities covered under the Beaufort Sea ITR would occur.

In the event any maintenance or operational activity is determined to potentially generate underwater sound at levels that exceed Level A or B harassment of marine mammals, AGDC would apply for an Incidental Take Authorization from NMFS and/or the USFWS. NMFS and the USFWS would review each operational maintenance activity according to MMPA regulatory requirements, and mitigation measures would be developed, applied, and implemented as warranted and required under the authorization.

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[4] AGDC's Petition for Incidental Take Regulations for Construction of the Alaska LNG Project in Cook Inlet, Alaska, Revision 4 was submitted to NMFS on October 1, 2018, and is included in AGDC's response to Information Request No. 119 (Accession No. 20181022-5218). It can be viewed on the FERC website at http://www.ferc.gov. Using the "eLibrary" link, select "Advanced Search" from the eLibrary menu and enter 20181022-5218 in the "Numbers: Accession Number" field. AGDC also submitted a joint Petition for Incidental Take Regulations for Oil and Gas Activities in Cook Inlet, Alaska with Hilcorp Alaska, Harvest Alaska, and Alaska Gasline Development Corporation on June 28, 2018.

2.0 PROJECT DESCRIPTION

A summary of Project-specific details has been included in this BA; however, additional details can be found in the Project EIS (FERC Docket No. CP17-178-000). The Mainline Pipeline would start at the Gas Treatment Facilities on the North Slope and generally follow the existing Trans Alaska Pipeline System crude oil pipeline and adjacent highways south to Livengood, Alaska. From Livengood, the Mainline Pipeline would diverge from the Trans Alaska Pipeline System and generally head south–southwest to Trapper Creek following the Parks Highway and Beluga Highway, and then turn south–southeast around Viapan Lake. Finally, the Mainline Pipeline would cross Cook Inlet from near Beluga Landing on the west side of Cook Inlet to near Suneva Lake on the east side of Cook Inlet on the Kenai Peninsula, ending at the Liquefaction Facilities. Land requirements for the Project are described in section 2.1.2 of the EIS. An overview of the Project is shown on figure 2-1 with more detailed U.S. Geological Survey (USGS) topographic-based maps provided in appendix B of the EIS.

The key components of each facility are described below. These facilities would each have a nominal design life of 30 years. More detailed information on the proposed facilities can be found in section 2.0 of the EIS.

2.1 PROPOSED PROJECT FACILITIES

2.1.1 Gas Treatment Facilities

The Gas Treatment Facilities would be new facilities in the Prudhoe Bay Unit (PBU) near the Beaufort Sea coast. The Gas Treatment Facilities would be on state land within the North Slope Borough in an area designated for oil and natural gas development. Components of the Gas Treatment Facilities are summarized below.

- Gas Treatment Plant (GTP)
    - three gas treatment systems (trains) to remove liquids and impurities from the natural gas
    - control building
    - on-site ancillary facilities, including flares, metering, fuel gas and propane pipelines, fuel systems, and byproduct pipelines
    - utilities, including power generation facilities, water supply and treatment systems, sewage treatment, waste disposal (including two underground injection control Class 1 wells), and a communication tower
    - Operations Center and camp
- West Dock Causeway
    - widening of the West Dock Causeway and expansion of West Dock (to be called West Dock 4) to accommodate delivery of pre-fabricated modular components of the GTP from marine vessels
    - staging area
    - temporary, annually installed, barge bridge and turning basin

- Water reservoir
  - new freshwater reservoir constructed to supply water to the GTP, including pump facilities and a transfer pipeline between the reservoir and the GTP
- Gravel mine
  - new gravel mine to supply granular fill for roads, pads, West Dock Causeway widening and expansion, staging areas, existing roads and pads, and augmentation and maintenance of pads and roads during operation
- Prudhoe Bay Unit Gas Transmission Line (PBTL)
  - 1-mile-long, 60-inch-diameter pipeline to transport natural gas from the existing PBU Central Gas Facility (CGF) to the GTP
  - new meter station
- Point Thomson Unit Gas Transmission Line (PTTL)
  - 62.5-mile-long, 32-inch-diameter pipeline to transport natural gas from the Point Thomson Unit (PTU) to the GTP
  - aboveground facilities, including a meter station, pig[5] launcher/receivers, and three mainline valves (MLVs)
- Access roads and staging area
  - four permanent gravel access roads to connect the GTP with other Gas Treatment Facilities
  - temporary ice roads and pads used during construction
  - 52 ice roads and ice pads for temporary access along the PTTL
  - module staging area
- Pioneer camp
  - temporary construction camp to house workers as well as materials to commence construction
- Associated transfer pipelines
  - 1.8-mile fuel gas pipeline from the PBU CGF to the GTP and GTP operations camp
  - 0.6-mile propane pipeline from the PBU CGF to the GTP
  - 1.1-mile Putuligayuk River pipeline from the Putuligayuk River to the reservoir
  - 5-mile supply water pipeline from the reservoir to the GTP and GTP operations camp

[5] A "pig" is a device to clean or inspect the pipeline. A pig launcher/receiver is an aboveground facility where pigs are inserted into or retrieved from the pipeline.

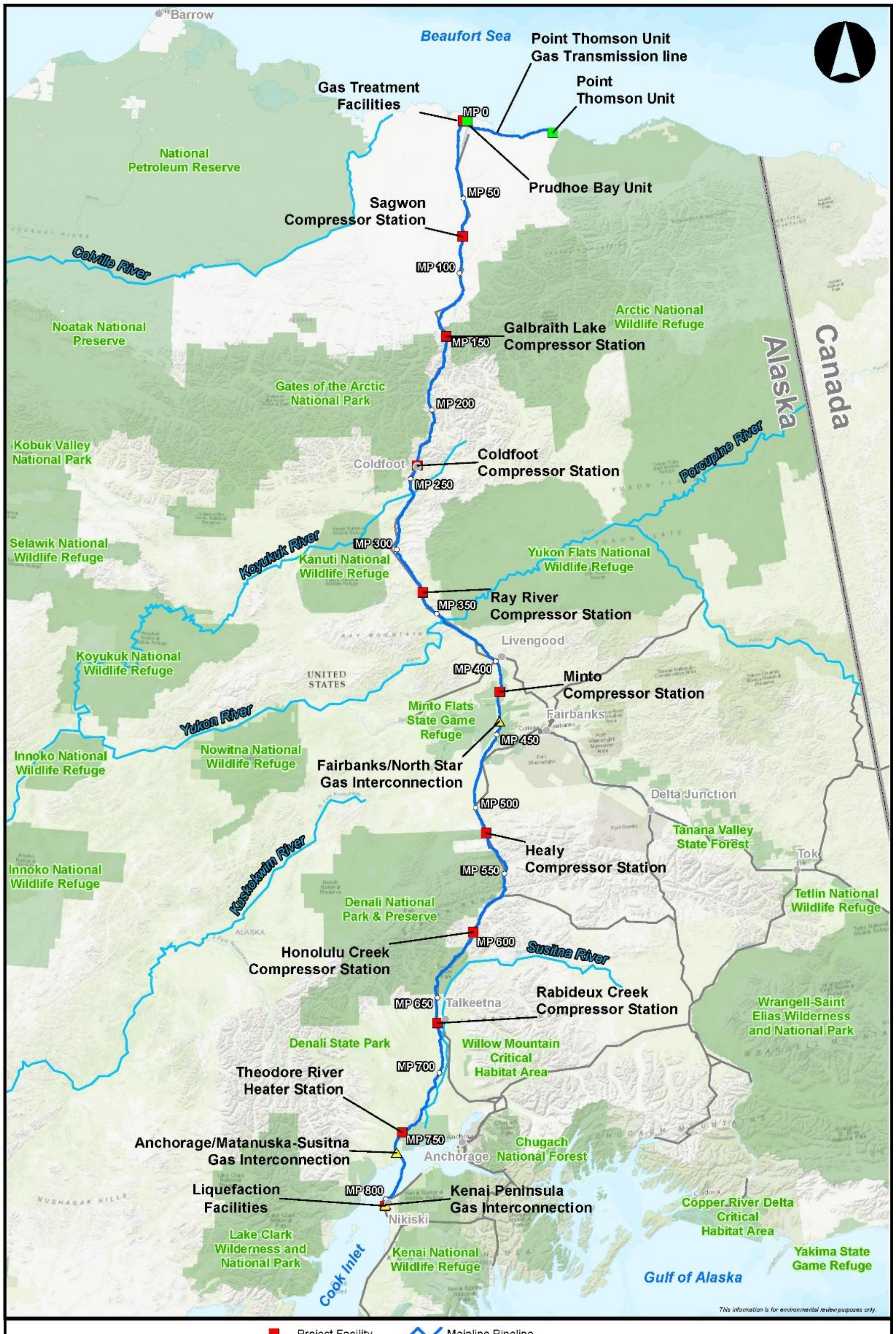


Figure 2-1
Alaska LNG Project
Project Overview

2.1.2 Mainline Facilities

The Mainline Facilities include a Mainline Pipeline originating at the GTP in the North Slope Borough and terminating at the Liquefaction Facilities in the Kenai Peninsula Borough. Aboveground facilities and additional work areas are also included as summarized below.

- Mainline Pipeline
  - about 806.6 miles of 42-inch-diameter pipeline from the GTP on the North Slope to the Liquefaction Facilities in Nikiski, Alaska, including a 27.3-mile-long offshore crossing of Cook Inlet
- Aboveground Facilities
  - eight natural-gas-driven compressor stations, a heater station, two meter stations, MLVs, pig launchers/receivers, and cathodic protection facilities
  - permanent material offloading facility (MOF) near Beluga, referred to as the Mainline MOF
  - three gas interconnection sites each with an isolation valve
- Additional Work Areas
  - additional temporary workspaces, access roads, helipads and airstrips, construction camps, contractor yards, pipe storage yards, railway yards and spurs, disposal sites, and material yards

2.1.3 Liquefaction Facilities

The Liquefaction Facilities would include new facilities constructed on the eastern shore of Cook Inlet in the Nikiski area of the Kenai Peninsula. The Liquefaction Facilities would consist of an LNG Plant, Marine Facilities, and additional work areas.

- LNG Plant
  - three natural gas liquefaction processing units, called trains, capable of liquefying up to 20 million metric tons per year of LNG
  - meter station
  - two 63.4 million-gallon LNG storage tanks
  - two flare systems, including a wet/dry ground flare at the LNG Plant and a low-pressure flare near the Marine Terminal
  - power plant systems, including the electric power supply, cathodic protection system, diesel fuel system, fuel gas system, nitrogen system, and waste heat recovery system
  - water supply systems, including a freshwater treatment system and a firewater system
  - associated infrastructure, including a condensate storage facility, catalysts and chemicals, lighting, communications facilities, and a consolidated building complex

- Marine Facilities
    - product loading facility (PLF) that would include two product loading and ship berthing areas
    - marine terminal building
- Additional Work Areas
    - temporary MOF, referred to as the Marine Terminal MOF
    - existing dock facilities at Arctic Slope Regional Corporation's Nikiski Fabrication Facility and Rig Tenders Marine Terminal facilities as a "Pioneer MOF"
    - dredged material disposal areas
    - a haul road, construction camp, material sites, and additional temporary work spaces

2.2 CONSTRUCTION SCHEDULE

Assuming receipt of authorizations and necessary permits, AGDC anticipates starting Project construction in the first quarter of 2020 and full Project completion in the third quarter of 2027.

AGDC proposes to construct and commission the Project in two phases over about 8 years. Phase 1 would be completed over about 6 years and include construction related to the Gas Treatment, Liquefaction, and Mainline Facilities. The second phase would install the remaining Project components needed for full production. Section 2.3 of the EIS discusses the proposed construction schedule, with details for activities by year provided in section 2.3.1 of the EIS. Detailed descriptions are provided in sections 2.1.3, 2.1.4, and 2.1.5 of the EIS. AGDC states that the Project facilities would have a nominal design life of 30 years.

2.3 PROJECT-LEVEL CONSERVATION MEASURES

AGDC has developed Project-level conservation measures to reduce impacts on federally listed species during Project construction and operation. These measures, which would be implemented as described below, have been taken into consideration for our effects determinations for the species described in sections 6 and 7. In some cases, the discussions note that we intend to recommend measures in the EIS for the Project to provide additional environmental protections. Typically, these recommendations are incorporated as conditions into a FERC authorization. As such, construction and operation of the facilities described below, as well as the conservation measures offered by AGDC or that we've recommended in the EIS, should be considered part of the proposed action under consideration in the ESA consultation process.

2.3.1 All Species

AGDC would implement a number of conservation measures to reduce impacts on sensitive species. The discussion below focuses on mitigation measures that AGDC would implement as part of the Project to minimize or prevent impacts that are common for most or all species, including impacts from aircraft overflights, vessel strikes, contaminate releases, aquatic invasive species, disturbance to benthic habitats, and water turbidity.

Marine mammals and birds often react to aircraft overflights. Patenaude et al. (2002) found that beluga and bowhead whales in the Alaskan Beaufort Sea showed little reaction to flights that were greater than 597 feet (182 meters) above the ocean surface. Fixed wing aircraft and helicopters using airstrips and landing pads for the Project would maintain aircraft flying altitudes of 1,500 feet or more above ground level (except during takeoff and landing or for safety considerations) and stay inland of the coasts as much as possible to minimize disturbance of marine mammals and birds and potential collisions with birds. In addition, AGDC would reduce the number of flights to the minimum number practicable.

To reduce disturbance effects on birds and marine mammals at Reindeer Island (adjacent to the Prudhoe Bay Operations Staging Area [PBOSA]) and the risk of strikes in the waters around the island, vessels using the PBOSA would anchor 0.5 mile off Reindeer Island, and vessel crews would not approach or go onto the island. Vessel crews would also be instructed not to feed wildlife.

To minimize the potential for an inadvertent equipment fluid release, AGDC would adhere to the fueling, storage, containment, and cleanup measures described in its Project Spill Prevention, Control, and Countermeasure (SPCC) Plan. To minimize the risk of a spill, AGDC would ensure that all contractors comply with the Project SPCC Plan and Stormwater Pollution Prevention Plan (SWPPP). AGDC has committed to developing facility/work site-specific SPCC plans prior to construction, and contractors would be required to develop their own site-specific SPCC plans that would be subject to Project review and approval, as discussed in section 4.2.6 of the EIS. Measures outlined in the Project Wetland and Waterbody Construction and Mitigation Procedures (Procedures) and SPCC Plan that would be implemented during construction include secondary containment for single-walled containers; parking and fuel setbacks from sensitive features such as waterbodies and wetlands; and daily maintenance and inspection of construction equipment for leaks. Additionally, the Project Procedures and SPCC Plan include preventive measures such as personnel training, equipment inspection, and refueling procedures to reduce the likelihood of spills, as well as mitigation measures, such as containment and cleanup, to minimize potential impacts should a spill occur. Implementation of the Project SPCC Plan and Procedures would reduce the likelihood of spills and the magnitude of spills should they occur. If a spill should occur, adherence to measures in the Project SPCC Plan would decrease the response time for control and cleanup, thus avoiding or minimizing the effects of a spill on federally listed species.

Oil spill response plans would be provided by AGDC for accidental releases of oil. In addition, LNG carriers are required to develop and implement a Shipboard Oil Pollution Emergency Plan (SOPEP), which includes measures to be taken when an oil pollution incident has occurred or a ship is at risk of one. Large oils spills are unlikely to occur since large quantities of oil would not typically be transported as part of Project construction and operation.

To reduce the likelihood of ship groundings, the International Maritime Organization (IMO) (2016) adopted the Aleutian Islands Areas to be Avoided (ATBA). For ships 400 gross tonnages and above on international voyages through the Aleutian Island region, the ATBA recommends using the Northern and Southern Great Circle routes. Vessels in transit to the Project through the Aleutian Islands would adhere to the following measures:

- travelling in established shipping lanes;
- sailing on routes well offshore of the Aleutian Islands whenever possible; and
- avoiding travel through the ATBA.

These measures would reduce the likelihood of vessel groundings that could potentially damage northern sea otter and Steller sea lion critical habitat and would reduce the likelihood of vessel strikes of individual animals in the Aleutian Island region (Navigation, Communications, and Search and Rescue, 2014; Aleutian Islands Risk Assessment Project Management Team, 2011; Huntington et al., 2015; Nuka, 2015). Compliance with the Aleutian Islands ATBA by Project-related vessel traffic would also reduce the potential for effects from vessel grounding and fuel releases on other federally listed species that occur in this area (e.g., short-tailed albatross, northern sea otters, fin whales, gray whales, humpback whales, North Pacific right whales, sperm whales, and Steller sea lions). Compliance with the Aleutian Islands ATBA would also reduce the likelihood of vessel strikes of birds and marine mammals, since vessels in transit to the Project through the Aleutian Islands would avoid travel through this area.

As described in section 4.3.3.3 of the EIS, accidental gas releases from the Mainline Pipeline are not anticipated. However, during operation, the pipeline would employ industry standards for safety and pipeline monitoring detailed in sections 2.5.2.1 and 4.18 of the EIS that would minimize the duration of an accidental release and result in a brief and localized impact on marine waters.

To prevent and mitigate against inadvertent contamination from waste, all waste generated from construction would be handled in accordance with the Project Waste Management Plan. All hazardous waste and contaminated soils would be stored at collection sites until they could be transported to the Lower 48 for disposal. AGDC would minimize the attraction of predatory birds and mammals (including polar bears) to facility sites through strict food waste management (see conservation measures for polar bears and Pacific walrus below). AGDC would deter foxes from denning by eliminating open containers, culverts, pipes, and other potential shelters at ground level to minimize predation on nesting spectacled eiders and on adult Alaska-breeding Steller's and spectacled eiders by foxes.

To reduce the risk of introducing aquatic invasive species from vessel traffic, AGDC would implement its Invasives Plan. In addition, heavy lift vessels (HLVs) would ballast loads with cargo rather than water and use minimal amounts of freshwater for ballast. Use of freshwater ballast would reduce the likelihood of transporting marine aquatic invasive species. Aquatic invasive species on or in semisubmersible vessels, barges, and tugs would also be controlled by ballast water regulations; LNG carriers and marine barges used for this Project must meet the requirements of the U.S. Environmental Protection Agency Vessel General Permit and Coast Guard regulations (see section 4.3.3.3 of the EIS for additional details). To ensure compliance with U.S laws and regulations governing ballast water discharges, AGDC would require visiting vessels to possess documentation to demonstrate compliance with ballast water regulations and best management practices prior to allowing ballast water to be discharged into the berthing area. Adherence to these regulations would reduce the likelihood of Project-related vessel traffic introducing aquatic invasive species. In addition, AGDC would develop a Ballast Water Management Plan by September 2019 that complies with the above standards. This plan would include protocols and management measures for LNG carriers and ships transporting equipment.

AGDC's proposed method to install the shoreline approaches of the offshore segment of the Mainline Pipeline would involve trenching/dredging and pipeline burial. Disturbance of benthic habitats and increased turbidity would occur at the trenching/dredging locations. To reduce impacts on critical habitat for Cook Inlet beluga whale and marine mammal and bird prey species and habitat, we have recommended that AGDC incorporate the use of the direct micro-tunneling (DMT) continuation methodology for the shoreline crossings at Beluga Landing and Suneva Lake or provide a site-specific justification, supported by additional geotechnical investigations conducted during detailed engineering design, demonstrating that this methodology would not be feasible (see section 4.3.3.3 of the EIS).

2.3.2 All Marine Mammals

AGDC would implement various mitigation measures to minimize noise impacts and risks of vessel strikes on marine mammals. Various project activities could cause underwater and airborne noise impacts on marine mammals. Using NMFS's updated *Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing—Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts* (NMFS Technical Guidance) to determine distances to Level A and B harassment, AGDC would minimize impacts on marine mammals by setting shutdown and harassment zones for pile driving (including removal of the Marine Terminal MOF after construction) and anchor handling activities in Cook Inlet. Protected Species Observers (PSO) would be used during anchor handling and pile driving activities to identify any marine mammals that could come into proximity of these activities. Anchor handling procedures cannot be stopped once the activity has started due to the need to ensure safety and sound constructability of the pipeline, but PSOs would confirm the observation area is clear of marine mammals before starting anchor handling. During pile driving, PSOs would be given the authority to stop construction and/or lower sound levels when marine mammals are visible within the various acoustic zones.

AGDC is proposing the following shutdown and harassment zones for pile driving:

- a 328.1-foot (100-meter) shutdown zone for pile driving operations for beluga whales to prevent Level A take by injury;
- a 1,640.4-foot (500-meter) shutdown zone for pile driving operations for humpback whales to prevent Level A take by injury;
- a 1.4-mile (2.2-kilometer) Level B harassment zone for impact pile driving operations based on the calculated distance to the 160-decibel (dB) threshold for pipe piles, to be used:
  - for potential Level B exposures for marine mammals other than beluga whales; and
  - as the shutdown zone for beluga whales;
- a 2.9-mile (4.6-kilometer) Level B harassment zone for vibratory pile driving operations based on the calculated distance to the 120-dB threshold for sheet piles, to be used:[6]
  - for potential Level B exposures for marine mammals other than beluga whales; and
  - as the shutdown zone for beluga whales; and
- a 1.2-mile (2-kilometer) Level B harassment zone for anchor handling operations based on the calculated distance to the 120-dB threshold, to be used:
  - for potential Level B exposures for all marine mammals.
- A walrus monitoring zone would be established where the received impulsive sound level would be greater than or equal to 160 dB relative to 1 microPascal (dB re 1 μPa); walruses observed within this zone would be assumed to have experienced Level B take.
  - No action would be taken for walrus identified within this zone.
- A walrus mitigation zone would be established where the received impulsive sound level would be greater than or equal to 180 dB re 1 μPa.
  - If walruses are identified in this zone, ramp-up, power down, and shutdown procedures would be followed as described in the Polar Bear and Walrus Plan.

[6] AGDC acknowledged the calculated distance to the 120-dB threshold for vibratory pile driving of pipe piles is 13.4 miles (21.5 kilometers). AGDC states that it is not feasible to monitor this zone, so the proposed zone is based on the calculated distance for vibratory pile driving of sheet piles. Further, the species of greatest concern, beluga whales, occur within 1.2 miles (2.0 kilometers) of shore (Goetz et al., 2012a), so AGDC determined that a proposed zone of 2.9 miles (4.6 kilometers) is feasible and biologically appropriate. However, the noise may travel along the shoreline up to 13.4 miles from the activity, impacting Cook Inlet beluga whales.

- A polar bear mitigation zone would be established where the received impulsive sound level would be greater than or equal to 190 dB re 1 μPa.
    - If polar bears are identified in this zone, ramp-up, power down, and shutdown procedures would be followed as described in the Polar Bear and Walrus Plan.

The distances to the shutdown, harassment, and mitigation zones AGDC committed to above do not apply to all activities and do not match the modeled distances provided in appendix L-1 of the EIS. Because these distances would not be sufficiently protective to marine mammals for all underwater noise-generating activities that could cause marine mammal disturbance, we have recommended AGDC file revised shutdown distances for all underwater noise generating activities (i.e., pile driving [impact, vibratory, and all pile types], dredging, screeding, anchor handling, Mainline Pipeline shoreline installation, and Marine Terminal MOF removal). For the revised shutdown distances, we have recommended AGDC establish:

- shutdown zones for Level A harassment for all marine mammals based on the modeled distances in appendix L-1, tables L-1-3, L-1-4, L-1-8, and L-1-9 of the EIS (pile driving activities should stop until the animal moves out of the shutdown injury zone);

- shutdown zones for Level B harassment for Cook Inlet beluga whales based on the modeled distances in appendix L-1, tables L-1-10 and L-1-12 of the EIS (pile driving and dredging activities should stop until the animal moves out of the shutdown harassment zone); and

- harassment zones for Level B harassment for all marine mammals (except Cook Inlet beluga whales) based on the modeled distances in appendix L-1, tables L-1-5, L-1-10, L-1-11, L-1-12, and L-1-13 of the EIS (activity noise levels should be lowered when animals enter these zones, until they leave the area, if possible).

Alternatively, AGDC may commit to conducting a Sound Source Verification during construction that would establish appropriate shutdown and harassment zones based on observed underwater noise levels (see section 4.6.3.2 of the EIS).

AGDC has proposed to have PSOs monitor construction activities and minimize marine mammal exposure to sound levels in excess of NMFS thresholds, as described above. AGDC would shut down impact pile-driving activities if marine mammals enter the applicable zone, and these activities would only resume once the animal has left the zone.

AGDC committed to having at least two PSOs on watch during pile driving activities in Cook Inlet, and at least one PSO on the barge and on watch during pipe laying activities. However, in AGDC's draft Marine Mammal Monitoring and Mitigation Plans for Cook Inlet and Prudhoe Bay, AGDC committed to using land-based PSOs only. Due to the large radius required for pile driving monitoring (up to 2.9 miles), and lack of information on PSOs for removal of the Marine Terminal MOF in Cook Inlet and pile driving in Prudhoe Bay, we have recommended that AGDC file a revised PSO deployment plan that includes the following:

- for pile driving activities in Cook Inlet and Prudhoe Bay, AGDC should station at least one PSO at-sea near the edge of the shutdown zone (for Level A) and one PSO stationed at-sea or on land near the edge of the harassment zone (for Level B); and station at least one PSO on the pile-driving barge, or in an adjacent land-based vantage point;

- for anchor handling activities in Cook Inlet, AGDC should station at least one PSO on the pipelay vessel; and

- for dredging and screeding activities and Mainline Pipeline shoreline installation, AGDC should station at least one PSO on each dredging and screeding vessel or accompanying vessel (see section 4.6.3.2 of the EIS).

Dock Head 4 piles and sheet piles in Prudhoe Bay would be installed between June and August, outside the bowhead whale sensitive periods. This would minimize the risk of exposing bowhead whales to Level B harassment noise from pile driving. However, implementation of PSOs, as described above, would minimize impacts on bowhead whales, if present.

We have recommended AGDC provide PSOs for screeding activities in Prudhoe Bay. Shutdown zones would be based on Level B harassment distances provided in appendix L-1 of the EIS. One PSO would be stationed on the screeding vessel or accompanying work or survey boat. We have also recommended that AGDC provide PSOs for dredging activities in Cook Inlet (see section 4.6.3.2 of the EIS). Shutdown zones would be based on Level B harassment distances provided in appendix L-1 of the EIS. One PSO would be stationed on the dredging vessel or accompanying work or survey boat.

Pile driving would be conducted during daylight hours, making observations of marine mammals in the vicinity possible. Anchor handling would occur 24 hours per day in summer, and dredging and screeding would occur 24 hours per day from spring through fall; all three activities could occur during dark hours when marine mammal observation would not be possible. There is an increased risk of marine mammals entering Level B harassment zones and being affected by noise generating activities at these low light or dark times.

AGDC would use a vibratory hammer to drive the top half of some sheet piles before using an impact hammer to reduce generated noise levels. For impact hammering, AGDC would use a "soft-start" technique at the beginning of each day's pipe/pile driving activities, or, if pipe/pile driving has ceased for more than 1 hour, would allow any marine mammal that could be in the immediate area to leave before pile driving resumes full energy. This “ramping up” would alert marine mammals of impending hammering noise and allow them to vacate the general area (Dahl et al., 2015). NMFS has recommended that AGDC implement a soft-start technique if pile driving has ceased for 30 minutes or more to minimize the risk of harassment to marine mammals that may have entered the exclusion zone during the inactive period. In its draft Marine Mammal Monitoring and Mitigation Plans for Cook Inlet and Prudhoe Bay, AGDC stated it would implement soft-start techniques after activities had ceased for 30 minutes or more. Additional measures that AGDC would implement to reduce the impacts of pile driving on marine mammals are described below.

- The Level B zone would be cleared 30 minutes prior to a soft-start to confirm no marine mammals are within or entering the zone.

- AGDC would begin the impact hammering soft-start with an initial set of three strikes from the impact hammer at reduced energy, followed by a 1-minute waiting period, then two subsequent three-strike reduced energy sets.

- AGDC would immediately shut down hammers at any time a marine mammal is detected entering or within the Level A zone. Hammering operations would not resume until the zone has been visually inspected for at least 30 minutes to confirm the absence of marine mammals, or the marine mammals are seen exiting the area.

- Initial hammering starts would not begin during periods of poor visibility (e.g., night, fog, wind).

- Any shutdown due to a marine mammal sighting within the zone would be followed by a 30-minute all-clear period and then a standard ramp-up.

- Any shutdown for other reasons resulting in the cessation of the sound source for a period greater than 30 minutes would be followed by the standard ramp-up procedures.

AGDC has committed to developing a Transit Management Plan to decrease noise and possible vessel strikes on marine mammals. This plan would include decreased speeds and course change minimizations. All humpback whales in Alaska are protected from approach by vessels, regardless of which DPS they are from (50 Code of Federal Regulations [CFR] 216, 223, 224; 81 Federal Register [FR] 62018). A Ship Strike Avoidance Measures Package would also be provided to LNG carrier shippers. This package would include the measures proposed by NMFS for avoidance of marine mammals to further reduce the likelihood of adverse effects on these species. Potential measures are listed below.

- AGDC would provide training materials to vessel crews, including the use of a reference guide such as the *Marine Mammals of the Pacific Northwest, including Oregon, Washington, British Columbia, and South Alaska* (Folkens, 2001). This is a pamphlet that would be provided to vessels calling on the terminal and would be included as part of the terminal use agreement to the shippers.

- Vessel masters would be asked to provide reports of marine mammal sightings while in the Exclusive Economic Zone (EEZ) to AGDC upon docking. This reporting request would be included in the Ship Strike Avoidance Measures Package provided to each vessel, and compliance with the measures and the reporting would be included in all service agreements with shippers.

- Vessels would use minimal speeds that do not sacrifice vessel safety or steerage but minimize noise and maneuverability to avoid collisions with marine mammals.

- AGDC would provide a copy of the NMFS compact-disc-based training program, A Prudent Mariner's Guide to Right Whale Protection (NMFS, 2009) to all vessels calling on the terminal.

The following measures would be implemented for vessels in transit to the West Dock Causeway in the Beaufort Sea to reduce impacts on whales, including the risk of strikes:

- slow vessel speeds if whales are spotted during transit;
- avoid groups of whales where possible;
- remain landward of Cross Island; and
- maintain vessel traffic near established navigation routes, where feasible.

AGDC would contractually require vessels to comply with the *Vessel Strike Avoidance Measures & Reporting for Mariners* (NMFS, 2008c), and vessels would be informed about the latest information regarding the distribution and numbers of marine mammals likely to be encountered within the activity area or route. The measures consistent with NMFS guidance above, which would use minimal speed that maintains vessel safety and steerage but minimizes potential collisions, are listed below.

- Vessel operators and crews would maintain a vigilant watch for marine mammals and sea turtles to avoid striking protected species.

- When whales are sighted, vessels would maintain a distance of 100 yards or greater between the whale and the vessel.

- When sea turtles or small cetaceans are sighted, vessels would attempt to maintain a distance of 50 yards or greater between the animal and the vessel, whenever possible.
- When small cetaceans are sighted while a vessel is underway (e.g., bow-riding), the vessel would attempt to remain parallel to the animal's course. The vessel would avoid excessive speed or abrupt changes in direction until the cetacean has left the area.
- Vessels would reduce speed to 10 knots or less when mother/calf pairs, groups, or large assemblages of cetaceans are observed near an underway vessel, when safety permits (e.g., maintain steerage speed to maintain vessel control). A single cetacean at the surface could indicate the presence of submerged animals in the vicinity; therefore, prudent precautionary measures would be exercised. The vessel would attempt to route around the animals, maintaining a minimum distance of 100 yards, whenever possible.
- Whales could surface in unpredictable locations or approach slowly moving vessels. When an animal is sighted in the vessel's path or in close proximity to a moving vessel and safety permits, the vessel would reduce speed and shift the engine to neutral. The vessel would not engage the engines until the animals are clear of the area.

Sealifts to the West Dock Causeway would be conducted when surface ice coverage is 30 percent or less and during the ice-free period (the average is 61 days, with the earliest opening being July 15, and the latest closing November 4). In addition to the *Vessel Strike Avoidance Measures & Reporting for Mariners* for sealifts to the West Dock Causeway, additional transport conditions may originate from the *Conflict Avoidance Agreement* with the Inupiat Eskimo Whaling Commission. Some of these conditions are general good practice in line with the Inupiat Whaling Commission recommendations for tugs and barges transiting from Port Clarence to Prudhoe Bay, such as:

- keeping vessels away from active whaling areas;
- keeping vessels outside "quiet zones" (i.e., 20 nautical miles offshore during transit), subject to safe transit navigation;
- imposing vessel speed restrictions if whales are encountered;
- maintaining vessel speeds of less than 10 knots in proximity of feeding whales or whale aggregations; and
- reducing vessel speeds to 5 knots within 900 feet of whales.

AGDC would conduct marine mammal monitoring to collect information on marine mammal presence within the disturbance and injury zones for the Project during construction. Results of Project monitoring efforts would be provided to NMFS in a draft summary report within 90 days after monitoring ends. This information could be made available to regional, state, and federal resource agencies, universities, and other interested private parties upon written request to NMFS. Before Project startup each year, AGDC would identify other monitoring programs in Cook Inlet so that information on species sightings can be shared among programs to minimize impacts.

2.3.3 Birds

AGDC would implement measures to avoid, minimize, and mitigate impacts on Alaska-breeding Steller's eiders and spectacled eiders as provided in the Project Migratory Bird Conservation Plan. Granular fill placement, vegetation clearing, and grading could occur in Alaska-breeding Steller's and spectacled eider habitat on the tundra when birds are present on the landscape. Non-breeding Alaska-breeding Steller's eiders and nesting spectacled eiders could occur near the Project area. AGDC would consult with the USFWS if any site preparation and/or construction activities on the tundra occur between June 1 and July 31 within Alaska-breeding Steller's and spectacled eiders' suitable habitat. A qualified biologist would conduct pre-construction surveys according to USFWS guidelines for any activities during this time (USFWS, 2011a). AGDC would clear vegetation for construction during winter months in some locations; however, various conditions (e.g., environmental constraints) could prevent winter clearing, causing AGDC to clear during the scheduled start of construction in the summer. AGDC would implement conservation measures to avoid and minimize potential impacts on Alaska-breeding Steller's eiders, spectacled eiders, and their habitat. In addition, per FERC's Plan, AGDC would conduct operational vegetation clearing outside the migratory bird nesting season for all Project areas (including the Alaska-breeding Steller's and spectacled eiders nesting habitat), unless FERC grants a waiver of the clearing restriction, based on any input provided by the USFWS.

To reduce noise disturbance impacts on birds, AGDC committed to performing non-lethal hazing to clear areas of wildlife prior to blasting. Hazing techniques would be identified in AGDC's Alaska Department of Fish & Game (ADF&G) hazing permits and include the use of movement, noisemakers, pyrotechnics, or vehicular presence. To reduce general blasting impacts, AGDC would implement measures described in the Project Blasting Plan.

To avoid or reduce lighting effects on Alaska-breeding Steller's, spectacled eiders, and short-tailed albatross, AGDC would implement Federal Aviation Administration (FAA) guidelines and the USFWS's *Guidance for Lighting for Birds* (USFWS, 2016a). AGDC would follow the latest version of FAA Advisory Circular 150/5345-43 *Specification for Obstruction Lighting Equipment* and Advisory Circular 70/7460-1 *Obstruction Marking and Lighting* (FAA, 2016). The advisory circulars set forth lighting color and flash requirements. AGDC would follow the standards regarding the number of lights, minimum intensity, and minimum number of flashes per minute.

AGDC would also implement measures to avoid and minimize lighting impacts on Alaska-breeding Steller's eiders and spectacled eiders including:

- the use of localized task lights (e.g., use of light hoods to reduce outward radiating light) when possible to minimize the potential for disorienting migrating birds;
- avoiding the use of steady-state red lights on structures;
- the use of white (preferable) or red strobe lights for tower lighting set at the minimum number of flashes per minute allowable by the FAA. If possible, solid red or pulsating red warning lights at night would be avoided; and
- use of down-shielded lights on buildings, freestanding lighting, or security lighting for on-pad facilities and equipment, particularly near coastal areas.

Additional details are described in AGDC's Project Lighting Plan (see table 2.2-1 in the EIS).

To minimize the potential for bird collisions with Project facilities, AGDC would implement the following measures:

- design communication towers (e.g., monopole towers) to avoid lattice and guy wires;
- place bird diverters on any guy wires that are used to support communication towers and/or antennas;
- design buildings and facility modules to reduce surfaces where birds could roost or nest;
- design buildings and facility modules to prevent bird access to structures where they could become entrapped, such as in exposed pipe ends, exhaust stacks, or exhaust fans;
- design flares to be freestanding (no guy wires);
- design communication towers to be freestanding;
- design new power distribution lines and poles with sufficient phase separation or alternative protective methods to prevent bird electrocutions or use as a nesting platform; and
- incorporate anti-perch devices into offshore and onshore structure design to prevent raptor and gull perching and associated enhanced predation on ground-nesting birds.

Measures in the Ship Strike Avoidance Measures Package, described above for marine mammals, would also reduce the risk of vessels striking Alaska-breeding Steller's eiders in Cook Inlet.

2.3.4 Pacific Walrus and Polar Bear

AGDC would implement a number of conservation measures to reduce impacts on Pacific walruses and polar bears from Project construction and operational activities. Measures include following the Beaufort Sea ITRs, use of PSOs, restricted aircraft flight altitudes, and spill plans.

As part of the Beaufort Sea ITR, the Project would be required to obtain individual Letters of Authorization (LOA) annually from the USFWS. The LOA would contain Project-specific mitigation measures. In addition, the following measures (quoted directly below) are part of the ITR and would be implemented by AGDC to reduce impacts on Pacific walruses and polar bears.

(a) "Mitigation measures for all LOAs: Holders of an LOA must utilize policies and procedures to conduct activities in a manner that minimizes to the greatest extent practicable adverse impacts on polar bears and/or Pacific walruses, their habitat, and the availability of these marine mammals for subsistence uses. Adaptive management practices, such as temporal or spatial activity restrictions in response to the presence of marine mammals in a particular place or time, or the occurrence of polar bears and/or Pacific walruses engaged in a biologically important activity (e.g., resting, feeding, denning, or nursing, among others) must be used to avoid interactions with and minimize impacts on these animals and their availability for subsistence uses.

(1) "All holders of an LOA must:

(i) "cooperate with the Service's Marine Mammals Management Office and other designated federal, state, and local agencies to monitor and mitigate the impacts of their activities on polar bears and Pacific walruses;

(ii) "designate trained and qualified personnel to monitor for the presence of polar bears and/or Pacific walruses, initiate mitigation measures, and monitor, record, and report the effects of their activities on polar bears and/or Pacific walruses;

(iii) “have an approved polar bear and/or Pacific walrus safety, awareness, and interaction plan on file with the Service’s Marine Mammals Management Office and available on site have key personnel undergo polar bear awareness training. Interaction plans must include:

(A) “the type of activity and where and when the activity will occur (i.e., a summary of the plan of operation);

(B) “a food, waste, and other “bear attractants” management plan;

(C) “personnel training procedures, procedures, and materials;

(D) “site specific polar bear and/or walrus interaction risk evaluation and mitigation measures;

(E) “polar bear and walrus avoidance and encounter procedures; and

(F) “polar bear and walrus observation and reporting procedures.

(2) “All LOA applicants must contact affected subsistence communities and hunter organizations to discuss potential conflicts caused by the proposed activities and provide the Service documentation of communications as described in 50 CFR 18.124.

(b) “Mitigation measures for onshore activities. Efforts to minimize disturbance around known polar bear dens: holders of an LOA must take efforts to limit disturbance around known polar bear dens.

(1) “Efforts to locate polar bear dens. Holders of an LOA seeking to carry out onshore activities in known or suspected polar bear denning habitat during the denning season (November through April) must make efforts to locate occupied polar bear dens within and near proposed areas of operation, utilizing appropriate tools, such as Forward Looking InfraRed surveys and/or polar bear scent-trained dogs. All observed or suspected polar bear dens must be reported to the Service prior to the initiation of activities.

(2) “Exclusion zone around known polar bear dens. Operators must observe a 1.6-kilometer (1-mile) operational exclusion zone around all known polar bear dens during the denning season (November through April, or until the female and cubs leave the areas). Should previously unknown occupied dens be discovered within 1.6 kilometers (1 mile) of activities, work must cease and the Service contacted for guidance. The Service will evaluate these instances on a case-by-case basis to determine the appropriate action. Potential actions may range from cessation or modification of work to conducting additional monitoring, and the holder of the authorization must comply with any additional measures specified.

(3) “The use of den habitat map developed by the USGS. A map of potential coastal polar bear denning habitat can be found at http://alaska.usgs.gov/science/biology/polar_bears/pubs.html. This measure ensures the location of potential polar bear dens is considered when conducting activities in the coastal areas of the Beaufort Sea.

(4) “Restrict the timing of the activity to limit disturbance around dens.

(c) “Mitigation measures for operational and support vessels.

(1) “Operational and support vessels must have dedicated marine mammal observers on board to alert crew of the presence of polar bears and walruses and initiate adaptive mitigation responses.

(2) “At all times, vessels must maintain the maximum distance possible from concentrations of polar bears or walruses. Under no circumstances, other than an emergency, should any vessel approach within an 805-meter (0.5-mile) radius of polar bears or walruses observed on land or ice.

(3) “Vessel operators must take every precaution to avoid harassment of concentrations of feeding walruses when a vessel is operating near these animals. Vessels should reduce speed and maintain a minimum 805-meter (0.5-mile) operational exclusion zone around feeding walrus groups. Vessels may not be operated in such a way as to separate members of a group of walruses from other members of the group. When weather conditions require, such as when visibility drops, vessels should adjust speed accordingly to avoid the likelihood of injury to walruses.

(4) “Vessels bound for the Beaufort Sea ITR Region may not transit through the Chukchi Sea prior to July 1. This operating condition is intended to allow walruses the opportunity to move through the Bering Strait and disperse from the confines of the spring lead system into the Chukchi Sea with minimal disturbance. It is also intended to minimize vessel impacts upon the availability of walruses for Alaska Native subsistence hunters. Exemption waivers to this operating condition may be issued by the Service on a case-by-case basis, based on a review of seasonal ice conditions and available information on walrus and polar bear distributions in the area of interest.

(5) “All vessels shall avoid areas of active or anticipated polar bear or walrus subsistence hunting activity, as determined through community consultations.

(6) “The use of trained marine mammal monitors associated with marine activities. USFWS may require a monitor on the site of the activity or on board drill ships, drill rigs, aircraft, icebreakers, or other support vessels or vehicles to monitor the impacts of the Project’s activity on polar bear and Pacific walruses.

(d) “Mitigation measures for aircraft.

(1) “Operators of support aircraft should, at all times, conduct their activities at the maximum distance possible from concentrations of polar bears or walruses.

(2) “Under no circumstances, other than an emergency, should aircraft operate at an altitude lower than 457 meters (1,500 feet) within 805 meters (0.5 mile) of polar bears or walruses observed on ice or land. Helicopters may not hover or circle above such areas or within 805 meters (0.5 mile) of such areas. When weather conditions do not allow a 457-meter (1,500-foot) flying altitude, such as during severe storms or when cloud cover is low, aircraft may be operated below

457 meters (1,500 feet). However, when aircraft are operated at altitudes below 457 meters (1,500 feet), the operator must avoid areas of known polar bear and walrus concentrations and should take precautions to avoid flying directly over or within 805 meters (0.5 mile) of these areas.

(3) "Plan all aircraft routes to minimize any potential conflict with active or anticipated polar bear or walrus hunting activity, as determined through discussions with local communities.

(e) "Mitigation measures for sound producing offshore activities. Any offshore activity expected to produce constant or pulsed underwater sounds with received sound levels ≥160 dB re 1 μPa will be required to establish and monitor acoustically verified mitigation zones surrounding the sound source and implement adaptive mitigation measures as follows:

(1) "Mitigation zones.

(i) "A walrus mitigation zone where the pulsed or constant received sound level would be ≥ 160 dB re 1 μPa;

(ii) "A walrus mitigation zone where the received pulsed sound level would be ≥ 180 dB re 1 μPa; and

(iii) "A polar bear or walrus mitigation zone where the received pulsed sound level would be ≥ 190 dB re 1 μPa.

(2) "Adaptive mitigation measures.

(i) "Ramp-up procedures. For all sound sources, including sound source testing, the following sound ramp-up procedures must be used to allow polar bears and walruses to depart the mitigation zones:

(A) "Visually monitor the mitigation zones and adjacent waters for polar bears and walruses for at least 30 minutes before initiating ramp-up procedures. If no polar bears or walruses are detected, ramp-up procedures may begin. Do not initiate ramp-up procedures when mitigation zones are not observable (e.g., at night, in fog, during storms or high sea states, etc.).

(B) "Initiate ramp-up procedures by activating a single, or least powerful, sound source, in terms of energy output and/or volume capacity.

(C) "Continue ramp-up by gradually increasing sound output over a period of at least 20 minutes, but no longer than 40 minutes, until the desired operating level of the sound source is obtained.

(ii) “Power down. Immediately power down a sound source when:

(A) “One or more walruses is observed or detected within the area delineated by the constant sound ≥ 160 dB re 1 μPa walrus mitigation zone;

(B) “One or more walruses is observed or detected within the area delineated by the pulsed sound ≥ 180 dB re 1 μPa walrus mitigation zone; and

(C) “One or more polar bear or walruses are observed or detected within the area delineated by the pulsed sound ≥ 190 dB re 1 μPa polar bear or walrus mitigation zone.

(iii) “Shut down when:

(A) “If the power down operation cannot reduce the received constant sound level to < 160 dB re 1 μPa (walrus) or received pulsed sound level to < 180 dB re 1 μPa (walrus) or < 190 dB re 1 μPa (walrus or polar bear), the operator must immediately shut down the sound source).

(B) “If observations are made or credible reports are received that one or more polar bears or walruses within the area of the sound source activity are believed to be in an injured or mortal state, or are indicating acute distress due to received sound, the sound source must be immediately shut down and the Service contacted. The sound source will not be restarted until review and approval has been given by the Service. The ramp-up procedures must be followed when restarting.

(f) “Monitoring requirements. Holders of an LOA will be required to:

(1) “Develop and implement a site-specific, Service approved, marine mammal monitoring and mitigation plan to monitor and evaluate the effectiveness of mitigation measures and the effects of activities on polar bears, walruses, and the subsistence use of these species.

(2) “Provide trained, qualified, and Service-approved on-site observers to carry out monitoring and mitigation activities identified in the marine mammal monitoring and mitigation plan.

(3) “For offshore activities, provide trained, qualified, and Service-approved observers on board all operational and support vessels to carry out monitoring and mitigation activities identified in the marine mammal monitoring and mitigation plan. Offshore observers may be required to complete a marine mammal observer training course approved by the Service.

(4) "Cooperate with the Service and other designated federal, state, and local agencies to monitor the impacts of oil and gas activities on polar bears and walruses. Where insufficient information exists to evaluate the potential effects of proposed activities on polar bears, walruses, and the subsistence use of these species, holders of an LOA may be required to participate in joint monitoring and/or research efforts to address these information needs and insure the least practicable impact on these resources.

(g) "Reporting requirements. Holders of an LOA must report the results of monitoring and mitigation activities to the Service's Marine Mammals Management Office via email at: FW7_MMM_REPORTS@FWS.GOV."

Other proposed mitigation, monitoring, and reporting requirements are explained on pages 36663 to 36701 of the Proposed Rule (81 FR 36663). AGDC has developed a Draft Project Polar Bear and Walrus Plan (see table 2.2-1 in the EIS). The Polar Bear and Walrus Plan includes measures to avoid or minimize potential interactions with Pacific walruses. These measures include:

- food and waste management,
- vessel avoidance and interaction procedures,
- aircraft avoidance and interaction procedures, and
- use of PSOs to minimize noise disturbances.

The Polar Bear and Walrus Plan includes four levels for avoiding and minimizing impacts on, and reducing interactions with, polar bears:

- education and training;
- detection and avoidance;
- deterrence; and
- reporting.

All workers would be required to watch a "Polar Bear Awareness" video and complete the North Slope Training Cooperative Unescorted Program through the North Slope Training Cooperative. Where PSOs would be used, they would be required to have completed a marine mammal monitoring training course. PSOs would be required on all Project vessels transiting through the Beaufort Sea. If a polar bear or Pacific walrus is spotted by the PSO, the vessel would stay 0.5 mile away from the animal, or slow down and move to increase the distance between the individual and the vessel.

Preventive measures would be taken to reduce the chance of wildlife, such as polar bears, gaining access to waste and food. All personnel would be required to comply with the *North Slope Environmental Field Handbook* (BP Exploration Alaska, Inc., 2015) and the Project Waste Management Plan.

To minimize impacts on denning polar bears, AGDC would conduct den surveys using forward-looking infrared imagery within 1 mile of known dens and activities in critical habitat. If an active den is identified, a 1-mile no-activity exclusion zone would be placed around the den. If the den is on an ice road or ice pad, the ice road or ice pad would be rerouted if it is not already built. If the road is already built, AGDC would consult with the USFWS to determine the appropriate mitigation measures. Deterrence of polar bears may occur when a polar bear is in the work area and is affecting the personnel's ability to operate. Deterrence techniques may include shouting, air horns, chemical repellents (i.e., bear spray), or non-lethal projectiles (e.g., cracker shells and bean bags). Any observations or interactions with polar bears would be recorded and reported to the USFWS.

Adherence to current safety practices, including speed limits, would reduce the likelihood of collisions with polar bears. Vehicle horns, sirens, lights, spot lights, and vehicles are sometimes used to deter bears from remaining at, or near, a worksite (USFWS, 2011b).

2.3.5 Ringed Seals

Project activities could disturb or harm ringed seals while they are in lairs with pups. Ringed seal lair surveys would be conducted with traditional hunters or specially trained dogs for any marine construction activities in Prudhoe Bay after March 1 in previously undisturbed areas in waters deeper than 10 feet (3 meters) to identify and avoid ringed seal structures by a minimum of 492 feet (150 meters).

2.3.6 Cook Inlet Beluga Whale

The Mainline Pipeline would cross designated critical habitat for the Cook Inlet beluga whale in Cook Inlet. For the offshore segment of the Mainline Pipeline, AGDC proposes to trench the shoreline approaches, which would cause increased impacts on critical habitat for the Cook Inlet beluga whale (the remainder of the offshore pipeline segment would be laid on the seabed). To reduce impacts, we have recommended that AGDC incorporate the use of DMT continuation methodology for the shoreline approaches at Beluga Landing and Suneva Lake, or provide a site-specific justification, supported by additional site-specific geotechnical investigations, demonstrating that this methodology is not feasible (see section 4.3.3.3 of the EIS).

Nearly the entire population (up to 83 percent) of Cook Inlet beluga whales is found near the Project on the western side of Cook Inlet near the Susitna River delta in June and July (McGuire et al., 2014). Pile driving for construction of the Mainline MOF and anchor handling for pipelay operations may occur during this time and would generate noise that would reach Level A (injury) and/or Level B (disturbance) harassment thresholds for Cook Inlet beluga whales. AGDC has committed to providing PSOs to monitor and implement shutdown zones to reduce the risk of Cook Inlet beluga whales experiencing Level A or Level B harassment during pile driving activities. PSOs would be provided for anchor handling, but would not be able to shut down activities if a whale entered the shutdown zone. NMFS has recommended that any activities in Cook Inlet within the Susitna Delta Exclusion Zone be avoided from April 15 through October 15; however, AGDC can only complete in-water marine construction when the area is free of sea ice. Based on discussions with NMFS concerning this species, the importance of the habitat to Cook Inlet beluga whales for feeding and reproduction during this time period, and to further reduce impacts on Cook Inlet beluga whales, we have recommended that AGDC not conduct pile driving activities for construction of the Mainline MOF during June and July (see section 4.8.1.3 of the EIS).

2.3.7 Chinook Salmon and Steelhead Trout

Pile driving could cause noise impacts on Chinook salmon and steelhead trout in Cook Inlet. Soft starts of impact hammers used to minimize impacts on marine mammals in Cook Inlet could also reduce impacts on Chinook salmon and steelhead trout in the area. Soft starts of the impact hammer would alert fish of impending hammering noise and allow them to vacate the general area before maximum sound energy is produced during impact pile driving.

3.0 ACTION AREA

An action area is defined by regulation as all areas that would be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR 402.02). The Project's action area spans the State of Alaska from Cook Inlet to Prudhoe Bay on the North Slope, including marine areas crossed by LNG carriers from Cook Inlet through Shelikof Strait or the Gulf of Alaska, and through the Aleutian Islands and southern Bering Sea. The action area also includes marine areas crossed by HLV through the Bering, Chukchi, and Beaufort Seas; the Gulf of Alaska; and Cook Inlet. The transit routes of construction and operational support vessels and LNG carriers are analyzed from the Mainline MOF, Liquefaction Facilities, or West Dock through the following where known listed resources may occur: Cook Inlet; the Gulf of Alaska; and the Chukchi, Bering, and Beaufort Seas.

The geographic extent of the action area includes those areas in which Project activities would have the potential to directly or indirectly affect threatened, endangered, or candidate species and their critical habitats, which includes a 1-mile buffer around all land-based facilities and a 6-mile buffer on marine facilities (seaward) and vessel routes. A 1-mile buffer is used around the Project footprint to account for potential effects on denning polar bears, and is the buffer distance from active dens that the USFWS typically recommends for construction and operational activities (USFWS, 2012a). This area also encompasses the 656-foot (200-meter) distance the USFWS uses to assess indirect impacts from disturbance on nesting Steller's and spectacled eiders (USFWS, 2011a) (see figures 3-1 through 3-3).

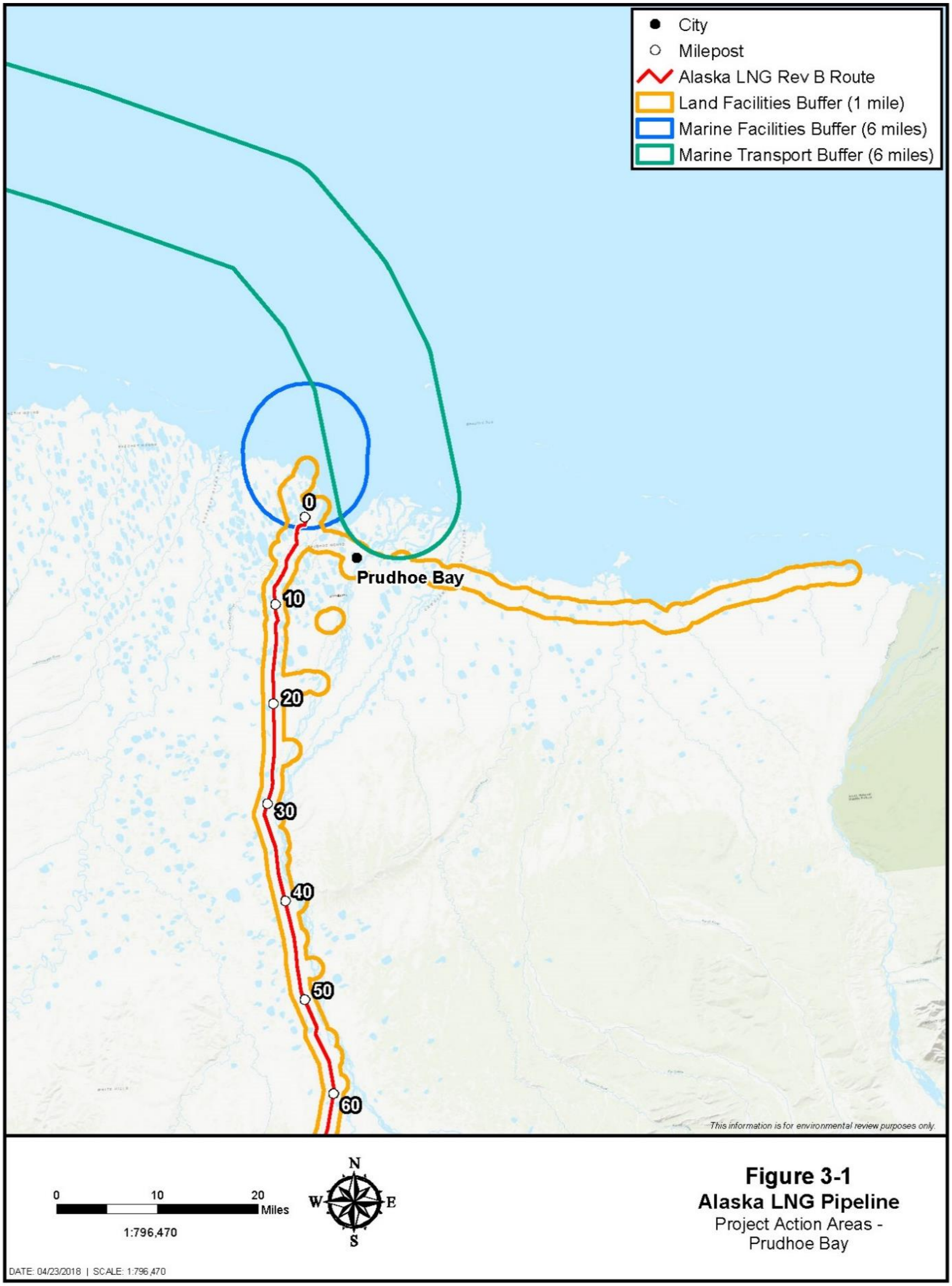


Figure 3-1
Alaska LNG Pipeline
Project Action Areas - Prudhoe Bay

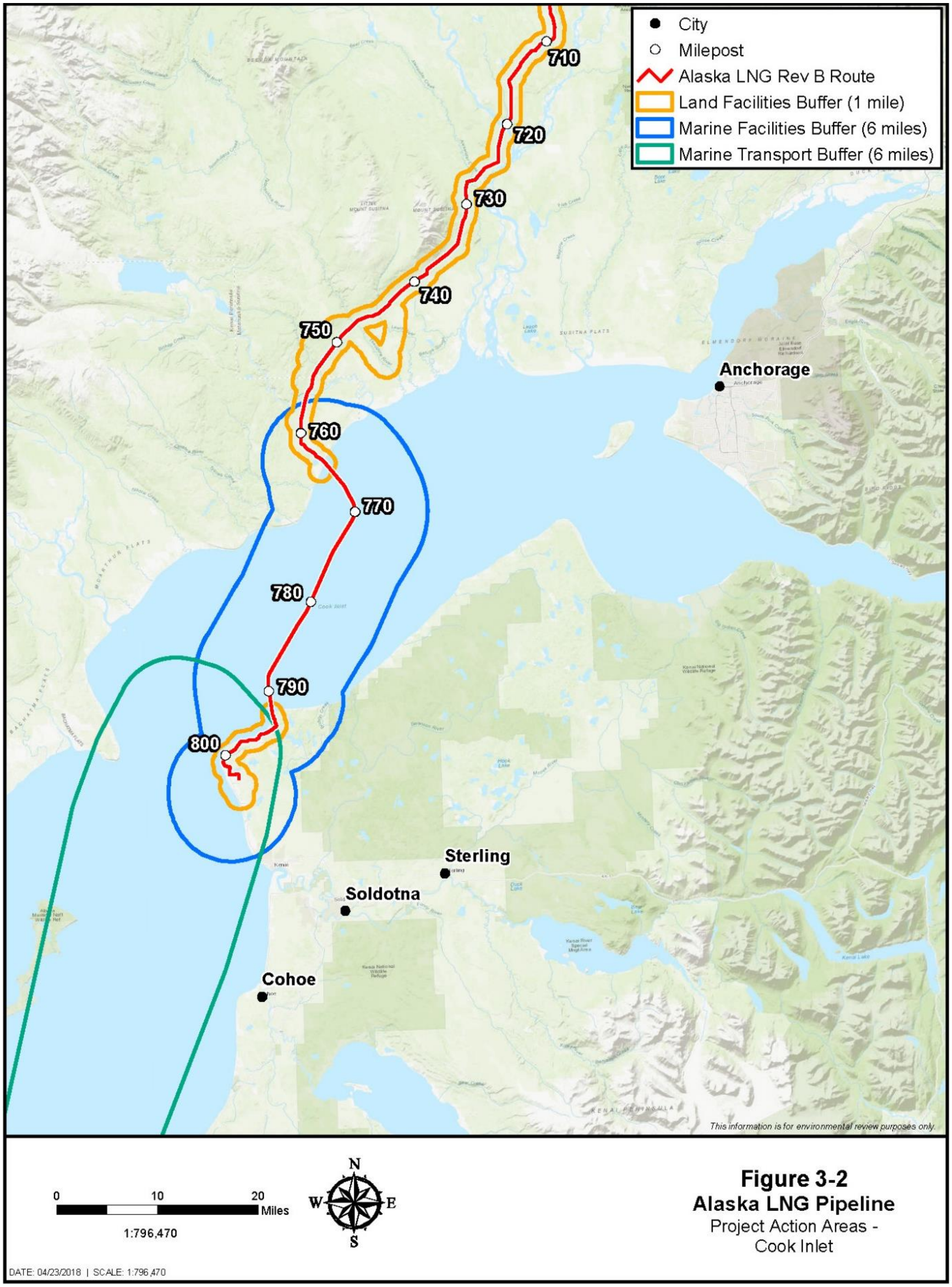


Figure 3-2
Alaska LNG Pipeline
Project Action Areas -
Cook Inlet

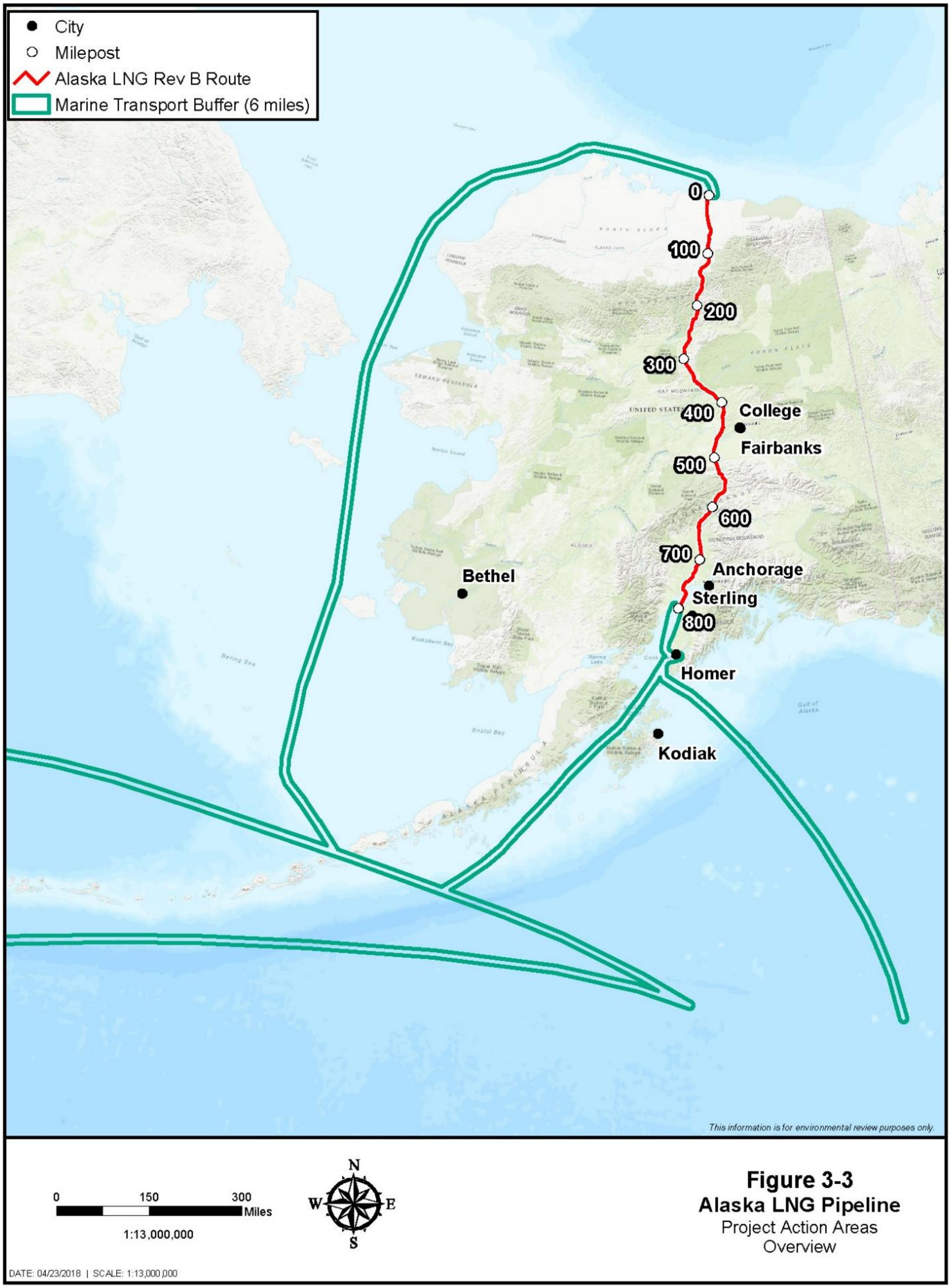


Figure 3-3
Alaska LNG Pipeline
Project Action Areas
Overview

4.0 CURRENT ENVIRONMENTAL CONDITIONS

Descriptions of the environmental conditions found in the Project area are provided in section 4.0 of the EIS.

5.0 SPECIES AND CRITICAL HABITAT CONSIDERED

To assist in compliance with Section 7 of the ESA, AGDC, acting as FERC's non-federal representative, initiated informal consultation with the USFWS and NMFS regarding federally listed species and designated critical habitat in October 2014. AGDC reviewed websites of the USFWS, ADF&G, and NMFS to identify which federally listed species may occur in the Project area. Habitat and species-specific surveys were not conducted. Through review of these resources and consultation with the USFWS and NMFS, FERC identified 32 federally listed, DPS, or ESU species and 1 previous candidate species that could occur in the Project area. These species are listed in table 5-1.

TABLE 5-1

Federally Listed Species Associated with the Project

Species	Federal Status, Designated Critical Habitat (DCH)	Project Facility Association
U.S. Fish and Wildlife Species		
Birds		
Alaska-breeding Steller's eider (*Polysticta stelleri*)	Threatened, DCH	Gas Treatment Facilities, Mainline Pipeline, Marine Terminal, vessel traffic (Cook Inlet, Bering, Chukchi, and Beaufort Sea)
Eskimo curlew [a] (*Numenius borealis*)	Endangered	None
Short-tailed albatross (*Phoebastria albatrus*)	Endangered	Vessel traffic (Cook Inlet, Gulf of Alaska, Bering Sea)
Spectacled eider (*Somateria fisheri*)	Threatened, DCH	Gas Treatment Facilities, Mainline Pipeline, vessel traffic (Chukchi and Beaufort Seas)
Mammals		
Northern sea otter, Southwest Alaska DPS (*Enhydra lutris kenyoni*)	Threatened, DCH	Vessel traffic (Cook Inlet, Bering Sea, Gulf of Alaska)
Pacific walrus (*Odobenus rosmarus divergens*)	Previous Candidate	Gas Treatment Facilities, vessel traffic (Beaufort Sea)
Polar bear (*Ursus maritimus*)	Threatened, DCH	Gas Treatment Facilities, Mainline Pipeline, vessel traffic (Beaufort Sea)
Wood bison (*Bison bison athabascae*)	Threatened; Experimental	None
National Marine Fisheries Service Species		
Mammals		
Bearded seal, Beringia DPS (*Erignathus barbatus*)	Threatened	Gas Treatment Facilities, vessel traffic (Bering Sea, Chukchi Sea, Beaufort Sea)
Blue whale (*Balaenoptera musculus)*	Endangered	Vessel traffic (Gulf of Alaska)
Bowhead whale (*Balaena mysticetus*)	Endangered	Gas Treatment Facilities, vessel traffic (Bering Sea, Chukchi Sea, Beaufort Sea)
Cook Inlet beluga whale (*Delphinapterus leucas*)	Endangered, DCH	Marine Terminal, Mainline MOF, Mainline Pipeline, vessel traffic (Cook Inlet)
Fin whale (*Balaenoptera physalus*)	Endangered	Vessel traffic (Gulf of Alaska, Bering Sea, Chukchi Sea, Beaufort Sea)

TABLE 5-1

Federally Listed Species Associated with the Project

Species	Federal Status, Designated Critical Habitat (DCH)	Project Facility Association
Gray whale, Western North Pacific DPS (*Eschrichtius robustus*)	Endangered	Gas Treatment Facilities, vessel traffic (Cook Inlet, Gulf of Alaska, Bering Sea, Chukchi Sea, Beaufort Sea)
Humpback whale, Western North Pacific DPS (*Megaptera novaeangliae*)	Endangered	Vessel traffic (Cook Inlet, Gulf of Alaska, Bering Sea, Chukchi Sea)
North Pacific right whale (*Eubalaena japonica*)	Endangered, DCH	Vessel traffic (Gulf of Alaska, Bering Sea)
Ringed seal (*Phoca hispida*)	Threatened	Gas Treatment Facilities, vessel traffic (Beaufort Sea)
Sei whale (*Balaenoptera borealis*)	Endangered	Vessel traffic (Gulf of Alaska and possibly Cook Inlet [c])
Sperm whale (*Physeter microcephalus*)	Endangered	Vessel traffic (Gulf of Alaska, Bering Sea)
Steller sea lion (western DPS) (*Eumetopias jubatus*)	Endangered, DCH	Vessel traffic (Cook Inlet, Gulf of Alaska, Bering Sea)
Fish		
Chinook salmon ESUs [b] (*Onchorhynchus tshawytscha)*		
Lower Columbia River Spring	Threatened	Vessel traffic (Cook Inlet, Gulf of Alaska, Bering Sea)
Upper Columbia River	Endangered	Vessel traffic (Cook Inlet, Gulf of Alaska, Bering Sea)
Puget Sound	Threatened	Vessel traffic (Cook Inlet, Gulf of Alaska, Bering Sea)
Snake River Fall	Threatened	Vessel traffic (Cook Inlet, Gulf of Alaska, Bering Sea)
Snake River Spring/Fall	Threatened	Vessel traffic (Cook Inlet, Gulf of Alaska, Bering Sea)
Upper Willamette River	Threatened	Vessel traffic (Cook Inlet, Gulf of Alaska, Bering Sea)
Steelhead Trout DPS's [b] (*Oncorhynchus mykiss)*		
Lower Columbia River	Threatened	Vessel traffic (Gulf of Alaska, Cook Inlet)
Middle Columbia River	Threatened	Vessel traffic (Gulf of Alaska, Cook Inlet)
Upper Columbia River	Endangered	Vessel traffic (Gulf of Alaska, Cook Inlet)
Puget Sound	Threatened	Vessel traffic (Gulf of Alaska, Cook Inlet)
Snake River Basin	Threatened	Vessel traffic (Gulf of Alaska, Cook Inlet)
Upper Willamette River	Threatened	Vessel traffic (Gulf of Alaska, Cook Inlet)

Sources: ADF&G, 2018; NMFS, 2017b, 2018b; USFWS, 2018a

[a] Considered extirpated.

[b] Fish/stocks (ESU/DPS) spawn on the West Coast outside Alaska, but could occur in Lower Cook Inlet, Gulf of Alaska, Aleutian Island, and Bering Sea waters during the marine phase of their life cycle.

[c] Based on information provided during traditional knowledge workshops (see section 4.14 of the EIS).

6.0 U.S. FISH AND WILDLIFE SERVICE SPECIES

6.1 ALASKA-BREEDING STELLER'S EIDER

6.1.1 Species Description and Potential Presence in the Action Area

Steller's eiders are diving sea ducks that breed inland and spend the remainder of the year in marine waters (ADF&G, 2018). Steller's eiders average 1.8 pounds in weight and are the smallest of the four eider species measuring 17 to 18 inches long. Adult male Steller's eiders are distinguished by their breeding plumage during winter, spring, and early summer when they have a black back, white shoulders, chestnut breast and belly, and white head with black eye patches. In contrast, females and juveniles are mottled dark brown throughout the year. Characteristic of many dabbling ducks such as mallards (*Anas platyrhynchos*), Steller's eiders of both sexes have an iridescent blue patch with a white border on their upper wings (USFWS, 2011a).

Two breeding populations of Steller's eiders are recognized in Arctic Russia, and one breeding population is recognized in Alaska. It is only the Alaska-breeding Steller's eiders that are listed as threatened under the ESA, and are addressed here (USFWS, 2011a). Steller's eider pair bonding occurs in the winter and pairs move to Arctic nesting grounds once the sea ice retreats. They first breed at 2 to 3 years of age. Alaska-breeding Steller's eiders that arrive on the North Slope but have not begun to nest are typically associated with deep to shallow ponds characterized with *Arctophila* and *Carex* spp. (grasses and sedges) (Rojek, 2008; Quakenbush et al., 2004). The USFWS commented that waterbodies characterized by *Arctophila* spp. are considered a limited habitat type on the North Slope.

Female Steller's eiders select coastal nest sites typically on islands or peninsulas in tundra lakes and ponds and build nests made from grass lined with down where they lay 5 to 10 eggs between early June and mid-July. Females incubate the eggs for 25 to 28 days, with nestlings/young generally present from early July to late August (Smith et al., 2017). These diving ducks spend most of the year in shallow marine waters where they primarily feed on benthic invertebrates (e.g., mollusks and crustaceans) and aquatic plants in waters generally less than 33 feet (10 meters) in depth. Steller's eider lifespan ranges from 16 to 21 years (ADF&G, 2018).

The migration of Alaska-breeding Steller's eiders is based on spring, molt, and fall seasonal movements. In the spring, Steller's eiders migrate from staging and wintering areas to their breeding grounds (Rosenberg et al., 2016). Migration occurs during the following periods (Smith et al., 2017):

- spring: mid-April to early July;
- molt: late June to mid-October; and
- fall: late July to December.

The historic nesting range of Alaska-breeding Steller's eiders overlaps the Gas Treatment Facilities (and within the action area) near Prudhoe Bay where Alaska-breeding Steller's eiders have been observed during the breeding season; however, nesting Alaska-breeding Steller's eiders have not been documented at Prudhoe Bay (Quakenbush et al., 2002). Alaska-breeding Steller's eiders' current breeding range includes the Arctic Coastal Plain, with concentrations near Barrow; but they are rarely found nesting east of the Colville River (USFWS, 2011a, 2018b). Steller's eiders are so rare that in some years they are not detected by aerial survey methods. Based on aerial surveys within their core breeding areas near Barrow, nesting density recorded during the years of 1999 through 2012 ranged from 0 to 0.04 male per square kilometer (Safine, 2013). Non-breeding Steller's eiders are found in the Prudhoe Bay area and utilize waters of the Chukchi and Beaufort Seas. USFWS aerial surveys conducted from 1992 to 2010 for breeding Steller's eiders detected five individuals east of the Colville River, including the most recent observation in 1998. During wing-molt from late August to early October, most Alaska-breeding Steller's eiders use the Kuskokwim Shoals critical habitat area, which is outside the Project area, as well as sites along the Alaska Peninsula (e.g., Port Heiden, Seal Islands Lagoon, or Nelson Lagoon (Rosenberg et al. 2016; Martin et al., 2015). Kamishak Bay is a known molting and wintering site for Steller's eiders (Rosenberg et al., 2016; Larned, 2006). The winter range includes the Aleutian Islands, Alaska Peninsula, and the western Gulf of Alaska including Kodiak and Lower Cook Inlet (Larned, 2012). The migration in spring occurs along the Bristol Bay Coast of the Alaska Peninsula across Bristol Bay toward Cape Pierce, moving north along the Bering Sea Coast (Larned, 2012).

Alaska-breeding Steller's eiders are monitored by ground and aerial surveys (Stehn and Platte, 2009). Alaska-breeding Steller's eiders are estimated to number 576 individuals (Stehn and Platte, 2009; USFWS 2011a, 2014b). The Alaska-breeding population was listed as threatened under the ESA in 1997 due to range contraction. Recent surveys support this declining trend. An estimated 59,638 Steller's eiders were counted during spring migration surveys, and this was the third lowest in the 1992 to 2012 history of the survey (Larned, 2012). The Yukon-Kuskokwim Delta was once the most populated breeding ground in Alaska for Alaska-breeding Steller's eiders, but this breeding ground has since nearly disappeared (Kertell, 1991).

As a result of the population decline, critical habitat was designated for Alaska-breeding Steller's eiders in 2001. Designated critical habitat for Alaska-breeding Steller's eider totals 2,831 square miles comprised of about 65 percent federal lands or waters, 25 percent state waters, and 10 percent native lands (USFWS, 2001a). Critical habitat for the Alaska-breeding Steller's eider includes breeding habitat on the Yukon-Kuskokwim Delta and molting habitat in marine waters of Kuskokwim Shoals, Sea Islands, Nelson Lagoon, and Izembek Lagoon in western Alaska (see figure 6.1.1-1) (ADF&G, 2018). Primary constituent elements (PCE) for critical habitat designated for molting and wintering of Alaska-breeding Steller's eiders include marine waters up to 30 feet (9 meters) in depth, aquatic substrate and associated invertebrate fauna, and an underlying benthic community, including eelgrass beds.

During molting and wintering, Alaska-breeding Steller's eiders may occur in Upper Cook Inlet near the Liquefaction Facilities on the eastern shore of Cook Inlet near Nikiski; along HLV traffic during construction in Lower Cook Inlet, Shelikof Strait, and the Aleutian Islands; and along potential marine transportation routes through the Shelikof and Bering Straits, and the Bering, Chukchi, and Beaufort Seas (see figure 6.1.1-2). Sea ice in Lower Cook Inlet is a significant factor influencing use of winter habitats by Steller's eiders (Larned, 2006). Steller's eiders were observed 25 percent of the time in eastern Cook Inlet between the nearshore area of Anchor Point to 15 miles north of Ninilchik (Larned, 2006), which is south of the Marine Terminal. In western Cook Inlet, Steller's eiders were most abundant in the shoals from Douglas Bay to Bruin Bay, in a shoal 7 miles southeast of Bruin Bay, and in the mouth of Iniskin Bay (see figure 6.1.1-2). Designated critical habitat for Alaska-breeding Steller's eider would fall outside the Project action area.

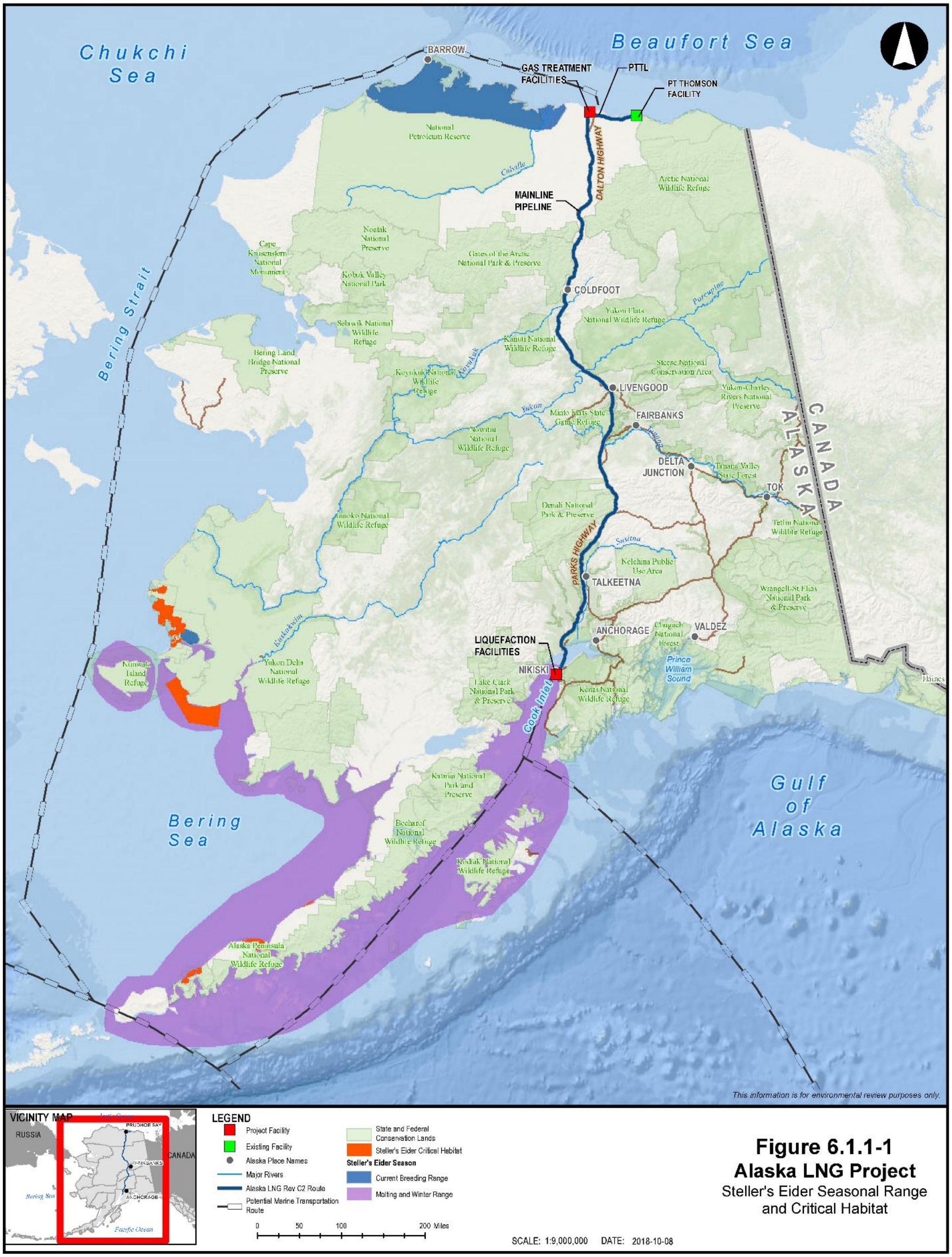


Figure 6.1.1-1
Alaska LNG Project
Steller's Eider Seasonal Range and Critical Habitat

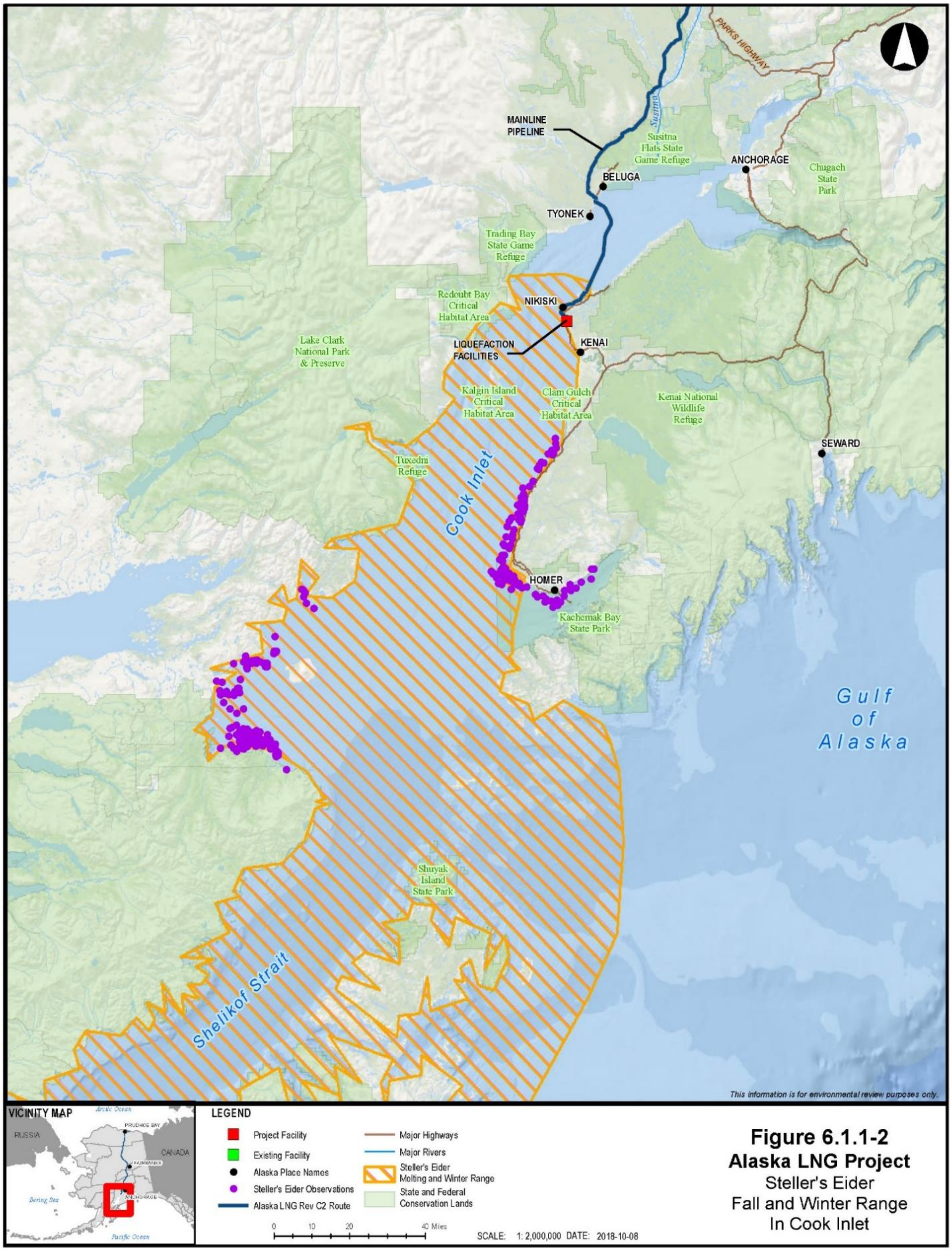


Figure 6.1.1-2
Alaska LNG Project
Steller's Eider
Fall and Winter Range
In Cook Inlet

The causes for the population decline of Alaska-breeding Steller's eiders are unknown; however, several potential threats have been identified. These threats include lead poisoning, predation, contaminants, and collision with towers and wires during periods of poor visibility (USFWS, 2011a). Eider species (e.g., king [*Somateria spectabilis*], common [*Somateria mollissima*], Steller's, and spectacled) are particularly vulnerable to oil spills due to the large flock sizes, distance to shore, and use of moderate-ice areas (Smith et al., 2017). Chronic oil contamination is a serious problem for eiders in areas near shipping lanes, such as the Aleutian Islands, the Bering Sea, the Bering Strait, and increasingly in the Chukchi and Beaufort Seas (Smith et al., 2017). Climate change has also been documented as a potential threat to the Alaska-breeding Steller's eider. Fuller et al. (2008) used a two-stage optimization model and found that if Alaska's Arctic experiences 2.7°Fahrenheit (°F) (1.5°Celsius [°C]) of warming by 2040, which is predicted by the Intergovernmental Panel on Climate Change's A2 scenario, then potential habitat will significantly decrease for several Arctic species including Alaska-breeding Steller's eiders. Climate change impacts, along with reduced food availability, and/or oceanic regime shifts, have been documented as causes for non-breeding events in populations of Alaska-breeding Steller's eider (Dunham and Grand, 2017). The non-breeding events, similar to those observed in common eiders (*Somateria mollissima*), may be a strategy to reduce the risk of mortality associated with breeding when conditions are poor (Coulson, 2010).

6.1.2 Effects Analysis

Construction impacts on Alaska-breeding Steller's eiders from Project activities would include habitat disturbance or loss; noise and lighting disturbance; collisions (e.g., with vessels, aircraft, and buildings); waste generation; and human disturbance. Potential impacts on Alaska-breeding Steller's eiders from Project operation include activities such as stormwater discharge from the Gas Treatment Facilities, Mainline Pipeline aboveground facilities, and the LNG Plant; flare operation; human activity; and lighting disturbance.

6.1.2.1 Habitat Effects

Constructing and operating the Project would result in the temporary and permanent loss and degradation of habitat. The Project would affect a variety of vegetated habitats including forested, scrub/shrub, and herbaceous as well as a diversity of vegetation communities. Tundra and/or alpine ecosystems would have a slower regeneration time after disturbance, and impacts in these areas would be long term to permanent. Habitat loss and/or degradation would directly affect Alaska-breeding Steller's eiders by increasing the rates of stress, injury, and mortality. Habitat loss may also indirectly affect the survival of individual Alaska-breeding Steller's eiders by affecting foraging and migratory behaviors. Construction and operational activities associated with the Gas Treatment Facilities and Liquefaction Facilities would contribute to habitat loss for the Alaska-breeding Steller's eider, as described below.

Construction activities, including the West Dock Causeway expansion, development of the reservoir and gravel mine site, and screeding (e.g., subsea scraping), would reduce, degrade, or eliminate habitat for the Alaska-breeding Steller's eider. The West Dock Causeway expansion would include a temporary, annually installed barge bridge and turning basin as discussed in sections 2.1.3 and 2.2.1 of the EIS. The barge bridge would be temporarily installed before the beginning of the open-water season (typically before August) and removed 4 to 6 weeks later (typically October). Disturbance during this time would cause displacement of Alaska-breeding Steller's eiders and abandonment of suitable habitat. Researchers have documented ducks, geese, and cormorant displacement due to anthropogenic disturbance, and in some cases, suitable areas were completely abandoned (Hockin et al., 1992).

Transportation of the GTP modules to the West Dock Causeway would occur during six summer seasons. Activities associated with summer module transport could result in disturbance and/or displacement of Alaska-breeding Steller's eiders. Dock Head 4 construction to accommodate the module deliveries would also result in habitat loss and/or disturbance to Alaska-breeding Steller's eiders. Disturbance associated with these activities (e.g., noise and increased human activity) over six summer seasons could result in discontinued use of some available adjacent habitat for the Alaska-breeding Steller's eider. Tugs and barges associated with the sealifts would be anchored in the PBOSA 5 miles northwest of West Dock and landward of Reindeer Island during the open-water seasons. Reindeer Island is within the Beaufort Sea Nearshore Important Bird Area (see section 4.6.2.5 of the EIS). The impacts on Alaska-breeding Steller's eiders from staging tugs and barges at the PBOSA would be similar to impacts caused by vessels in the turning basin of West Dock; birds could be displaced, disturbed, or risk collision.

Land and offshore-based construction of the Mainline Facilities, including the construction of the Mainline MOF, would result in disturbance, habitat loss, and habitat alteration and may result in the displacement of birds from molting or wintering habitats. Similarly, construction and operational activities associated with the Liquefaction Facilities, including operation at the Marine Terminal Facilities and dredging for the Marine Terminal MOF and its removal, would result in habitat loss and disturbance for the Alaska-breeding Steller's eider at molting and wintering habitats.

Shipping lanes passing through the Aleutian Islands, including Unimak Pass, Akutan Pass, and the approach to Dutch Harbor, are inhabited by wintering Steller's eiders. Steller's eiders have been observed in shoals, nearshore bays, and lagoons in Cook Inlet from late August through April, with peak winter occurrences in January and February (Larned, 2006). Vessels in transit to the Marine Terminal MOF and Mainline MOF during construction, and LNG carriers during operation, would temporarily stage or anchor at Kachemak Bay and would transit through Shelikof Strait. These areas have high concentrations of Alaska-breeding Steller's eiders in nearshore environments during winter (December through March) and spring (April through May) (ADF&G, 2018; NOAA, 2018). Effects on Alaska-breeding Steller's eider include the degradation of molting and wintering habitat from vessel traffic, including LNG carrier traffic. Habitat degradation could occur through marine vessel grounding, spills, and the introduction of aquatic invasive species.

Alaska-breeding Steller's eiders are flightless during about 3 weeks of their molting season and are more sensitive to disturbance at this time. Individuals are more vulnerable during the molting season due to their enhanced energy demands for new feather growth and their limited flying capabilities (Guillemette et al., 2007; King, 1980). Steller's eiders often congregate in large concentrations and feed more frequently during the molting season, which also makes them more vulnerable to disturbance during this time (Fredrickson, 2001; Petersen, 1980).

6.1.2.2 Noise

Birds use a vast array of sounds for communicating, finding mates, establishing and expressing territories, and other social behaviors (Dooling and Popper, 2016). Birds, and particularly nesting birds, can be negatively affected by noise emitted at continuous or irregular intervals during sensitive times of the year (Burton et al., 2002; Drewitt and Langston, 2006). Short-term, startle/response effects of noise in wildlife are well known, whereas effects from long-term noise exposure are poorly understood and difficult to quantify (Gill et al., 1996). Physical damage to birds' ears occurs with short-duration loud sounds or continuous exposure to noise (Dooling and Popper, 2016; Ortega, 2012). Temporary threshold shifts in birds, which is temporary hearing loss that recovers over a period of minutes to days from the end of noise exposure, can also occur from some noise generating activities (Dooling and Popper, 2016). Extensive literature documents the effects of anthropogenic noise on wildlife (Barber et al., 2011). Studies show that noise functions as a chronic stressor that can alter stress hormones and have multiple effects on fitness in bird communities (Kleist et al., 2018). Chronic and frequent noise interferes with animals' abilities to detect important sounds, such as from predators, whereas intermittent and unpredictable noise is often perceived as a threat. Given the energetic costs extended in responding to aural disturbance (e.g., flushing and increased stress), these effects can lead to fitness costs, either directly or indirectly (Francis and Barber, 2013). Behavioral responses to disturbance can include reduced feeding, increased vigilance, and a reduction in parental care. Impacts on wildlife range from mild to severe and include damage to the auditory system, a reduced ability to find prey, mates, or avoid predators due to masking of natural sounds, imposition of chronic stress and associated physiological responses, startle responses, interference with mating, and population declines (Schroeder et al., 2012; Blickley and Patricelli, 2010). Both acute and chronic noise could cause nest abandonment and failure, reduced juvenile growth and survival, and malnutrition or starvation of the young (Francis et al., 2009).

Noise from construction equipment, vehicle/vessel traffic, airplanes, helicopters, blasting, and general Project-related activity during construction and operation could affect Alaska-breeding Steller's eider behavior. Ground-nesting marine birds in the Canadian Arctic have demonstrated avoidance behaviors from aircraft by which they initiated flight from their nests when aircraft was within 1 kilometer of their colony. Similarly, birds demonstrate avoidance behaviors when humans approach on foot within 328 feet (100 meters) (Mallory, 2016). Research has demonstrated flushing can affect marine birds' reproductive success. Impacts on ground-nesting marine birds ranged from nest abandonment to skipping breeding (Carney and Sydeman, 1999). However, disturbance to nesting Alaska-breeding Steller's eiders would be unlikely due to their low densities across the North Slope, which includes areas near the Gas Treatment Facilities. Noise sources generated by Project activities include single impulse sounds (e.g., blasting), multiple impulses (e.g., jackhammers, pile driving), and non-strike continuous noise (e.g., construction sounds) (Dooling and Popper, 2016). Noise levels associated with some common machines and activities that would be present during construction and operation are discussed in sections 4.16.3 and 4.16.4 of the EIS. Primary sources of noise generated from construction and operational activities that would disturb Alaska-breeding Steller's eiders and their habitat include site preparation involving clearing and grading; building construction including facility foundations (e.g., pile driving); materials transport; installation and operation of the gravel mine and construction camps; installation of the water reservoir; and dredging for the Marine Terminal MOF. Continuous operational noise associated with aboveground facilities and intermittent noise due to blowdowns (as described in section 4.16.4.2 of the EIS) would disturb Alaska-breeding Steller's eiders.

Birds are at greatest risk of injury from noise as they near construction areas, but impacts could also occur at greater distances from activities such as pile driving and blasting. Distances at which noise would attenuate to ambient levels would depend on local conditions such as tree cover and density, topography, weather (humidity), and wind, all of which can alter background noise conditions. As a consequence, impacts on birds from construction noise would vary along the length of the Project corridor. The USFWS commented that short, intermittent disturbances like blasting could have greater deleterious impacts on birds than long-term noise. Noise generated during vibratory and impact pile driving as well as dredging at the Liquefaction Facilities could range from 39 to 68 dB on the A-weighted scale (dBA). When reviewing effects of highway noise on birds, Dooling and Popper (2016) documented that birds can tolerate up to 72 hours of continuous exposure to noises up to 110 dBA without experiencing hearing damage. Ryals et al. (1999), however, documented that the amount of hearing loss and time of recovery varied considerably among different bird species. If present, Alaska-breeding Steller's eiders could be temporarily displaced during active sheet and pile driving, but could return to marine construction areas during breaks from these activities (e.g., maintenance days and shifts at night). Pile driving noise for Dock Head 4 construction could also disturb and displace Alaska-breeding Steller's eiders in the vicinity of the activity; most of the pile installation would be done with an impact hammer. Underwater noise associated with pile driving could disturb Alaska-breeding Steller's eiders since they spend time underwater while foraging, but birds in the vicinity would likely disperse prior to lethal noise levels (Leopold and Camphuysen, 2007). Blasting could have a direct effect on Alaska-breeding Steller's eider hearing. Hearing thresholds vary by species and age of the individual. Behavioral effects from blasting would be similar to those described for pile driving. Additionally, birds, including Alaska-breeding Steller's eiders, within the blast zone (e.g., for North Slope gravel mining) could experience injury or death through noise concussion or flyrock strikes.

Gas Treatment and Liquefaction Facilities operation, including operation of the GTP and LNG Plant, would generate noise above ambient levels, although it would not reach the 93-dBA level for temporary threshold shifts (i.e., behavioral effects or temporary effects on hearing) outside the facility footprint (Dooling and Popper, 2016). Birds that enter the footprints of these facilities could experience behavioral and energetic effects. The facilities would contribute to an increase in industrial noise in the area that could result in displacement of and loss of fitness for Alaska-breeding Steller's eiders. While sounds would not reach temporary threshold limits established by Dooling and Popper (2016), noise from these facilities would be above background noise levels and operate continuously for the life of the Project. Noise from the GTP could decrease the suitability of the area for Alaska-breeding Steller's eiders. The CGF, east of the GTP, contributes to the ambient noise levels in this region (Anderson et al., 1992). Noise would be expected to dissipate to background levels within about 2.25 miles of the facility. Alaska-breeding Steller's eiders would likely avoid foraging and resting in this area for the life of the Project due to the increased noise levels. Sounds from equipment could affect sensitive bird habitat, including Alaska-breeding Steller's eider habitats that occur near the Liquefaction Facilities by raising ambient sound levels, which degrade habitat quality. Habitat surrounding the Project's aboveground facilities could become uninhabitable by birds, as they would avoid these areas due to noise and disturbance (Andersen et al., 1992; Habib et al., 2007; Ortega, 2012).

An increase in air traffic, including helicopter and airplane noise associated with construction of the Mainline Facilities, and operation of the Liquefaction and Gas Treatment Facilities would create more noise disturbance for Alaska-breeding Steller's eiders around these facilities. For example, nesting birds would flush from their nests during helicopter overflights. Sullender (2017) reports the energetic cost of disturbance may be compounded by an increase in nest predation while the disturbed bird is away. While the nesting bird is flushed, nest predators such as gulls and jaegers can take advantage and prey on abandoned eggs or unfledged chicks. Aircraft generally flying below altitudes of 4,000 feet and within 4,000 feet laterally of birds would elicit behavioral responses. Responses are strongest within 3,280 feet for eiders and 5,280 feet for molting geese (Sullender, 2017). Molting geese can be displaced to as much as 1.8 miles from the disturbing aircraft (Derksen et al., 1982); eiders will dive under water in an attempt to avoid disturbing aircraft (Mosbech and Boertmann 1999; Sullender, 2017).

Disturbance from noise to nesting Alaska-breeding Steller's eiders would be unlikely due to their extremely low densities across the North Slope, particularly near the Gas Treatment and Mainline Facilities. If Alaska-breeding Steller's eiders should occur near the Project, impacts on the species from Project-related noise would be minimal due to the short duration of construction noise and low levels of operational noise

6.1.2.3 Lighting

Sources providing artificial lighting that could pose risks for injury to Alaska-breeding Steller's eiders include facility lighting (i.e., during construction and operation), tower or antenna lighting, lighting on docks or anchored marine barges and vessels, worker camp lighting, and flare tower operation. Additionally, artificial lighting sources include facility lighting (e.g., Gas Treatment Facilities and Marine Terminal) that would illuminate working areas for work onshore and work over and within water (e.g., screeding and pile driving), lighting for security purposes, and lighting that would illuminate work areas during winter construction.

During operation, the aboveground facilities would require year-round lighting. Facility lighting would consist of normal and essential lighting panels and lighting fixtures to provide lighting for working areas and for security requirements. Outdoor general lighting would be high-pressure sodium or light-emitting diode lights mounted on poles about 100 feet high and directed toward facilities, similar to typical street lighting. Lighting design would direct lighting only in places where it is necessary, and would be designed and shielded, where applicable, to reduce light trespass, unwanted projection, and upward-directed light.

Artificial lighting can alter bird behavior. During migration and periods of low visibility, birds could be attracted by facility lighting or the low-pressure flare pilot and collide with the flare, communication tower, power lines, Marine Terminal, or other buildings or modules (Day et al., 2015). During periods of low visibility (e.g., stormy or foggy conditions) in Alaska, eiders have landed in obscure places including a main street of town and fishing boats (Day et al., 2015). Eider species are also attracted to bright lights, especially while flying at night, and observations have been recorded in the Gulf of Alaska, and the Bering, Chukchi, and Beaufort Seas (Day et al., 2004b, 2005, 2015; Dick and Donaldson, 1978).

Offshore and onshore construction-related lighting that would not normally be present during winter could affect overwintering Alaska-breeding Steller's eiders in Cook Inlet (Montevecchi, 2006). These artificial light sources could affect birds that overwinter in this area since they could be attracted to the source, thereby increasing collision risk. Because AGDC would design facility lighting to direct lighting only in places where it is necessary, and design and shield facility lighting where applicable to reduce light trespass, unwanted projection, and upward directed light, effects from light on birds would be reduced.

6.1.2.4 Collisions

Alaska-breeding Steller's eiders are susceptible to collisions with Project facilities and equipment. Migratory birds are particularly at risk of collision when darkness and/or inclement weather impairs vision. Collisions with structures often result in mortality (Black, 2004; Manville, 2005; Weir, 1976). Birds could also experience collision injuries including concussions, internal hemorrhaging, and broken bones.

Avian species at greatest risk for collisions with vessel traffic include eiders (e.g., common, king, spectacled, and Steller's) due to their high-speed flight travel, relatively low flight altitude over water, and attraction to bright lights at night (Day et al., 2004a,b, 2005; Johnson and Richardson, 1982). Information is limited, but the best available information to estimate collision risk between marine vessels and migratory birds is observations recorded during Royal Dutch Shell's exploratory oil and gas activities in 2012 (USFWS, n.d.; Schroeder, 2013). Ten vessels operating in the Chukchi Sea for 108 days resulted in 131 total bird–vessel encounters. There were 17 fatal collisions with eiders, 13 king eiders and 4 common eiders. Of these 17 collisions, 2 involved mobile offshore drilling units, and 15 involved support vessels. When considering that 10 vessels were involved in the 15 fatal eider collisions with support vessels, an estimated collision rate per vessel would be 1.5 (i.e., 15 ÷ 10 = 1.5 collisions/vessel) over a 108-day season. The total number of vessel trips associated with Project construction and operation is provided in appendix L-2 of the EIS. Researchers have also documented energetic implications for seabirds associated with vessel traffic. Escaping from vessel traffic or being alarmed from the disturbance can cause a loss of foraging time and an increase in energy expenditure (Schwemmer et al., 2011).

Vessel traffic traveling to West Dock in the Bering, Chukchi, and Beaufort Seas during the ice-free period, typically August and September, would disturb and displace Alaska-breeding Steller's eiders. Few Alaska-breeding Steller's eiders are expected to occur offshore where most shipping vessel traffic would occur. However, if a vessel strike or collision should happen, it could result in mortality and/or injury to the bird. Specifically, birds would be vulnerable to collision during winter months when Alaska-breeding Steller's eiders are found in nearshore environments where vessels temporarily stage or anchor at Kachemak Bay and transit through Shelikof Strait.

Helicopter and aircraft activities during construction and operation would cause a short-term disturbance, distract birds, and increase the collision risk. Direct and indirect effects on Alaska-breeding Steller's eiders from air traffic would include injury or mortality from collisions, disruption of seasonal movements, displacement from roadside habitats, and/or reduced productivity from disturbance. Birds would be vulnerable to collision injury or mortality; however, they may already be accustomed to these activities due to the existing air traffic flying to Kenai Municipal Airport as well as the on-going habitat management projects at the airport reported in the *Wildlife Hazards Management Plan* updated by the FAA in August 2011 (Wince-Corthell-Bryson and Aries Consultants LTD., 2013). Alaska-breeding Steller's eiders could be susceptible to disturbance from helicopter and aircraft activities while occupying molting and wintering habitat. Gollop et al. (1974) documented impacts of helicopter overflights on molting long-tailed ducks (*Clangula hyemalis*) and surf scoters (*Melanitta perspicillata*) and found that while most molting ducks swam away from the helicopter, many reacted by diving under water. The reaction of the sea ducks to low level flights resulted in an interruption of normal behavior and/or displacement from foraging areas. After Steller's eiders' wing-molt, where large congregations disperse from Nelson and Izembek Lagoons to sites along the Alaska Peninsula, Kodiak Island, Aleutian Islands, and Lower Cook Inlet, birds would be susceptible to disturbance and displacement from air traffic within the Lower Cook Inlet where they occupy shallow waters to feed on bivalves (Fredrickson, 2001).

The GTP and LNG Plant flare stacks would increase the potential for Alaska-breeding Steller's eider collisions. In addition, collocation of stormwater ponds with the ground-flare system could lead to unintentional bird mortality if the birds are using the pond and/or nearby suitable habitat when the flare becomes active. The flare height would generally preclude an incineration hazard for nesting birds. The bright light emitted during flare events could attract migrating eiders, and could present a collision and incineration hazard for them, although most eiders would migrate offshore and at mean altitudes well below the flare height (Day et al., 2015). Due to the installation of a radiation fence about 52 feet high around the ground-flare system on the LNG Plant (see section 2.1.5 of the EIS), and height (200 feet high) of the flare adjacent to the Marine Terminal, impacts on Alaska-breeding Steller's eiders would be minimal, with individual birds potentially avoiding these areas altogether.

6.1.2.5 Spills

USFWS commented on the potential for hydrocarbon spills related to the accidental releases of LNG and/or fuel spills, specifically where these would enter waterbodies (e.g., coastal and marine environments of Cook Inlet and the Beaufort Sea) and in terrestrial habitats. The use of mechanical equipment to construct and operate the Project could result in accidental spills or releases of fuel and other hazardous materials, adversely affecting water quality for birds.

Equipment operation for the construction methods used during waterbody crossings could release fuel resulting in impacts on water quality and avian resources. Alaska-breeding Steller's eiders could be directly affected by equipment-related fluid spills through ingestion or contact with their plumage as well as inhalation. These effects could reduce survival and reproduction that could result in population declines. Threats to Alaska-breeding Steller's eiders increase when spills occur near or within areas of high bird concentration such as wintering or molting congregations (NOAA, 2018; ADF&G, 2018). The magnitude of impact would depend on fluid type, volume, season, and response. In addition, LNG carriers are required to develop and implement an SOPEP, which includes measures to be taken when an oil pollution incident has occurred or is at risk of occurring.

6.1.2.6 Human Presence

Construction camps would create the potential for wildlife–human interactions and changes in wildlife behavior or habitat use that would affect birds, including Alaska-breeding Steller's eiders

(Gill, 2007). The Prudhoe Bay construction camp (milepost [MP] 0.6) would overlap potential habitat for Alaska-breeding Steller's eiders (see table 2.1.4-5 of the EIS). Studies have suggested that pedestrian traffic is more disruptive on some bird species than vehicular traffic (Borgmann, 2011). Researchers have documented that shorebird species occur at lower densities near roads in the Prudhoe Bay oil field than in areas away from roads (Troy, 1988). Overall, human disturbance from vehicular and pedestrian traffic could affect bird activity and have negative impacts on their nest density and success.

Workers would be present at the GTP and LNG Plant at all times, resulting in permanent impacts associated with human disturbance. Most Mainline Facilities compressor stations would be remotely operated; therefore, this potential would be reduced. Facilities can also provide artificial den sites, thermal refuges, and access to human food for arctic and red foxes, which are predators of many bird species (Stickney et al., 2013). An increase in hunting pressure from humans and predators due to the creation of new access roads and cleared right-of-way along the Mainline Pipeline would also directly affect Alaska-breeding Steller's eiders.

Construction and operational impacts would include changes to bird habitat types. The construction of aboveground facilities, including communication towers and elevated pipelines associated with the GTP, PTTL, and PBTL, could provide nesting and vantage perches for raptors, common ravens, and glaucous gulls that are not otherwise available across the Beaufort Coastal Plain Subregion (Platte, 2003). The USFWS recommended the use of bird deterrence structures (e.g., perch guards) to limit raven nesting on facilities. The facilities could also provide artificial den sites, thermal refuges, and access to human food for birds and their predators. Predators attracted to the area could increase predation risk for Alaska-breeding Steller's eiders. For example, on the North Slope, oil development may have affected densities of some predators (e.g., arctic fox, glaucous gull, common raven, and grizzly bear) that are known to prey on brant and snow geese. Discarded human food wastes potentially attract omnivorous scavengers that may prey on waterfowl (Truett et al., 1997). Due to expected low densities of Alaska-breeding Steller's eiders within the Project action area overlapping the Gas Treatment and Mainline Facilities, impacts on nesting Alaska-breeding Steller's eiders from human presence would not be expected. Impacts associated with human presence and disturbance would be minimal in areas that overlap Alaska-breeding Steller's eiders' molting and wintering areas within the Project action area since concentrations of birds would be present in nearshore marine waters (e.g., the eastern Aleutian Islands, the south side of the Alaska Peninsula, Kodiak Archipelago, and Lower Cook Inlet) (USFWS, 2014g).

6.1.2.7 Critical Habitat

Project-related vessel traffic would follow the Northern Pacific Great Circle route and the Northern Sea route through the Aleutians subarea at Unimak Pass, which is west of Steller's eider marine critical habitat on the Yukon-Kuskokwim Delta and in marine waters of southwestern Alaska (USFWS, 2001a). An oil spill associated with vessel transit and/or grounding or other accidental release could result in localized effects on marine habitats, but these spills are not expected to reach critical habitat. AGDC would require all contractors to comply with the Project SPCC Plan minimizing potential long-term impacts on critical habitat, if a spill should occur. In addition, LNG carriers are required to develop and implement a SOPEP, which includes measures to be taken when an oil pollution incident has occurred or is at risk of occurring. Normal operation of Project-related vessel traffic would have no effect on designated Steller's eider critical habitat.

6.1.3 Determination of Effect

The Project **may affect** Alaska-breeding Steller's eiders because:

- Alaska-breeding Steller's eiders migrate through marine waters in the Beaufort, Chukchi, and Bering Seas, and molt and winter in the Aleutian Islands, Shelikoff Strait, and Cook Inlet during construction and operation of the Project;
- the Project would increase vessel traffic in Alaska waters where Alaska-breeding Steller's eiders are known to occur; and
- there is potential for disturbance and spills from Project-related vessel traffic through occupied habitat in the Aleutian Islands, Shelikoff Strait, and Cook Inlet as well as marine waters of the Beaufort, Chukchi, and Bering Seas.

The Project is **not likely to adversely affect** Alaska-breeding Steller's eiders because:

- most activities in Cook Inlet would not occur when Alaska-breeding Steller's eiders are molting;
- increased vessel traffic noise would only cause temporary disturbances as vessels transit through or near occupied habitat;
- vessel grounding and fuel spills are unlikely; and
- compliance with the Aleutian Islands ATBA by Project vessel traffic would reduce the potential for effects from vessel grounding and associated fuel releases on Alaska-breeding Steller's eiders.

The Project **may affect** Alaska-breeding Steller's eider critical habitat because:

- critical habitat for Alaska-breeding Steller's eiders occurs on the Yukon-Kuskokwim Delta and in marine waters of southwestern Alaska;
- Project-related vessels may transit through the Aleutians Subarea at Unimak Pass, which is west of Steller's eider marine critical habitat; and
- spills from vessels may occur near critical habitat.

The Project is **not likely to adversely affect** Alaska-breeding Steller's critical habitat because:

- Project-related vessel traffic along the planned route would not cross Steller's eider critical habitat; and
- spills, if they should occur, would be small, and with the implementation of Project spill response procedures, significant impacts on critical habitat are unlikely.

6.2 ESKIMO CURLEW

The Eskimo curlew was listed as endangered in 1967. The Eskimo curlew is a medium-sized shorebird that formally migrated through eastern and northwestern Canada from wintering areas in South

America to nest on the Arctic tundra in Alaska and northwestern Canada (ADF&G, 2018). The Eskimo curlew is likely extinct and no longer present in Alaska. Therefore, there would not be an effect on the Eskimo curlew, and a detailed analysis of effects was not conducted for the species. The Project would have **no effect** on the Eskimo curlew.

6.3 SHORT-TAILED ALBATROSS

6.3.1 Species Description and Potential Presence in the Action Area

The short-tailed albatross was listed as endangered in 1970. Critical habitat has not been designated for the short-tailed albatross. The short-tailed albatross is a large pelagic seabird, with an average wingspan of 7.5 feet and a body length of 36 inches. Short-tailed albatross nest on four remote islands in the western Pacific. They spend most of their life at sea over the continental shelf edge foraging on shrimp, squid, crustaceans, and fish including bonitos (*Sarda* spp.), flying fishes (*Exocoetidae*), and sardines (*Clupeidae*) (USFWS, 2008). Breeding begins in late fall, typically late October.

The current range of the short-tailed albatross extends through most of the North Pacific Ocean, as well as a few observations from the Sea of Okhotsk and the East China Sea. Short-tailed albatross typically spend most of their time in regions of upwelling and high productivity along the northern edge of the Gulf of Alaska, along the Aleutian Islands, and along the Bering Sea continental shelf break from the Alaska Peninsula out toward St. Matthew Island (Suryan et al., 2008; USFWS, 2009). Short-tailed albatross have been documented in Lower Cook Inlet, and at least one juvenile individual was sighted from two different survey vessels in the Chukchi Sea in 2012 (USFWS, 2014c; Day et al., 2013; and Gall et al., 2013). The Aleutians and Bering Sea may be especially important during molting (USFWS, 2014c). Concentration areas for short-tailed albatross were recently used to establish eight avoidance areas in the Aleutians to ensure protection of the short-tailed albatross (see figure 6.3.1-1; USFWS, 2014c). Although the highest concentrations of short-tailed albatross are found in the Aleutian Islands and Bering Sea (primarily outer shelf) regions of Alaska, subadults and juveniles appear to be further distributed in the Lower Cook Inlet and along the west coast of the United States (USFWS, 2014c). Short-tailed albatross use the outer Bering Sea shelf most during summer and fall. In the winter and spring, birds continue to occupy the southeastern Bering Sea, Aleutian Islands, and Gulf of Alaska (O'Connor, 2013).

Oil and gas development within short-tailed albatross breeding and at-sea habitats is a known threat identified for this species. Threats to short-tailed albatross, including the loss of nesting habitat due to volcanic eruptions, severe storms, interspecific competition for nesting habitat, and anthropogenic threats (e.g., fishing gear entanglement, ingestion of plastic debris, and contamination), have contributed to the decline in populations (USFWS, 2009, 2001c). Climate change could have direct impacts on short-tailed albatross (e.g., nesting habitat alterations) as well as indirect impacts (e.g., changes in prey abundance and distribution) (USFWS, 2014c). Modelling indicates sea level rise may cover nesting habitat in low-elevation sites including those found on Midway and Kure Atolls (USFWS, 2014c; Storlazzi et al., 2013).

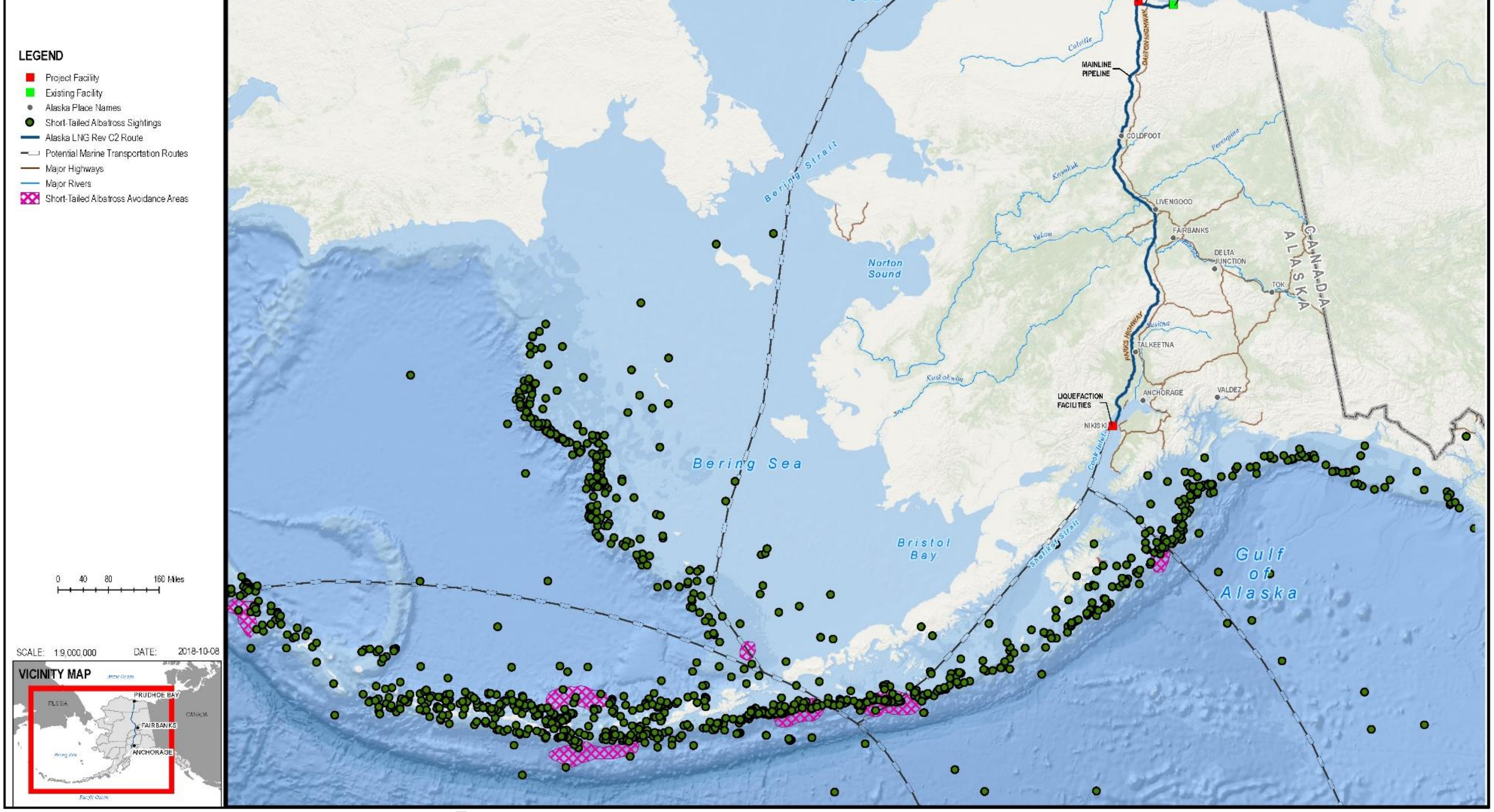


Figure 6.3.1-1
Alaska LNG Project
Short-Tailed Albatross Sightings and Concentration Areas

6.3.2 Effects Analysis

6.3.2.1 Lighting

Sources providing artificial lighting that could pose risks for injury to short-tailed albatross include lighting on marine barges and vessels. Artificial lighting can alter bird behavior (Montevecchi, 2006). During migration and periods of low visibility, birds could be attracted by vessel lighting increasing collision risks (Day et al., 2015). Juvenile short-tailed albatross could be at a greater risk due to their broad distribution throughout the North Pacific (USFWS, 2014c). Generally, lighting would not be expected to be a significant impact on short-tailed albatross due to their distance offshore and compliance with the Aleutian Islands ATBAs by Project-related vessel traffic.

6.3.2.2 Collisions

Short-tailed albatross are susceptible to collisions with Project vessels. Migratory birds are particularly at risk of collision when darkness and/or inclement weather impairs vision, and collisions with structures often result in mortality (Black, 2004; Manville, 2005; Weir, 1976). Vessel traffic traveling through the Gulf of Alaska, Aleutian Islands, and Bering Sea could disturb and displace short-tailed albatross present in the vessel routes. The total number of vessel trips associated with Project construction and operation are provided in appendix L-2 of the EIS. Specifically, birds would be vulnerable to collision during the molting period when short-tailed albatross are found in marine environments where vessels transit through the Aleutian Islands and the Bering Sea.

6.3.2.3 Spills

Construction and operation of the Mainline Pipeline and Liquefaction Facilities would require fuel transport and staging. Pipeline and materials would be transported to and from various ports in Alaska, and to the Marine Terminal and Mainline MOFs. Potential fuel spills in short-tailed albatross habitats could occur from fuel transfers and an increase in vessel traffic.

Shipping is a major source of spills in the Aleutian Islands and Bering Sea. Project-related vessel traffic would occur within the nonbreeding range of the short-tailed albatross. The greatest spill risk from vessels is predicted along the Aleutian Island chain at Unimak Pass, Akutan Pass, and the approach to Dutch Harbor, where concentrations of short-tailed albatross may be high (Det Norske Veritas and Environmental Resources Management-West, Inc., 2010; USFWS, 2014c). Aleutian Islands vessel routing measures that establish five ATBAs went into effect on January 1, 2016, for vessels making transoceanic voyages through the Bering Sea and North Pacific Ocean (Nuka, 2015).

6.3.3 Determination of Effect

The Project **may affect** short-tailed albatross because:

- short-tailed albatross would occur within the Alaskan waters of the Bering Sea, Aleutian Islands, Gulf of Alaska, and Lower Cook Inlet during construction and operation of the Project; and

- the Project would result in an increase of shipping vessel traffic within Alaska waters.

The Project is **not likely to adversely affect** short-tailed albatross because:

- vessel grounding and fuel spills are unlikely;
- spills would be unlikely, but should they occur, spill response procedures would minimize the extent of the spill and impact on short-tailed albatross; and
- compliance with the Aleutian Islands ATBAs by Project-related vessel traffic would reduce the potential for effects from vessel groundings and fuel releases.

6.4 SPECTACLED EIDER

6.4.1 Species Description and Potential Presence in the Action Area

The spectacled eider was listed as threatened in 1993. Spectacled eiders are large sea ducks, ranging from 20 to 22 inches long. They spend most of their life on marine waters feeding primarily on clams. Spectacled eiders first breed at 2 to 3 years of age, arriving at breeding grounds as pairs in late May or June (USFWS, 2010a). Females lay one egg per day for a clutch of three to nine oval, olive-green eggs at nest sites on tundra lake islands and peninsulas (USFWS, 2010a). Eggs are incubated for 24 to 28 days, and young fledge in late August (USFWS, 2010a). Spectacled eiders feed on amphipods, crustaceans, insects, mollusks, and vegetation by diving and dabbling (USFWS, 2010a).

Spectacled eiders nest on tundra habitats on Alaska's Beaufort Coastal Plain Subregion and western Alaska, molt in coastal areas of the Chukchi and Bering Seas, and winter in polynyas (areas of persistent open water in sea ice) and leads (a linear area of open water within the sea ice) in the Bering Sea (see figure 6.4.1-1). The Beaufort Coastal Plain Subregion breeding population leaves wintering areas in the Bering Sea following spring leads and openings in the Bering and Chukchi seas, arriving on the Beaufort Coastal Plain Subregion in May and June (Sexson et al., 2011). Telemetry data indicate that spring migrant spectacled eiders remain within about 30 miles of shore with first arrival on June 10 (Sexson et al., 2011).

Established pairs migrate together to nesting grounds generally within 12 miles of the coast where they use a variety of tundra habitat types (USFWS, 2010a). However, spectacled eider breeding habitat range is documented further inland within the Arctic Coastal Plain (Alaska Center for Conservation Science, 2016) (see figure 6.4.1-1). No spectacled eiders are expected to nest south of MP 33 on the Mainline Pipeline. Nests are generally constructed by the female within 10 feet of water, with many nests on shorelines, islands, or peninsulas of tundra lakes and ponds (USFWS, 2010a). The female incubates eggs for an average of 24 days, and hatching begins in early July (USFWS, 2010a). Broods are reared near freshwater where they feed on invertebrates along pond edges (USFWS, 2010a).

After breeding, males move to nearshore marine waters in late June, undergoing a complete molt of their flight feathers in the eastern Siberian Sea. Nesting females remain on the coastal tundra until late August to early September and then congregate to molt. Female spectacled eiders breeding in Arctic Alaska primarily molt in Ledyard Bay (Petersen et al., 1999). Nonbreeding females or those with failed nests arrive in molting areas in late July, while successfully breeding females arrive in late August and stay through October. Movement between nesting and molting areas takes several weeks; the eiders make several stops along the Beaufort and Chukchi Sea coasts. Concentrations of migrant spectacled eiders along the central Beaufort Sea included areas near West Dock, Harrison Bay, and Smith Bay (Sexson et al., 2011). After molting, eiders travel to their wintering areas, where they remain from October through March.

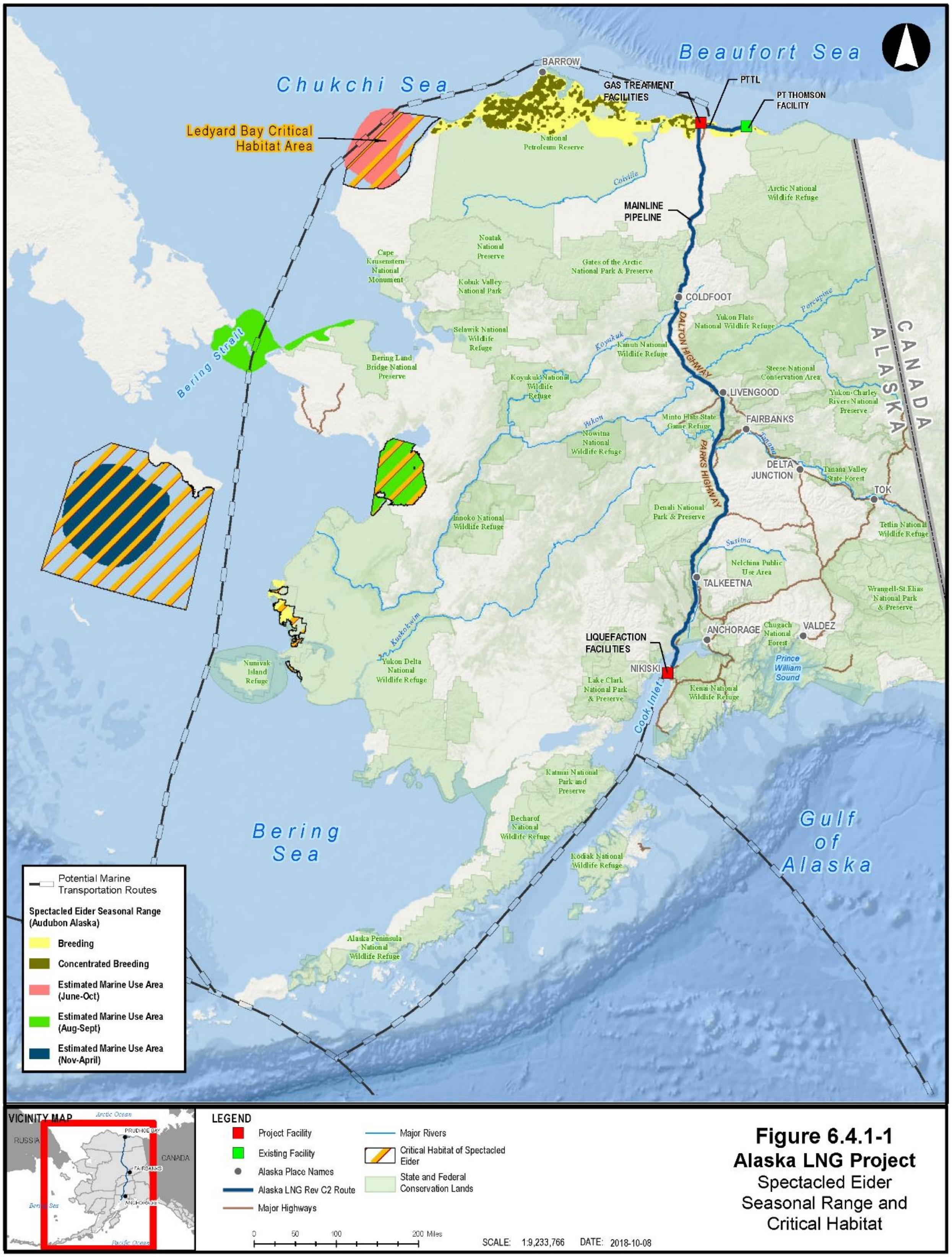


Figure 6.4.1-1
Alaska LNG Project
Spectacled Eider Seasonal Range and Critical Habitat

Annual spring waterfowl surveys conducted by the USFWS sample nesting habitats in Alaska's Beaufort Coastal Plain Subregion. These surveys cover the GTP, PTTL, and about the first 60 miles of the Mainline Pipeline on the Beaufort Coastal Plain Subregion (see figure 6.4.1-2). Spectacled eiders have been documented during breeding pair surveys in the area designated for the GTP and within 0.5 mile of the PTTL (Stehn et al., 2013). They may be found during the molting season in coastal areas of the Chukchi and Bering Seas as well as Ledyard Bay along potential marine transportation routes, and in the winter on polynyas and open water in the Bering Sea. An estimation of 369,122 individual spectacled eiders wintering in the northern Bering Sea south of St. Lawrence Island were surveyed in 2010, and results are similar to photographic surveys conducted in 1997 and 1998 (Larned et al., 2012).

Critical habitat was designated in 2001 for nesting on the Yukon-Kuskokwim Delta; for molting in Norton Sound and Ledyard Bay; and for wintering south of St. Lawrence Island (66 FR 9146). No critical habitat for nesting was designated on Alaska's North Slope (66 FR 9146). The PCEs for spectacled eider critical habitat units are:

- vegetated intertidal zone and associated plant communities (e.g., low wet sedge tundra, grass marsh, mixed graminoid meadow) in the Yukon-Kuskokwim Delta;

- marine waters greater than 16.4 feet (5 meters) and less than or equal to 82.0 feet (25 meters) in depth, marine flora and fauna, and benthic community in the Norton Sound and Ledyard Bay units used during molting; and

- marine waters less than or equal to 246.1 feet (75 meters) in depth, along with marine flora and fauna, and benthic community in the wintering grounds south of St. Lawrence Island (USFWS, 2001b).

The causes for the population decline of spectacled eiders are still unknown; however, several potential threats have been identified. These threats include lead poisoning, predation, contaminants, and illegal harvesting (USFWS, 1996, 2011b). Spectacled eider population threats are similar to those discussed for Alaska-breeding Steller's eiders. Eider species (e.g., king, common, Steller's, and spectacled) are particularly vulnerable to oil spills due to large flock sizes, distance to shore, and use of moderate-ice areas (Smith et al., 2017; USFWS, 2011b). Chronic oil contamination is a serious problem for eiders in areas near shipping lanes, such as the Aleutian Islands, the Bering Sea, the Bering Strait, and increasingly in the Chukchi and Beaufort Seas (Smith et al., 2017). Climate change has also been documented as a potential threat to spectacled eiders. Changes in the Bering Sea ecosystem, including weather patterns and complex changes in prey populations (e.g., fish and invertebrates) may be affecting food availability and survival of spectacled eiders during the 8- to 10-month non-breeding season (USFWS, 2011b). More recently, Sexson et al. (2016) documented that the core distribution of molting spectacled eiders in Ledyard Bay has shifted, indicating changes in the Arctic ecosystem (e.g., prey abundance and environmental conditions).

Figure 6.4.1-2
Alaska LNG Project
Spectacled Eider 2009 to 2012 Breeding Pair Density Based on 2009-2012 Aerial Breeding Pair Surveys

LEGEND

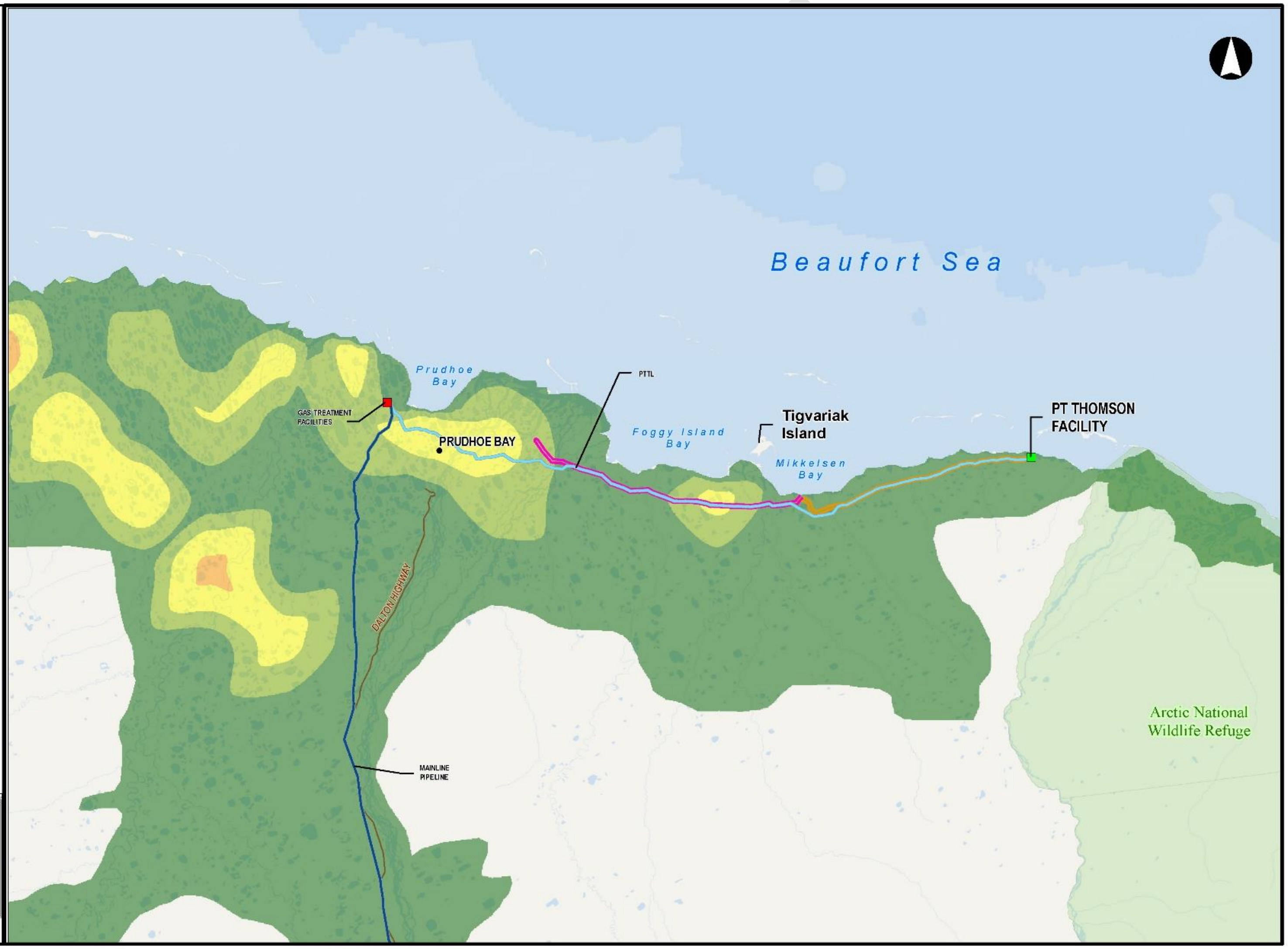
- Project Facility
- Existing Facility
- Alaska Place Names
- Alaska LNG Rev C2 Route
- Point Thomson Transmission Line
- Badami Pipeline
- Point Thomson Export Pipeline
- Major Highways
- State and Federal Conservation Lands

Spectacled Eider - USFWS (2009-2012)
Est. Birds Per Sq Kilometer

- 0.000 - 0.028
- 0.028 - 0.111
- 0.011 - 0.236
- 0.236 - 0.425

0 2 4 8 Miles

SCALE: 1:500,000 DATE: 2017-03-21



6.4.2 Effects Analysis

6.4.2.1 Habitat Effects

Constructing and operating the Project would result in the temporary and permanent loss and degradation of habitat. The Project would affect a variety of vegetated habitats including forested, scrub/shrub, and herbaceous as well as a diversity of vegetation communities. Tundra and/or alpine ecosystems would have a slower regeneration time after disturbance, and impacts in these areas would be long term to permanent. Habitat loss and/or degradation would directly affect spectacled eiders by increasing rates of stress, injury, and mortality. Habitat loss may also indirectly affect the survival and reproductive success of individual spectacled eiders by affecting foraging, mating, breeding, nesting, and migratory behaviors. Construction and operational activities associated with the Gas Treatment Facilities (e.g., the West Dock Causeway) and the Mainline Facilities would contribute to habitat loss for spectacled eiders. Clearing during the summer nesting season would remove nesting habitat for spectacled eiders and/or disturb actively nesting birds. Additionally, clearing near active nests during incubation or brood rearing would affect egg and young survival and result in bird displacement.

Available breeding habitat for spectacled eiders would be permanently affected by wetland fill and facility infrastructure (e.g., ice roads and ice pads, access roads, work camps, and permanent right-of-ways) associated with construction of the Gas Treatment and Mainline Facilities. Several additional work areas (e.g., material sites near MPs 11.6, 17.9, 25.5, and 33.5, and pipe storage yards near MP 24.7) would overlap spectacled eider breeding and nesting habitat. Placement of granular fill, clearing, and grading during the summer nesting season could remove nesting habitat for spectacled eiders and/or disturb actively nesting birds, including destruction of nests resulting in nestling/egg mortality. Additionally, clearing near active nests during incubation or brood rearing would likely affect egg and young survival and result in bird disturbance and displacement.

Additional construction activities including the West Dock Causeway expansion, development of the reservoir and gravel mine site, and screeding (e.g., subsea scraping) would reduce, degrade, or eliminate habitat for the spectacled eider. The West Dock Causeway expansion would include a temporary, annually installed barge bridge and turning basin, as discussed in sections 2.1.3.2 and 2.2.1.2 of the EIS. As noted in section 6.1.2 for the Alaska-breeding Steller's eider, disturbance during this time would cause displacement and abandonment of suitable habitat for spectacled eiders.

The PTTL would be elevated and run parallel to the coast through known breeding habitat for the spectacled eider. While the pipeline itself would not create a physical barrier to spectacled eider movement, the structure, permanent access road, and associated disturbance from operational activities could interfere with the ability of spectacled eiders to use breeding/nesting habitat. The structure could also create new perching platforms for prey species (e.g., ravens and gulls) that prey upon spectacled eiders and their eggs or young.

Vessel traffic in the Chukchi Sea associated with the Project would consist of six sealifts to West Dock (two pre-construction and four construction sealifts). Vessels in transit to West Dock would temporarily anchor at the PBOSA, which could affect spectacled eiders using nearby habitat (Schwemmer et al., 2011). Vessels would remain offshore of Reindeer Island (a barrier island); however, their proximity to this barrier island could disturb and displace spectacled eiders using this habitat. Indirect effects on spectacled eiders include the degradation of molting and wintering habitat from vessel traffic, including LNG carrier traffic. Habitat degradation could occur through marine vessel groundings, spills, and the introduction of aquatic invasive species. AGDC has committed to all planned vessel transits occurring outside the Ledyard Bay critical habitat area; vessels are expected to occur greater than 4.4 miles from this critical habitat area. Inclement weather or other contingencies, however, could require vessels to shift their route to the south and overlap Ledyard Bay critical habitat area.

Granular material placement, and the water reservoir and material site excavation associated with construction of the Gas Treatment and Mainline Facilities, would result in long-term nesting habitat alteration and/or loss for spectacled eiders. Temporary habitat loss for spectacled eiders would result from ice roads and ice pads built for the Mainline Facilities. With the incorporation of the conservation measures previously described, impacts on spectacled eiders and their habitat would be avoided or minimized.

6.4.2.2 Noise

Similar to noise impacts on Alaska-breeding Steller's eiders discussed in section 6.1.2.2, noise from construction equipment, vehicle/vessel traffic, airplanes, helicopters, pile driving, blasting, and general Project-related activity during construction and operation could affect spectacled eider behavior. Noise sources include single impulse sounds (e.g., blasting), multiple impulses (e.g., jackhammers, pile driving), and non-strike continuous noise (e.g., construction sounds) (Dooling and Popper, 2016). Primary sources of noise generated from construction and operational activities that would disturb spectacled eiders and their habitat include site preparation clearing and grading; building construction including facility foundations (e.g., pile driving); materials transport; installation and operation of the gravel mine and construction camps; and installation of the water reservoir.

As previously discussed for Alaska-breeding Steller's eiders, short, intermittent disturbances (e.g., blasting) could have greater deleterious impacts on spectacled eiders than long-term noise. Both acute and chronic noise could cause nest abandonment and failure, reduced juvenile growth and survival, and malnutrition or starvation of the young (Francis et al., 2009). Continuous operational noise associated with aboveground facilities, and intermittent noise due to blowdowns (as described in section 4.16.4.2 of the EIS), would disturb spectacled eiders. Anderson et al. (1992) documented that spectacled eider distribution during the nesting season was altered in response to noise generated from a compressor station (USFWS, 1996). Operation of the Gas Treatment Facilities would generate noise above ambient levels, and could affect spectacled eiders. Spectacled eiders near the Gas Treatment Facilities would be subject to background noise levels from the CGF and other surrounding facilities. The additional contribution of noise from the GTP could increase background levels. Noise from the GTP could decrease the suitability of the area for spectacled eiders. The CGF, east of the GTP, contributes to the ambient noise levels in this region (Anderson et al., 1992). Noise would be expected to dissipate to background levels within about 2.25 miles of the GTP. Spectacled eiders would likely avoid nesting, foraging, and resting in this area for the life of the Project due to the increased noise levels.

Spectacled eiders could be temporarily displaced from areas during active sheet pile and pile driving, but could return to marine construction areas during breaks from these activities (e.g., maintenance days and shifts at night). Pile driving noise for the Dock Head 4 construction could also disturb and displace spectacled eiders in the vicinity; most of the pile installation would be done with an impact hammer. Underwater noise associated with pile driving could disturb spectacled eiders since they spend time underwater while foraging and diving for prey up to 230 feet (70 meters) (Lovvorn et al., 2003); however, birds near pile driving would likely disperse prior to lethal noise levels (Leopold and Camphuysen, 2007). Blasting could have a direct effect on spectacled eider hearing. Hearing thresholds vary by species and age of the individual. When analyzing the effects of road construction blasting noise on birds, Dooling and Popper (2016) recommended a threshold of 140 dBA for single-impulse sounds. The threshold would prevent temporary threshold shifts in birds. Behavioral effects from blasting would be similar to those described for pile driving. Additionally, birds, including spectacled eiders, within the blast zone (e.g., for North Slope gravel mining) could experience injury or death through concussion or flyrock.

Impacts on spectacled eiders from noise generated from GTP operation would be similar as described for Alaska-breeding Steller's eiders. Birds that enter the footprints of these facilities could experience behavioral and energetic effects. Noise from the GTP could decrease the suitability of the area for spectacled eiders. The CGF, east of the GTP, contributes to the ambient noise levels in this region (Anderson et al., 1992). Noise would be expected to dissipate to background levels within about 2.25 miles of the facility. Spectacled eiders would likely avoid nesting, foraging, and resting in this area for the life of the Project due to the increased noise levels. Sounds from equipment could affect sensitive bird habitat, including spectacled eider nesting habitats near the Gas Treatment Facilities by raising ambient sound levels, which degrade habitat quality. Habitat surrounding the Project's aboveground facilities could become uninhabitable by birds, as they would avoid these areas due to noise and disturbance (Andersen et al., 1992; Habib et al., 2007; Ortega, 2012). No compressor stations would be within spectacled eider nesting habitat on the Beaufort Coastal Plain.

An increase in air traffic, including helicopter and airplane noise associated with construction and operation of the Gas Treatment and Mainline Facilities, would create more noise disturbance for spectacled eiders around these facilities. About three helicopter flights per day would generally be associated with Project camps, but there could be as many as six per day. One camp (Prudhoe Bay) and one temporary helipad would be within spectacled eider breeding habitat near MP 0.6. MLV 2 would have a permanent helipad near MP 36.7. While the MLV 2 helipad is not within the first 33 miles of the Mainline Pipeline route (e.g., within spectacled eider habitat), it would be near spectacled eider nesting habitat where air traffic could disturb birds. Nesting spectacled eiders would flush from their nests during helicopter overflights, which would expose eggs or young birds to predators and inclement weather.

Due to the short duration of construction noise and low levels of operational noise, impacts on spectacled eiders from Project-related noise would be minimal.

6.4.2.3 Lighting

Sources providing artificial lighting that could pose risks for injury to spectacled eiders include facility lighting (i.e., during construction and operation), tower or antenna lighting, lighting on docks or anchored marine barges and vessels, worker camp lighting, and flare tower operation. Additionally, artificial lighting sources include facility lighting (e.g., Gas Treatment Facilities) that would illuminate working areas for work onshore and work over and within water (e.g., screeding and pile driving), lighting for security purposes, and lighting that would illuminate work areas during winter construction.

During operation, the aboveground facilities would require year-round lighting. Facility lighting would consist of normal and essential lighting panels and lighting fixtures to provide lighting for working areas and for security requirements. Outdoor general lighting would be high-pressure sodium or light-emitting diode lights mounted on poles about 100 feet high and directed toward facilities, similar to typical street lighting. Lighting design would direct lighting only in places where it is necessary, and would be designed and shielded, where applicable, to reduce light trespass, unwanted projection, and upward-directed light.

Artificial lighting can alter bird behavior. During migration and periods of low visibility, birds could be attracted by facility lighting or the low-pressure flare pilot and collide with the flare, communication tower, power lines, or other buildings or modules (Day et al., 2015). During periods of low visibility (e.g., stormy or foggy conditions) in Alaska, eiders have landed in obscure places including a main street of town and fishing boats (Day et al., 2015). Eider species are also attracted to bright lights, especially while flying at night, and observations have been recorded in the Gulf of Alaska, and the Bering, Chukchi, and Beaufort Seas (Day et al., 2004b, 2005, 2015; Dick and Donaldson, 1978).

6.4.2.4 Collisions

Spectacled eiders are susceptible to collisions with Project facilities and equipment. Migratory birds are particularly at risk of collision when darkness and/or inclement weather impairs vision. Collisions with structures often result in mortality (Black, 2004; Manville, 2005; Weir, 1976). Birds could also experience collision injuries including concussions, internal hemorrhaging, and broken bones.

Avian species at greatest risk for collisions with vessel traffic include eiders (e.g., common, king, spectacled, and Steller's) due to their high-speed flight travel, relatively low flight altitude over water, and attraction to bright lights at night (Day et al., 2004a,b, 2005; Johnson and Richardson, 1982). Information is limited, but the best available information to estimate collision risk between marine vessels and migratory birds is observations recorded during Royal Dutch Shell's exploratory oil and gas activities in 2012 (USFWS, n.d.; Schroeder, 2013). Collision risks and associated predictions for spectacled eiders would be similar to those described in section 6.1.2 for Alaska-breeding Steller's eiders. The total number of vessel trips associated with Project construction and operation are provided in appendix L-2 of the EIS. Spectacled eider collisions with on-land and off-shore structures, towers, and wires are rare but have been reported (USFWS, 2011b).

As previously discussed for Alaska-breeding Steller's eiders, vessel traffic traveling to West Dock during the ice-free period, typically August and September, would disturb and displace spectacled eiders. Direct effects on spectacled eiders would include mortality and/or injury from collisions with marine vessel traffic. Specifically, birds would be vulnerable to collision during the month of August when spectacled eiders are found in nearshore/marine environments where vessels transit through the marine use area in the Bering Strait (see figure 6.4.1-1).

Helicopter and aircraft activities during construction and operation would cause short-term disturbance, distract birds, and increase the collision risk. Larned and Tiplady (1997) documented that flocks of wintering spectacled eiders often took flight during fixed-wing aircraft approaches of 492 to 656 feet (150 to 200 meters). As previously discussed, about three helicopter flights per day would generally be associated with Project camps, but there could be as many as six per day. Direct and indirect effects on spectacled eiders from air traffic would include injury or mortality from collisions, disruption of seasonal movements, displacement from roadside habitats, and/or reduced productivity from disturbance.

The GTP flare stacks would increase the potential for spectacled eider collisions. In addition, collocation of stormwater ponds with the ground-flare system could lead to unintentional bird mortality if they are using the pond and/or nearby suitable habitat when the flare becomes active. The flare height would generally preclude an incineration hazard for nesting birds. The bright light emitted during flare events could attract migrating eiders, and could present a collision and incineration hazard for them, although most eiders would migrate offshore and at mean altitudes well below the flare height (Day et al., 2015).

6.4.2.5 Spills

As previously discussed for Alaska-breeding Steller's eiders, spectacled eiders would be directly affected by equipment-related fluid spills through ingestion or contact with their plumage as well as inhalation. These effects could reduce survival and reproduction that could result in population declines. Threats to spectacled eiders increase when spills occur near or within areas of high bird concentrations, such as wintering or molting congregations near the Ledyard Bay critical habitat area (NOAA, 2018; ADF&G, 2018), and would result in indirect effects on spectacled eiders including habitat disturbance or alteration and displacement from molting or wintering habitats. The magnitude of impact would depend on fluid type, volume, season, and response.

6.4.2.6 Human Presence

Construction camps would create the potential for wildlife–human interactions and changes in wildlife behavior or habitat use that would affect spectacled eiders. Construction camps that overlap potential habitat for spectacled eiders include the Prudhoe Bay (MP 0.6) and Franklin Bluffs (MP 43.7) camps (see table 2.1.4-5 of the EIS). Effects to spectacled eiders would be similar as those described for Alaska-breeding Steller's eiders. Activities related to Gas Treatment and Mainline Facilities construction and operation would overlap known spectacled eider breeding habitat, and the increase in human disturbance from vehicular and pedestrian traffic could affect bird activity and have negative impacts on nest density and success.

Workers would be present at the GTP at all times, resulting in permanent impacts associated with human disturbance. Most Mainline Facilities compressor stations would be remotely operated; therefore, this potential would be reduced. Facilities can provide artificial den sites, thermal refuges, and access to human food for arctic and red foxes, which are predators of many bird species (Stickney et al., 2013). Spectacled eider eggs and ducklings are vulnerable to predation by ravens, jaegers, snowy owls, arctic and red foxes, and large gulls (ADF&G, 2018; USFWS, 2012c). An increase in hunting pressure from humans and predators due to the creation of new access roads and cleared right-of-way along the Mainline Pipeline would also directly affect spectacled eiders.

Construction and operational impacts would include changes to bird habitat types. The construction of aboveground facilities including communication towers and elevated pipelines associated with the GTP, PTTL, and PBTL could provide nesting and vantage perches for raptors, common ravens, and glaucous gulls that are not otherwise available across the Beaufort Coastal Plain Subregion (Platte, 2003). The USFWS recommended the use of bird deterrence structures (e.g., perch guards) to limit raven nesting on facilities. The facilities could also provide artificial den sites, thermal refuges, and access to human food for birds and their predators. Predators attracted to the area could increase predation risk for nesting spectacled eiders. For example, on the North Slope, oil development may have affected densities of some predators (e.g., arctic fox, glaucous gull, common raven, and grizzly bear) that are known to prey on brant and snow geese. Discarded human food wastes potentially attract omnivorous scavengers that may prey on waterfowl (Truett et al., 1997). Routine maintenance, such as erosion control measures and rehabilitation activities for the Mainline Pipeline during summer months, could disturb breeding spectacled eiders. These activities could displace adults and/or broods from preferred habitats during pre-nesting, nesting, and brood rearing. Females could be displaced from nests, which would expose eggs or small young to inclement weather and/or predation.

6.4.2.7 Critical Habitat

No critical habitat for nesting spectacled eiders is designated on Alaska's North Slope. Spectacled eider critical habitat in marine waters, particularly near Ledyard Bay, would be vulnerable to marine vessel traffic transiting to West Dock during construction. Vessel traffic along the planned route would be expected to occur more than 4.4 miles from the Ledyard Bay critical habitat area, however, and would not have an effect on the water depth, marine flora and fauna in the water column, or the underlying benthic community. Inadvertent fuel releases from vessels while transiting the area could result in adverse effects, but spills of fuels and other contaminants would be unlikely and would be minimized with the implementation of the Project SPCC Plan, the Alaska Pollutant Discharge Elimination System General Permit AKG320000, and oil spill response plans. In addition, LNG carriers are required to develop and implement a SOPEP, which includes measures to be taken when an oil pollution incident has occurred or is at risk of occurring.

6.4.2.8 Cumulative Impacts

As provided in appendix X-1 and referenced in section 4.19.3 of the EIS, the following projects would overlap with spectacled eider suitable habitat, occupied habitat, and designated critical habitat:

- Alliance Exploration;
- PTU Expansion Project; and
- PBU Major Gas Sales (MGS) Expansion Project.

Activities that may be associated with these projects that could cumulatively increase effects on spectacled eiders include:

- site preparation (e.g., clearing, grubbing, and grading);
- dredging and trenching;
- blasting and pile driving;
- vehicle, aircraft, and vessel traffic;
- accidental fuel and/or oil spills; and
- human interactions.

The above activities could directly or indirectly affect spectacled eiders and critical habitat by making it unavailable for use during feeding, breeding, wintering, and/or molting. Projects with vessel traffic that could transit through spectacled eider critical habitat could contribute to disturbances, increased collision risks, and increased spill potential. Critical habitat for spectacled eiders is found on the Kuskokwim Delta (nesting); Norton Sound and Ledyard Bay (molting); and south of St. Lawrence Island (wintering). Additional vessel traffic could have adverse effects on spectacled eiders using these habitats during sensitive periods.

The concern for spectacled eiders was in part related to the decline of nesting populations in western Alaska, particularly on the Yukon-Kuskokwim Delta breeding grounds (USFWS, 1996). While current trends indicate this population is increasing, limited data suggest the number of spectacled eiders nesting on the Arctic coast of Alaska is declining (USFWS, 2011b, 2012b). The activities above could directly or indirectly affect spectacled eiders and their critical habitat by eliminating potential nesting and foraging habitat as well as reducing molting and overwintering habitat quality and/or making it unavailable during energetically critical periods. With the implementation of conservation measures, activities associated with the Project would not be expected to cause significant cumulative effects on spectacled eider critical habitat.

6.4.3 Determination of Effect

The Project **may affect** spectacled eiders because:

- spectacled eiders may occur within occupied Alaska waters including Beaufort, Chukchi, and Bering Seas, and molt and winter in the Bering Sea (e.g., Ledyard Bay critical habitat area) during construction and operation of the Project;

- the Project would increase vessel traffic in Alaska waters where spectacled eiders are known to occur; and

- there is potential for disturbance and spills from Project-related vessel traffic through occupied habitat in the marine waters of the Beaufort, Chukchi, and Bering Seas.

The Project is **likely to adversely affect** spectacled eiders because:

- construction and operational activities may affect spectacled eider breeding and molting habitat and result in permanent removal of nesting habitat (e.g., from fill and excavation);
- construction and operational activities would disturb and displace spectacled eiders;
- an increase in vessel, air, and vehicle traffic, as well as buildings, flares, and communication towers, would result in collisions or exposure to injury and/or mortality; and
- spills or fuel releases, and/or additional environmental contaminants, could affect spectacled eiders health.

The Project **may affect** spectacled eider critical habitat because:

- vessels may transit through critical habitat near Ledyard Bay critical habitat area; and
- spills from vessels may occur in critical habitat.

The Project is **not likely to adversely affect** spectacled eider critical habitat because:

- vessel traffic along the planned route would be more than 4.4 miles from the Ledyard Bay critical habitat area, and therefore, would have no effect on the critical habitat PCEs;
- additional spectacled eider critical habitat locations (e.g., Yukon-Kuskokwim Delta, and critical habitat between St. Lawrence and St. Matthew Islands) would be outside the Project area; therefore, significant impacts on critical habitat are unlikely; and
- spills, if they should occur, would be small, and with the implementation of Project spill response procedures, significant impacts on critical habitat are unlikely.

6.5 NORTHERN SEA OTTER, SOUTHWEST ALASKA DISTINCT POPULATION SEGMENT

6.5.1 Species Description and Potential Presence in the Action Area

The northern sea otter was listed as threatened in 2005. The Southwest Alaska DPS may occur in Lower Cook Inlet on the western shores, and the non-listed Southcentral Alaska DPS may occur in Lower Cook Inlet on the eastern shores (see figures 6.5.1-1 and 6.5.1-2). Northern sea otters of either DPS are typically not found in Upper Cook Inlet, and are not expected to occur near the Liquefaction Facilities, Mainline Pipeline, or Mainline MOF. Critical habitat for the northern sea otter was designated and encompasses 5,855 square miles of shallow coastal waters from Attu Island in the Aleutians to Redoubt Point in Cook Inlet (74 FR 51988). Critical habitat occurs in nearshore marine waters ranging from the mean high tide line seaward for a distance of 328.1 feet (100 meters), or to a water depth of 65.6 feet (20 meters). The PCEs for northern sea otter critical habitat are:

- shallow, rocky areas where marine predators are less likely to forage (i.e., waters less than 6.6 feet [2 meters] in depth);
- nearshore waters that may provide protection or escape from marine predators (i.e., waters within 328.1 feet [100 meters] from the mean high tide line);
- kelp forests that provide protection from marine predators (i.e., that occur in waters less than 65.6 feet [20 meters] in depth); and
- prey resources within the areas identified by PCEs 1, 2, and 3 that are present in sufficient quantity and quality to support the energetic requirements of the species.

Critical habitat is divided into five habitat units that correspond to the Bureau of Land Management (BLM) management units for the DPS. Vessel routes pass through Units 3 (South Alaska Peninsula), 4 (Bristol Bay), and 5 (Kodiak, Kamishak, Alaska Peninsula) (see figure 6.5.1-1).

Adult sea otters are 5 feet long and weigh 50 to 100 pounds, with females smaller than males (ADF&G, 2018). Females are sexually mature at 2 to 5 years of age, and males at 4 to 6 years (ADF&G, 2018). Females give birth each year, usually in the late spring in Alaska, to a single pup weighing 3 to 5 pounds (ADF&G, 2018). Sea otters feed on fish and invertebrates, including clams, octopus, crabs, and sea urchins, which they find in shallow coastal waters (ADF&G, 2018). Sea otters are typically found within a few miles of shore, where bottom depths are typically less than 300 feet (USFWS, 2013).

Threats to northern sea otters in Alaska include increased predation from killer whales (*Orcinus orca*) and other predators, overharvest, oil spills and oiling, disease disturbance, and bycatch in fishing gear (USFWS, 2013; ADF&G, 2018). Populations in and near Cook Inlet are stable and may be increasing (USFWS, 2014d). The current estimated population of the Southwest Alaska DPS is about 54,000 (USFWS, 2014d).

Northern sea otters from either the Southwest Alaska DPS or the non-listed Southcentral Alaska DPS may occur in the Project area; these populations may both occur in Cook Inlet (USFWS, 2012b). Northern sea otters may occur in vessel traffic routes in the Gulf of Alaska, Aleutian Islands, and Cook Inlet. Vessels may transit through designated critical habitat for the sea otter in the Aleutian Islands, Gulf of Alaska, Shelikof Strait, and the entrance to Cook Inlet (see figure 6.5.1-1).

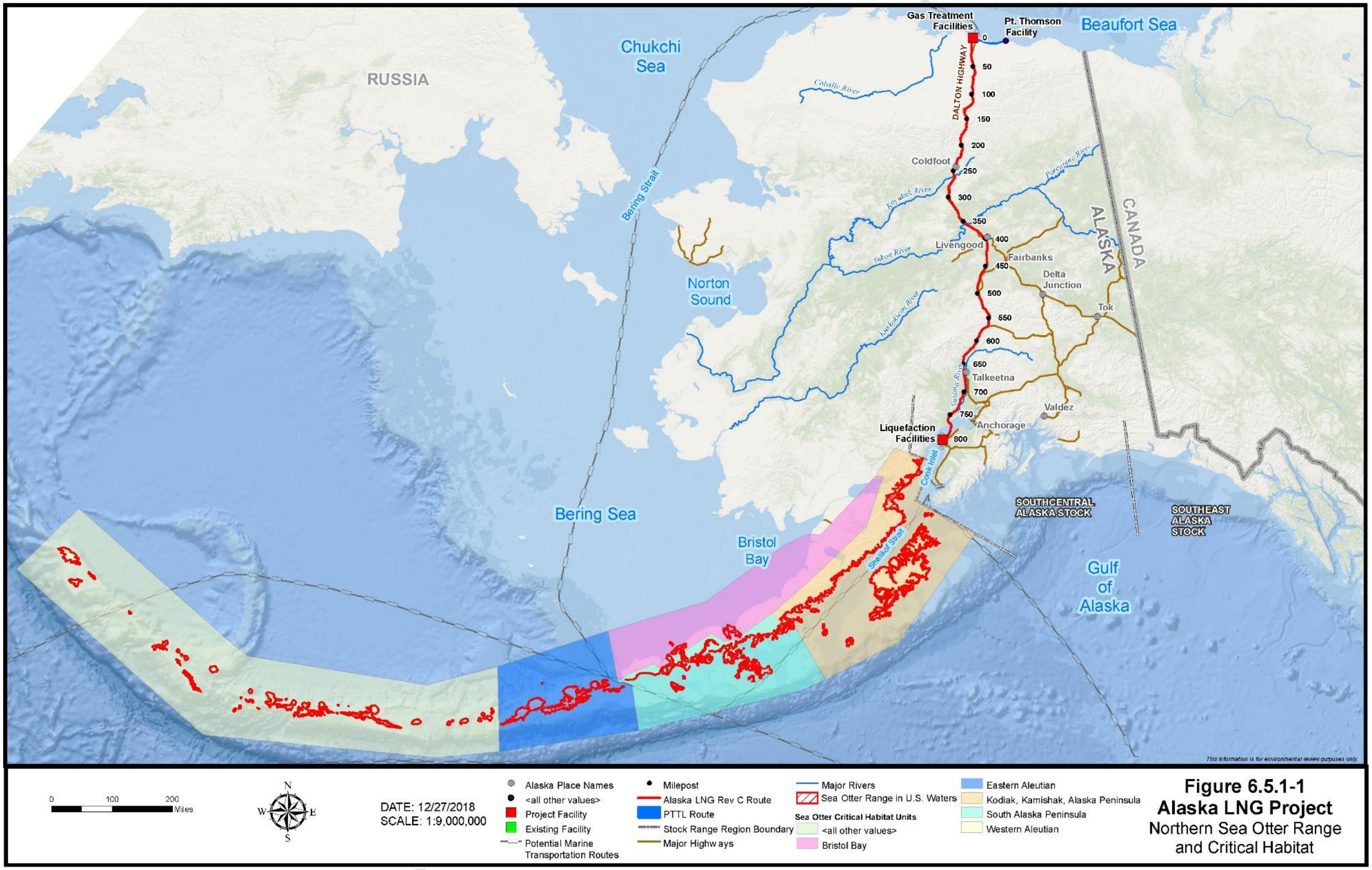
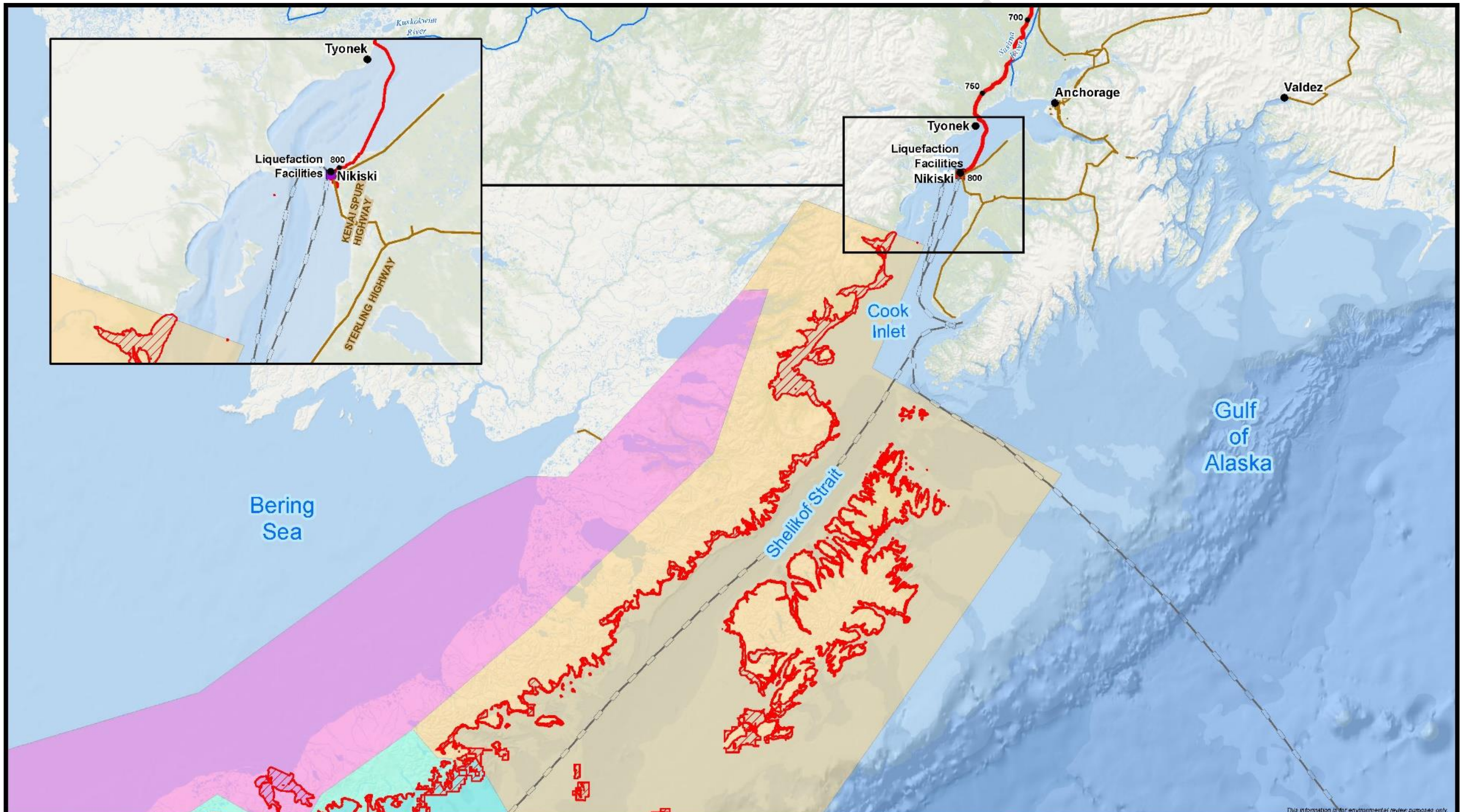


Figure 6.5.1-1
Alaska LNG Project
Northern Sea Otter Range and Critical Habitat



0 50 100 Miles

DATE: 12/27/2018
SCALE: 1:3,000,000

- Existing Facility
- Alaska Place Names
- Alaska LNG Rev C Route
- Milepost
- Potential Marine Transportation Routes
- Major Rivers
- Major Highways
- Sea Otter Range in U.S. Waters off Alaska

Sea Otter Critical Habitat Units

Management

- Bristol Bay
- Kodiak, Kamishak, Alaska Peninsula
- South Alaska Peninsula

Figure 6.5.1-2
Alaska LNG Project
Northern Sea Otter Range and Southwest Alaska DPS Critical Habitat Units in Cook Inlet

6.5.2 Effects Analysis

6.5.2.1 Noise

Complete noise analysis calculation results using the NMFS Technical Guidance and airborne noise guidance are included in appendix L-1 of the EIS. Project-related vessel traffic would affect sea otters through potential habitat degradation caused by increased underwater and airborne shipping noise. The total number of vessel trips associated with Project construction and operation is provided in appendix L-2 of the EIS. Anthropogenic noise could also indirectly affect the survival and reproductive success of individual sea otters by having a negative effect on their prey. Cook Inlet has a naturally noisy acoustic environment with anthropogenic noise sources such as vessels, oil platform activities, and aircraft overflights, as well as natural noise sources, such as the transport of bottom substrates by high currents from large tidal fluctuations (Blackwell and Greene, 2003). Sea otters occur in Cook Inlet year-round. LNG carriers are expected to visit the Marine Terminal year-round. Vessels and LNG carriers in transit to the Marine Terminal MOF and Mainline MOF during construction and operation, respectively, would temporarily stage or anchor at Kachemak Bay and transit through Shelikof Strait. These areas have high concentrations of sea otters in nearshore environments year-round (NOAA, 2018; ADF&G, 2018).

Underwater Noise

Marine mammals use hearing and sound transmission for vital life functions, such as communication, navigation, predator avoidance, and feeding. Anthropogenic noise in the underwater environment can disrupt those behaviors; effects vary from causing minor disturbances and harassment to injury and death.

NMFS has established guidelines to analyze noise effects on marine mammals. Some Project activities' sound levels are predicted to exceed thresholds established by NMFS as levels that could potentially result in effects on marine mammals (NMFS, 2018a; see table 6.5.2-1). Project noise was evaluated using NMFS Technical Guidance (NMFS, 2016b). Under the MMPA, NMFS has defined levels of harassment for marine mammals. The NMFS Technical Guidance identifies underwater sound-exposure criteria corresponding to A and B harassment levels and provides guidelines assessing the onset of permanent threshold shifts from anthropogenic sound. Level A harassment is defined as "…any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild." Level A harassment includes auditory injury. Level B harassment is defined 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, breeding, feeding, or sheltering."

The NMFS Technical Guidance separates marine mammals into five functional hearing groups (low frequency cetaceans, mid-frequency cetaceans, high-frequency cetaceans, phocid pinnipeds [underwater], and otariid pinnipeds [underwater]). Noise source types are separated into impulsive (e.g., impact pile driving) and non-impulsive (e.g., vibratory pile driving), and analyses are required for both the distance to the peak received sound pressure level (SPL) and the 24-hour cumulative sound exposure level (SEL). Sea otters may experience disturbance (Level B) thresholds from general vessel movements (see tables 6.5.2-2 and 6.5.2-3). Complete noise analysis calculation results using the NMFS Technical Guidance are included in appendix L-1 of the EIS.

TABLE 6.5.2-1

Marine Mammal Injury and Disturbance Thresholds for Underwater Sound [a]

		Level A (Injury) Threshold		Level B (Disturbance) Threshold	
Marine Mammals	Species	Impulsive	Non-impulsive	Impulsive	Non-impulsive
Low-frequency cetaceans	Blue whale Bowhead whale Fin whale Gray whale Humpback whale North Pacific right whale Sei whale	219 dB L_{pk} 183 dB SEL	199 dB SEL	160 dB_{rms}	120 dB_{rms}
Mid-frequency cetaceans	Cook Inlet beluga whale Sperm whale	230 dB L_{pk} 185 dB SEL	198 dB SEL	160 dB_{rms}	120 dB_{rms}
High-frequency cetaceans	None	202 dB L_{pk} 155 dB SEL	173 dB SEL	160 dB_{rms}	120 dB_{rms}
Phocid pinnipeds	Bearded seal Ringed seal	218 dB L_{pk} 185 dB SEL	201 dB SEL	160 dB_{rms}	120 dB_{rms}
Otariid pinnipeds and Other non-phocid marine carnivores	Northern sea otter Pacific walrus Polar bear Steller sea lion	232 dB L_{pk} 203 dB SEL	219 dB SEL	160 dB_{rms}	120 dB_{rms}

Sources: NMFS, 2018a

dB_{rms} = decibels root mean square; L_{pk} = peak pressure levels; SEL = sound exposure level

[a] Non-impulsive sounds are considered steady state. Examples include sonar and vibratory pile driving. Impulsive sounds are those with high peak sound pressures, are short in duration, and have a fast rise-time and broad frequency content. Examples include explosives, impact pile driving, and air guns.

TABLE 6.5.2-2

Summary of Underwater Noise Level A (Injury) Impact Area or Radius for Marine Mammals [a]

Activity	Pacific walrus	Polar bear	Bearded seal	Bowhead whale	Gray whale	Ringed seal	Cook Inlet beluga whale	Humpback whale	Steller sea lion
West Dock [b]									
11.5-inch H-pile, impact	0	0	<0.1 mi^2	0.15 mi^2	0.15 mi^2	<0.1 mi^2	N/A	N/A	N/A
14-inch pipe pile, vibratory	0	0	0.1 mi^2	0.3 mi^2	0.3 mi^2	0.1 mi^2	N/A	N/A	N/A
Cook Inlet [c]									
18- and 24-inch pile, impact	N/A	N/A	N/A	N/A	N/A	N/A	151 feet	0.8 mile	167 feet
48- and 60-inch pile, impact	N/A	N/A	N/A	N/A	N/A	N/A	443 feet	2.6 miles	486 feet
All sizes pile, vibratory [d]	N/A	N/A	N/A	N/A	N/A	N/A	23 feet	253 feet	10 feet
Sheet pile, impact	N/A	N/A	N/A	N/A	N/A	N/A	207 feet	1.1 miles	226 feet
Sheet pile, vibratory	N/A	N/A	N/A	N/A	N/A	N/A	3 feet	56 feet	3 feet
Mainline Pipeline trenching [e]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

mi^2 = square miles; N/A = Not applicable

[a] Based on SELs, as defined in appendix L-1 of the EIS.

[b] 48-inch pipe piles, sheet piling, and screeding would not result in Level A takes of marine mammals (see appendix L-1 of the EIS).

[c] Dredging, anchor handling, and DMT for Mainline Pipeline shoreline installation would not result in Level A takes of marine mammals (see appendix L-1 of the EIS).

[d] Also includes Marine Terminal MOF removal.

[e] Equipment that would generate noise that reached Level A harassment is represented here (trailing hopper suction dredge; see table L-1.1-13 in appendix L-1 of the EIS).

TABLE 6.5.2-3

Summary of Underwater Noise Level B (Disturbance) Impact Area or Radius for Marine Mammals [a]

Activity	All Marine Mammals – Distance to Disturbance Impacts
West Dock	
11.5-inch H-pile, impact	0.1 mi^2
14-inch pipe pile, vibratory	0.4 mi^2
48-inch pipe pile, impact	1.6 mi^2
Sheet pile, vibratory	6.2 mi^2
Screeding	330 feet
Cook Inlet	
18-and 24-inch pile, impact	1.1 miles
48-inch pile, impact	2.9 miles
60-inch pile, impact	1.3 miles
All sizes pile, vibratory	13.4 miles
Sheet pile, impact	0.6 mile
Sheet pile, vibratory [b]	2.9 miles
Anchor handling	1.3 miles
Dredging [c]	140 to 450 feet
Mainline Pipeline trenching [c]	140 feet to 1.9 miles
DMT	183 feet

mi^2 = square miles
[a] Based on SELs, as defined in appendix L-1 of the EIS.
[b] Also includes Marine Terminal MOF removal.
[c] Multiple types of equipment/activities may be used/conducted (see appendix L-1 of the EIS).

Airborne Noise

NMFS has established an airborne disturbance threshold of 90 dB re 20 μPa (un-weighted) for harbor seals (*Phocis vitulina*) and 100 dB re 20 μPa (un-weighted) for other seal species. Because Pacific walruses haul out on land and would be susceptible to airborne noise harassment, we are using the thresholds for "other seal species" for other marine mammals, including northern sea otter, Pacific walrus, and polar bear. Table 6.5.2-4 summarizes airborne noise impacts on marine mammals. While small airplanes and helicopters used for the Project may not generate noise levels that reach NMFS disturbance levels for non-harbor seal species, research has shown that marine mammals are affected by aircraft overflights.

TABLE 6.5.2-4

Airborne Noise Impacts on Marine Mammals [a]

Activity	Radius to Disturbance	Marine Mammal Species Potentially Affected
General construction (Gas Treatment Facilities)	0.2 mile	Pacific walrus Polar bear Bearded seal Ringed seal
General construction (Liquefaction Facilities)	0.2 mile	Steller sea lion
Mainline excavation, Cook Inlet shorelines	At source [b]	Steller sea lion
Aircraft overflights – fixed wing planes	79 feet	Pacific walrus Polar bear Steller sea lion Bearded seal Ringed seal Northern sea otter
Aircraft overflights – helicopters	79 feet	Pacific walrus Polar bear Steller sea lion Bearded seal Ringed seal Northern sea otter
Removal of Marine Terminal MOF	0.2 mile	Steller sea lion

[a] Marine mammal groups include harbor seals and other seals. Harbor seals are not federally listed, so have not been included here. Other non-pinniped marine mammals that could be affected by airborne noise (e.g., northern sea otter, Pacific walrus, and polar bear) were classified under "other seals" because they would be subject to airborne noise disturbance.

[b] Steller sea lions are not expected to haul out near the shoreline excavation sites and, therefore, would not be affected by airborne noise generated from these activities.

Disturbance from airborne noise, such as aircraft, would have a greater chance of disturbing northern sea otters than underwater noise because they spend more time above water than below. There are few studies on sea otter responses to aircraft disturbance. It is likely that sea otters would react similarly to aircraft disturbance as pinnipeds. Bodkin and Udevitz (1999) observed sea otters diving, swimming away from aircraft, or swimming erratically in the presence of aircraft during an aerial survey.

Noise generated by transiting vessels could cause sea otters to avoid the area, and noise could disturb resting, feeding, and breeding behaviors. Potential signs of sea otter disturbance from vessel traffic include swimming away from approaching vessels; hauled-out otters entering the water; resting or feeding otters beginning to periscope or dive; and groups of otters scattering in different directions (Udevitz et al., 1995). These reactions consume energy and divert time and attention from biologically important behaviors such as feeding. Sea otters generally show a high degree of tolerance and habituation to aircraft and vessel traffic, although sea otters in southern Alaska have been shown to avoid areas with seasonally heavy boat traffic and return during seasons with less traffic (Garshelis et al., 1984). Their behavior is suggestive of a dynamic response to disturbance, abandoning areas when disturbed persistently and returning when the disturbance stops. These impacts would be expected to be temporary and short term, with the exception of Kachemak Bay, where vessels are likely to anchor and wait before moving to the Marine Terminal, causing noise disturbance for hours or days in one location.

6.5.2.2 Vessel Strikes

Available data are limited for how often sea otters are struck by vessels; however, vessel strikes leading to injury or death have been recorded in Alaska and the Pacific Northwest (USFWS, 2013, 2014d; Miller et al., 2015). Due to the limited vessel traffic that would occur in nearshore potential habitat areas, vessel strikes would be unlikely.

6.5.2.3 Spills

Construction and operation of the Mainline Pipeline and Liquefaction Facilities would require fuel transport and staging. Pipeline and materials would be transported to and from various ports in Alaska and to the Marine Terminal and Mainline MOFs. Potential fuel spills in sea otter habitats could occur from fuel transfers and an increase in vessel traffic.

The most likely source of exposure to an oil spill during operation would be from a grounded LNG carrier with a subsequent fuel release. Vessels associated with operation of the Liquefaction Facilities would include LNG carriers and four to five assist tugs that would be used for docking and undocking, vessel escorts, ice management, and firefighting. LNG carrier traffic into Cook Inlet would consist of about 204 to 360 port calls per year, depending on capacity, during the life of the Project. LNG carriers could therefore potentially add 204 to 360 port calls per year to vessel traffic in Cook Inlet, resulting in a 42 to 74 percent increase over existing traffic levels. While vessel casualties (grounding, collision, fire, or sinking) with oil spills have occurred within Cook Inlet, they are rare; between 1992 and 2006, there were nine oil spills related to vessel casualties in Cook Inlet (Fley, 2006). Spills are more common from vessels transiting Cook Inlet; from January 1, 1992, to August 30, 2006, there were 295 minor oil spills from vessels (Fley, 2006) (minor is classified as less than 10,000 gallons).

Sea otters are particularly vulnerable when there is a spill of crude oil or fuel due to the risks of fouling their insulative fur, ingestion of toxic material directly and indirectly in prey, and their tendency to occur in large groups where many animals could be exposed to one spill (USFWS, 2013). Spills and leaks of oil or wastewater from Project activities that reach marine waters could directly affect the health of exposed marine mammals. If contaminants spill into the ocean, the material would travel with currents. Potential spills from transiting vessels would likely be limited to fuel spills; therefore, they are expected to be small and a low risk of exposing sea otters in the vicinity of the spilled material.

6.5.2.4 Critical Habitat

The primary constituent element for critical habitat likely to be affected by vessel traffic is waters less than 65.6 feet (20 meters) in Kachemak Bay, Shelikof Strait, and near the Aleutian Islands. Spills in critical habitat could occur during vessel transit, vessel staging, and vessel docking. In addition, there is a low risk of spills from the LNG Plant during operation; these spills are not expected to reach critical habitat. There would be a risk of effects on critical habitat from vessels staging at Kachemak Bay. These vessels would generate engine and anchoring noise in critical habitat and there would be a risk of spills to critical habitat. AGDC would require all contractors to comply with the Project SPCC Plan, which would minimize potential long-term impacts on critical habitat, if a spill should occur.

6.5.3 Determination of Effect

The Project **may affect** northern sea otters because:

- Southwest Alaska DPS northern sea otters may occur within Alaska waters during construction and operation of the Project;

- the Project would increase vessel traffic in Alaskan waters where northern sea otters are known to occur; and
- there is potential for disturbance and spills from Project-related vessel traffic through occupied habitat in the Gulf of Alaska, Aleutian Islands, and Cook Inlet.

The Project is **not likely to adversely affect** northern sea otters because:

- increased vessel traffic noise would cause temporary disturbances as vessels transit through or near occupied habitat;
- vessel strikes are unlikely to occur due to the use of existing shipping routes; and
- spills would be unlikely, and if they occurred, spill response procedures would minimize the extent of the spill and impact on northern sea otters.

The Project **may affect** northern sea otter critical habitat because:

- vessels may transit through critical habitat; and
- spills from vessels may occur in critical habitat.

The Project is **not likely to adversely affect** critical habitat because:

- spills, if they should occur, would be small, and with the implementation of Project spill response procedures, significant impacts on critical habitat are unlikely.

6.6 PACIFIC WALRUS

6.6.1 Species Description and Potential Presence in the Action Area

Pacific walruses are managed by the USFWS under the MMPA, with co-management agreements between the USFWS and Eskimo Walrus Commission, the Bristol Bay Native Association's Qayassiq Walrus Commission, and the State of Alaska allowing for, and monitoring, subsistence harvest. On February 10, 2011, the USFWS announced a 12-month finding on a petition to list the Pacific walrus as endangered or threatened and to designate critical habitat under the ESA (76 FR 7634). After review of the available scientific and commercial information, the USFWS determined that listing the Pacific walrus as endangered or threatened was warranted; but the listing was precluded by higher priority species and the Pacific walrus was added to the candidate list (76 FR 7634). Based on a court settlement, the USFWS agreed to review and either propose a listing rule or remove the Pacific walrus from the candidate list. In May 2017, the USFWS developed a final species status assessment for the Pacific walrus (MacCracken et al., 2017). On October 2, 2017, the USFWS determined the species did not warrant listing under the ESA, and will not receive protection under the ESA. Due to the potential for the Pacific walrus to be reviewed for listing again within the timeframe of this Project, we have included it in our analysis but have not made a determination of effect at this time. The species' Alaska stock occurs in Alaskan waters near the Project in the Beaufort Sea.

Pacific walruses are large pinnipeds possessing two ivory tusks and a thick, tough hide (ADF&G, 2018). Adult males (i.e., bulls) weigh up to 2 tons and are 7 to 12 feet long; females tend to be smaller at 5 to 10 feet long, weighing a ton or more (ADF&G, 2018). Females and males become sexually mature at 6 to 7 and 8 to 10 years of age, respectively, although males typically do not successfully breed until around age 15. Pacific walruses breed in January through March (ADF&G, 2018). Females typically give birth every 2 years to one calf on ice floes in late spring (ADF&G, 2018). Calves stay with their mothers for 2 years, during which time their weight increases to about 750 pounds (ADF&G, 2018). Pacific walruses consume a variety of soft invertebrates, including snails, clams, tunicates, and sea cucumbers (ADF&G, 2018). Males occasionally prey on seabirds and seals (ADF&G, 2018). Pacific walruses are social animals that winter on the Bering Sea pack ice, but when sea ice is not available, they will haul out on land in large groups (ADF&G, 2018). In the spring, females and their calves migrate from the Bering Sea to the Chukchi Sea, while adult males migrate to Bristol Bay (ADF&G, 2018). Return migrations to the Bering Sea occur in late fall ahead of the advancing sea ice (ADF&G, 2018) (see figure 6.6.1-1).

Threats to the Pacific walrus in Alaska include reduction in sea ice and availability of prey due to climate change, predation by killer whales and polar bears, and increased vessel traffic (which can cause an increase in pollution, ship strikes, and entanglement) (ADF&G, 2018; Garlich-Miller et al., 2011). A reduction is sea ice often forces females to haul out on land with their young, where trampling events cause significant mortality to young (Kovacs et al., 2015). Reductions of sea ice extent also force Pacific walruses to travel further to feeding grounds from land-based haulouts, rather than sea ice edges (Kovacs et al., 2015). The current Pacific walrus population trend is unknown due to a lack of data; however, recent studies estimate the minimum population of the Pacific walrus to be about 129,000 animals (ADF&G, 2018; USFWS, 2014e).

Pacific walruses are an important subsistence resource, especially for Chukchi Sea communities, with an estimated annual subsistence harvest of 6,713 animals per year (Muto et al., 2016). Pacific walruses are occasionally seen as far east as Prudhoe Bay in the summer, but are rare visitors to this area (USFWS, 2011c). Pacific walruses may occur near, and be attracted to, the West Dock Causeway as a haulout site (USFWS, 2011c). Pacific walruses may occur along the West Dock Causeway and in vessel traffic routes in the Bering, Chukchi, and Beaufort Seas.

6.6.2 Effects Analysis

6.6.2.1 Habitat Loss or Modification

Pacific walruses have been observed infrequently hauling out on the West Dock Causeway (USFWS, 2011c). Construction activities and the presence of humans on and near West Dock would disturb resting Pacific walruses, causing them to swim and leave the area. Pacific walruses could be disturbed by construction activity and noise and avoid using West Dock during construction and use of the dock for unloading. Those activities would make the habitat unsuitable for Pacific walrus use for 6 years.

The use of West Dock by Project personnel would cause an increased risk of human–walrus interactions. The primary cause of human-caused mortality (aside from subsistence use), is stampedes (USFWS, 2014e). Pacific walruses disturbed on haulout sites will often stampede and rush to the water; calves, sick, and other individuals are often injured or killed (USFWS, 2014e). Only a few individuals may occur at West Dock; therefore, stampedes with subsequent injury or death would not be expected.

Figure 6.6.1-1
Alaska LNG Project
Pacific Walrus Range

LEGEND

- Project Facility
- Existing Facility
- Alaska Place Names Alaska LNG Rev
- C2 Route
- Potential Marine Transportation Routes
- Major Highways
- Major Rivers
- Pacific Walrus Range in U.S. Waters off Alaska
- Hanna Shoal Walrus Use Area

0 50 100 200 Miles

Map may not represent full species range. Only includes areas within NMFS Alaska region.

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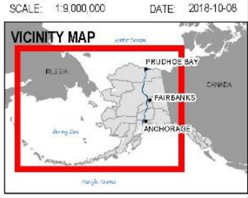

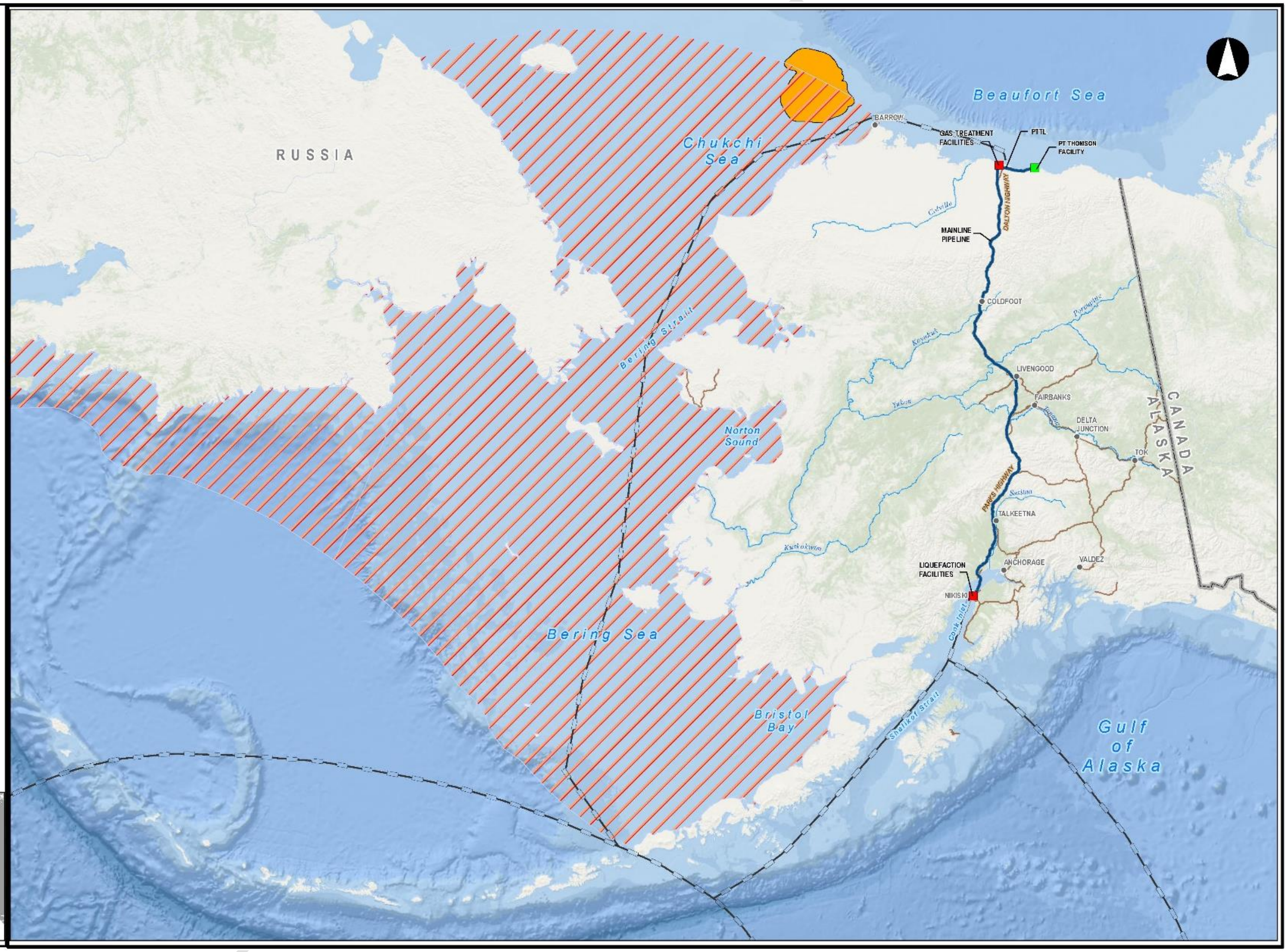

6.6.2.2 Noise

Complete noise analysis calculation results using the NMFS Technical Guidance and airborne noise guidance are included in appendix L-1 of the EIS. Summaries of Level A and B harassment areas are provided in tables 6.5.2-2 and 6.5.2-3. Pacific walruses use hearing and sound transmission for vital life functions, such as communication, navigation, and feeding. Anthropogenic noise can disrupt those behaviors; effects can vary from minor disturbances and harassment to injury and death. Anthropogenic noise is also known to create a masking effect on important sounds, which could affect the reproductive success of individual Pacific walruses (Todd et al., 2015).

Underwater Noise

Some Project activities' underwater sound levels are predicted to exceed thresholds established by NMFS as levels that could potentially result in incidental harassment of Pacific walruses (NMFS, 2018a; table 6.5.2-1). A number of construction activities would generate underwater noise that could cause injury to Pacific walruses or cause behavioral changes (e.g., changes to migratory behaviors) (see tables 6.5.2-2 and 6.5.2-3). Those noise-producing activities that could affect Pacific walruses at West Dock in Prudhoe Bay include material delivery vessels for construction, sheet piling for dock modifications, barge bridge support vessel construction, and screeding. While Pacific walruses spend more time above the water than below, underwater noise effects could affect feeding behaviors.

Much anthropogenic underwater noise frequencies are similar to frequencies that Arctic marine mammals use for communicating. Noise from pile driving, cargo vessels, and dredging can mask and interfere with marine mammal sounds, as well as cause injury and behavioral disturbances (Moore et al., 2012). Vessels are a major source of noise in coastal environments. Project-related vessel traffic would indirectly affect marine mammals through potential habitat degradation caused by increased shipping noise. The total number of vessel trips associated with Project construction and operation is provided in appendix L-2 of the EIS. Many reactions to ships or boats are presumably reactions to noise and often follow changes in engine and propeller speed. Underwater noise can change behaviors associated with migration, interfere with communication, increase stress hormones, and affect marine mammals' ability to find prey (Ellison et al., 2016). Material deliveries to West Dock with vessels would generate noise that could disturb marine mammals along vessel transit routes and while staged at the PBOSA. Vessels are expected to transit during periods of open ice in the summer months. The primary impact of vessel noise on marine mammals would be masking of sounds (Southall, 2005).

Project-related vessel traffic would indirectly affect Pacific walruses through potential habitat degradation caused by increased shipping noise in the Bering, Chukchi, and Beaufort Seas. Vessel noise could cause marine mammals to avoid the area near the transiting vessel and positioning vessels at docking facilities. Noise generated by vessels includes propeller cavitation, thrusters, engines, and depth sounders. Vessel use for deliveries to the West Dock Causeway could generate noise at levels that would disturb Pacific walruses. Due to the ephemeral nature of vessels in transit, vessel noise impacts would likely be minor as vessels travel through Prudhoe Bay to and from the Gas Treatment Facilities during construction and operation.

Dock Head 4 construction would require installing piles (sheet piling), most of which would be placed using an impact hammer in summer, and installing four dolphins required for affixing the temporary barge bridge across the causeway. The number and types of piles that would be used during construction are found in appendix L-1 of the EIS. Dock Head 4 piles and sheet piles would be installed between June and August. A few Pacific walruses could occur near West Dock during pile driving activities and be affected by pile driving noise. Pacific walruses within 0.1 to 1.6 square miles would be exposed to Level B disturbance (see tables 6.5.2-2 and 6.5.2-3).

Screeding would occur at West Dock to accommodate vessels. Noise generated by screeding vessels could exceed thresholds established by NMFS (see tables 6.5.2-2 and 6.5.2-3). Pacific walruses would occur within hearing distance of screeding activities while feeding in summer, and could be exposed to Level B harassment from noise within 330 feet. Use of PSOs to monitor and shut down activities when marine mammals enter the Level B harassment zone would not be possible under low light conditions; therefore, if activities occur during low lighting or inclement weather, some Pacific walruses could be exposed to Level B harassment due to a lack of visibility and the inability of PSOs to implement shutdown procedures.

Airborne Noise

Sources that could cause airborne noise levels above disturbance thresholds include pile driving; onshore facility construction and operational activities, including the use of vehicles and equipment; vessels; and aircraft overflights (see table 6.5.2-4). Airborne sounds over water may affect marine mammals at the water surface or when hauled out on land or sea ice (e.g., seals and sea otters). These noises could cause startle reactions, or cause marine mammals to avoid or move away from the areas where the noise is generated. Pacific walruses disturbed at haul out sites could trample young; however, Pacific walruses would not be expected to occur in large groups near West Dock, and airborne disturbance would likely cause avoidance of the area (Kovacs et al., 2015).

Pacific walruses at West Dock are subject to background noise levels from existing facilities, including the CGF to the east of the proposed GTP site (Anderson et al., 1992). GTP construction and operation would generate noise above ambient levels and contribute to an increase in background levels in the area. The increased ambient noise level could decrease habitat suitability for the Pacific walrus, although noise would most likely dissipate to background levels before reaching the coastal areas where Pacific walruses would occur.

Pile driving noise and other activities for Dock Head 4 construction could disturb and displace Pacific walruses from the vicinity and cause them to avoid hauling out. Most pile installation would be done with an impact hammer. Airborne noise generated during pile driving would be unlikely to reach disturbance levels for Pacific walruses unless the animal is immediately adjacent to the activity. Pacific walruses would be anticipated to avoid pile driving activities and thereby avoid Level B noise harassment. Construction noise for the Gas Treatment Facilities could reach disturbance levels 0.2 mile from the facilities. No blasting is planned near the Beaufort Sea coast for the Mainline Pipeline or Gas Treatment Facilities; therefore, no blasting impacts on Pacific walruses would be expected.

Vessels and aircraft could disturb Pacific walruses during construction and operation. Vessels approaching haulout areas (land or sea ice) or swimming walruses typically cause walruses to move away from the transiting vessel (National Research Council, 2003). Walruses will stampede into the water in reaction to noise from aircraft overflights (National Research Council, 2003). A helipad at Mainline MP 0.6, about 0.5 mile from West Dock, would be near a known walrus haulout. During construction, there would be a peak of six helicopter trips per day at construction camps, averaging three per day. Noise would reach disturbance levels at about 80 feet from the helicopter (see appendix L-1 of the EIS). While small airplanes and helicopters used for the Project may not generate noise levels that reach NMFS disturbance levels at flying altitudes, research has shown that marine mammals are affected by aircraft overflights.

6.6.2.3 Vessel Strikes

Available data are limited for how often Pacific walruses are struck by vessels; however, vessel strikes leading to injury or death are possible (Hauser et al., 2018). Young Pacific walruses are often curious and can be attracted to human activities, sometimes following vessels (USFWS, 2011b). Female and young walruses will often haul out on the ice, and could encounter vessel traffic as they transit through the Chukchi Sea to West Dock for deliveries. The total number of vessel trips associated with Project construction and operation is provided in appendix L-2 of the EIS; up to 186 vessel round trips could be made to West Dock during construction over 6 years. The USFWS recommends that vessels less than 50 feet long maintain a distance of at least 0.5 mile from hauled out Pacific walruses, and that vessels 50 to 100 feet long maintain a distance of at least 1 mile from hauled out walruses (USFWS, 2014f).

6.6.2.4 Spills

Construction and operation of the Gas Treatment Facilities would require fuel transport and staging. Pipe and other materials would be transported to West Dock from various ports in Alaska. Potential fuel spills in Pacific walrus habitats could occur from fuel transfers and an increase in vessel traffic.

The most likely source of exposure to an oil or fuel spill in the Beaufort Sea would be from a barge grounding, with a subsequent fuel release. There is insufficient data on oil spills offshore in the Arctic (Holland-Bartels and Pierce, 2011). However, impacts from a significant oil spill in the Arctic may be severe due to the remoteness and lack of spill response infrastructure in the region. Oil spill response plans would be available for vessel groundings or other accidental oil releases.

Spills could affect Pacific walruses and their prey if present around West Dock or the Beaufort and Chukchi Seas at the time of the spill. Pacific walruses tend to congregate in large numbers, so a spill near, or that reaches, a haulout area could have significant impacts on walruses (Garlich-Miller et al., 2011). Individual walruses could show acute irritation or damage to their eyes and skin and respiratory distress from the inhalation of vapors (NMFS, 2017a). Ingestion of contaminants could cause acute irritation to the digestive tract, including vomiting and aspiration into the lungs, which could result in pneumonia or death (NMFS, 2017a). A spill during winter could be particularly harmful to Pacific walruses that use leads and polynyas for breathing or feeding (Smith, 2010).

Oil and fuel spills occurring over the winter would likely remain on the ice surface as long as the ice surface remained solid. Cleanup on frozen ice could be very effective if done immediately after the spill. Blowing snow could combine with the spilled oil, moving oil across large distances and potentially into open water areas. Spills occurring during fall freeze-up would be trapped in freezing ice, later melting out in summer if the spill was not collected and cleaned up prior to melting. During spring thaw, spilled material would become trapped in melt pools between ice floes. Oil or fuel on the ice floes would travel with them as winds moved the ice. Material spilled during summer when no ice is present would travel with the currents. Oil and fuel spill response resources are limited in the Arctic, making a quick response that would minimize impacts unlikely (BLM, 2012).

6.7 POLAR BEAR

6.7.1 Species Description and Potential Presence in the Action Area

Polar bears were listed as threatened in 2008. Both the Chukchi/Bering Seas stock and Southern Beaufort Sea stock may occur in the Project area. Critical habitat has been designated for the polar bear along the Beaufort Sea coast and barrier islands (see figure 6.7.1-1).

Miles
1:500,000

Polar Bear Barrier Islands
Polar Bear Critical Feeding Habitat
Polar Bear No Disturbance Zone
Polar Bear 95% Den Habitat

Figure 6.7.1-1
Alaska LNG Project
Polar Bear Critical Habitat Map

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DRAWN BY: JML

PCEs for polar bear critical habitat include the following elements.

- Sea ice habitat used for feeding, breeding, denning, and movements, which is sea ice over waters 984.2 feet (300 meters) or less in depth that occurs over the continental shelf with adequate prey resources (primarily ringed and bearded seals) to support polar bears.

- Terrestrial denning habitat, which includes topographic features such as coastal bluffs and riverbanks with the following suitable macrohabitat characteristics:

    - steep, stable slopes (ranging from 15.5 to 50.0 degrees), with heights ranging from 4.3 to 111.6 feet (1.3 to 34.0 meters), and with water or relatively level ground below the slope and relatively flat terrain above the slope;

    - unobstructed, undisturbed access between den sites and the coast;

    - sea ice in proximity of terrestrial denning habitat prior to the onset of denning during the fall to provide access to terrestrial den sites; and

    - the absence of disturbance from humans and human activities that might attract other polar bears.

- Barrier island habitat used for denning, refuge from human disturbance, and movements along the coast to access maternal den and optimal feeding habitat. This includes barrier islands along the Alaska coast and their associated spits, within the range of the polar bear in the United States, and the water, ice, and terrestrial habitat within 1 mile (1.6 kilometers) of these islands (no-disturbance zone).

Polar bears have water-repellant white or yellowish coats, and large feet for swimming and walking on thin ice (ADF&G, 2018). They also have smaller ears, narrower heads, and longer necks than other bears (ADF&G, 2018). On average, males are 8 to 10 feet long and weigh 600 to 1,200 pounds; females weigh 400 to 700 pounds (ADF&G, 2018).

Females and males become sexually mature at 3 to 6 and 4 to 5 years of age, respectively. Polar bears breed from March through May (ADF&G, 2018). Females typically reproduce every 3 years, creating dens in October and November and give birth to cubs in December or January (ADF&G, 2018). Dens are typically dug in snow drifts along coastal bluffs, river banks, steep lakeshores, and on sea ice (Durner et al., 2006). Females may give birth to one to three cubs, but twins are most common. Cubs weigh 1 to 2 pounds at birth, but weigh about 20 to 25 pounds when they emerge from natal dens by late March or early April (ADF&G, 2018). Cubs remain with their mother for about 2.5 years; otherwise, polar bears are solitary animals (ADF&G, 2018). They primarily feed on ringed seals, but they will also consume bearded seals, walruses, and beluga whales (ADF&G, 2018). Polar bears are circumpolar and typically remain with the northern hemisphere pack ice as it seasonally advances and recedes; however, polar bears along the Beaufort Sea coast come on land to rest until shore-fast ice develops in late fall and they follow the pack ice south when it becomes suitable again for hunting (ADF&G, 2018).

Threats to polar bears in Alaska include reductions in sea ice from climate change, oil exploration and drilling activities, and pollutants (ADF&G, 2018; USFWS, 2010b,c). Generally, polar bear populations are declining in Alaska (USFWS, 2010b,c). There are no reliable population estimates for the polar bear in Alaska (USFWS, 2010b,c). The reduction in sea ice is causing polar bears to spend more time onshore, increasing their potential for interactions with humans and infrastructure (NMFS, 2016c). In particular, females are denning with increased frequency on land, versus sea ice, than they have in the past (NMFS, 2016c). Polar bears may occur in vessel traffic routes in the Beaufort Sea, at the PBOSA, near the West Dock Causeway, and on land near the Gas Treatment Facilities and the Mainline Pipeline on the Arctic Coastal Plain (see figure 6.7.1-1).

6.7.2 Effects Analysis

6.7.2.1 Habitat Loss or Modification

Polar bears primarily use terrestrial habitats for females to den and give birth over winter, and for males and females to travel and rest during open water periods (see figure 6.7.2-1). Project-related activities could cause permanent habitat loss from development of the GTP, PTTL, and Mainline Facilities. Activities that would result in temporary loss or alteration of habitat for polar bears include development of construction work surfaces, ice and gravel road corridors, and aboveground facilities; granular material placement; and water/ice withdrawal. Construction of the GTP, PTTL, and Mainline Pipeline in polar bear habitat would result in a permanent loss of denning habitat (see figure 6.7.2-1). Polar bears could be disturbed by construction activity and would avoid the area during active construction periods.

From late fall through late winter, female polar bears that hibernate and give birth in dens in sea ice and in snow on land, may be disturbed by Gas Treatment Facility and Mainline construction activities. Potential den habitat in the Project area is mapped and shown on figure 6.7.2-2. The GTP, PTTL, the Mainline Pipeline from MP 0.0 to 6.5, and West Dock and their associated facilities would occur in polar bear denning habitat; over 3,200 acres of suitable habitat would be affected by construction activities. Occupied dens could be disturbed if they occur within 1 mile of Project activities (USFWS, 2016b).

Polar bears regularly travel along the shoreline from the Sagavanirktok River delta to the Canning River delta, and female polar bears may den in the vicinity of the PTTL construction area; four dens have been documented within 1 mile of the PTTL (see table 6.7.2-1).

TABLE 6.7.2-1

Historical Polar Bear Den Sites Within 1 Mile of Project Winter Construction

Facility	Near Milepost	Distance from Den to Workspace (miles)	Year
PTTL			
Construction right-of-way	PTMP 9.3	0.7	2000 – 2001
Construction right-of-way	PTMP 14.9	0.3	2002 – 2003
Snow storage area	PTMP 26.7	0.4	1998 – 1999
Construction right-of-way	PTMP 36.4	1.0	2003 – 2004

Sources: USGS, 2010
PTMP = PTTL milepost

Denning polar bears would be disturbed by activities that generate noise, vibration, or physically affect the den itself. These activities could cause the polar bear to wake out of hibernation and abandon the den (Amstrup, 1993; Durner et al., 2006; Linnell et al., 2000). Den abandonment would result in mortality of the cub due to being left in the den alone or from emerging out of the den prematurely. If activities such as grading, granular fill placement, snow removal, or ice road and ice pad building should occur over an active den site, direct mortality of adults and cubs could occur because adults and cubs do not leave the den during this time period.

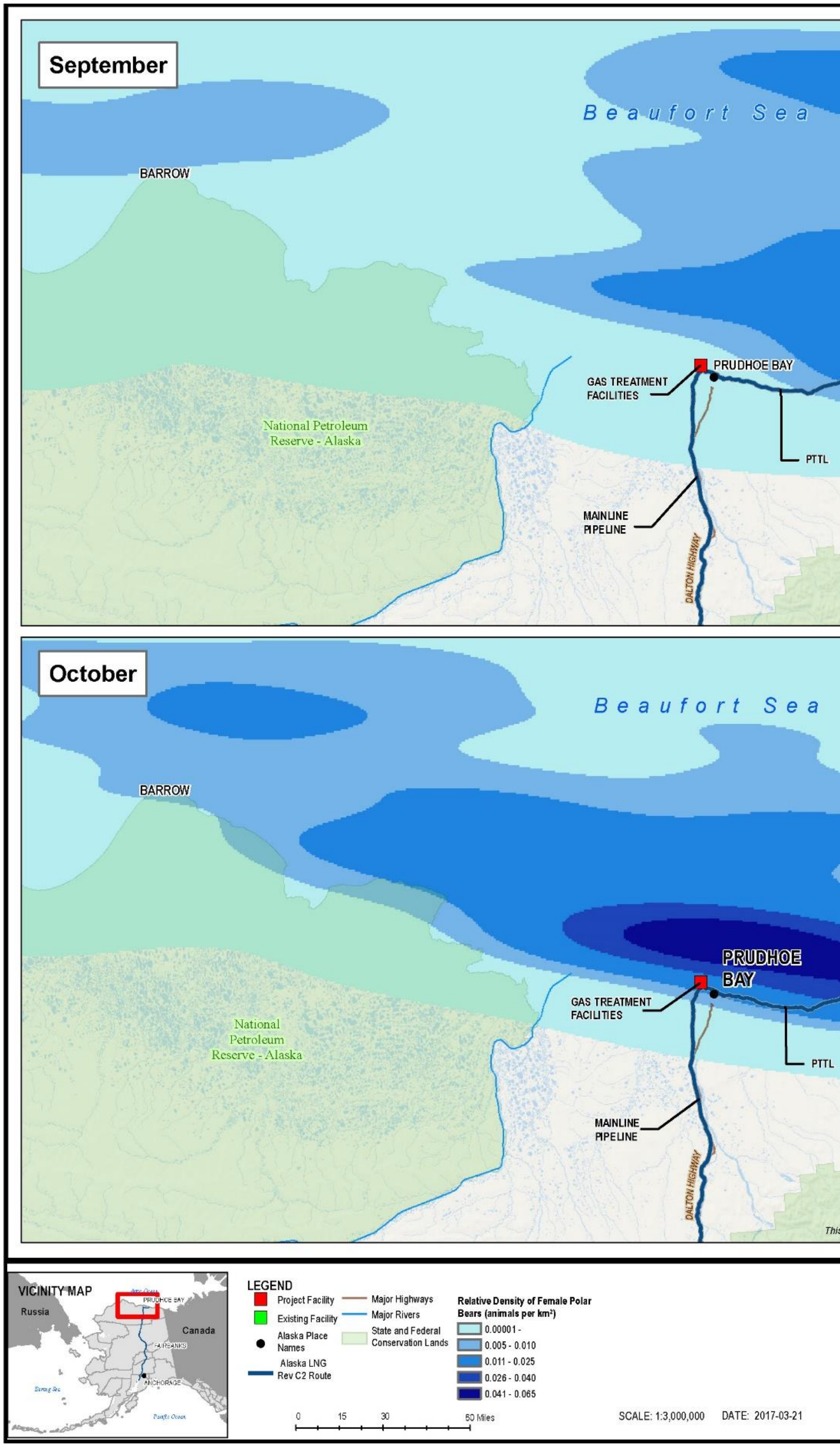


Figure 6.7.2-1
Alaska LNG Project
Relative Female Polar Bear Density During September and October

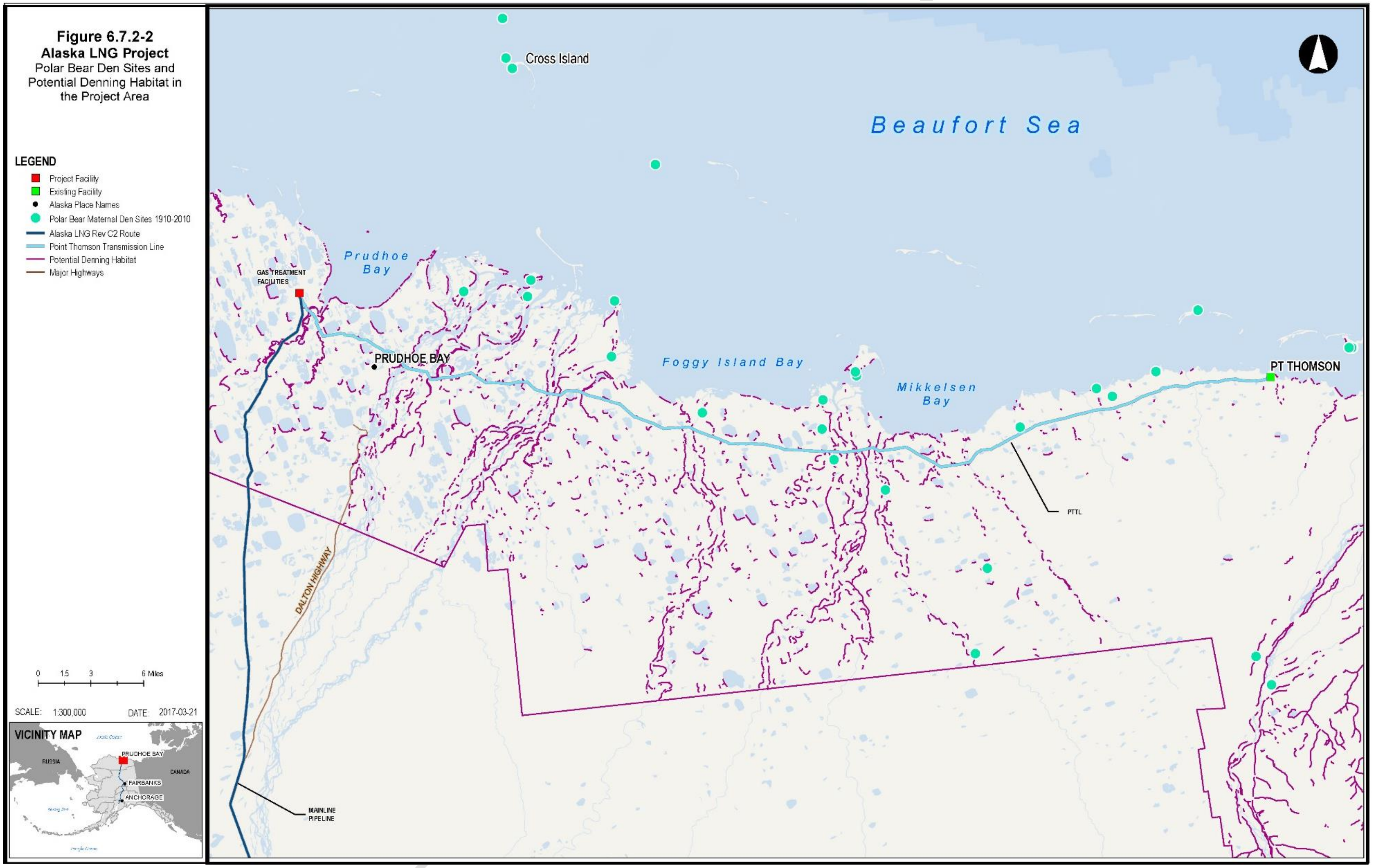


Figure 6.7.2-2
Alaska LNG Project
Polar Bear Den Sites and Potential Denning Habitat in the Project Area

6.7.2.2 Human Disturbance and Interaction

Project construction would occur over multiple years, with many activities continuing through operation for the life of the Project. In particular, camp use by Project personnel would create the potential for polar bear–human interactions and changes in polar bear behavior or habitat use. At peak times during construction, there could be over 1,900 additional people working in the Prudhoe Bay area. About 170 personnel would be in the North Slope Borough on rotation for operation and maintenance of the Gas Treatment Facilities.

Polar bears may occur on land near the PTTL and GTP, or on ice near West Dock, the GTP, and PTTL, which would cause a risk of human–bear interactions. Polar bears may occur in these areas year-round. Interaction with humans presents risks of injury and other effects on bears and humans, and may result in the need to engage in nonlethal take such as hazing or, on rare occasions, lethal take in defense of human life. Vehicle horns, sirens, lights, spot lights, and vehicles are sometimes used to deter bears from remaining at or near a worksite (USFWS, 2011c). Polar bears commonly occur along the Beaufort Sea coast during late winter and spring (March, April, and May) when females emerge from dens with their young and hunt ringed seal pups in shore-fast ice, and again during late summer and autumn (late August through November) when polar bears may be attracted by bowhead whale carcasses from subsistence hunts. The number of polar bear sightings at industrial sites along the Alaskan Beaufort Sea coast has increased in recent years as summer sea ice diminishes and coastal habitats are used more frequently, which increases the likelihood of human–bear encounters (Schliebe et al., 2008; USFWS, 2011c).

Areas with active construction may be either avoided by polar bears or bears may be attracted to the activity. Polar bears attracted to construction areas could be subject to unintentional harassment, lethal take, or intentional hazing away from the area (USFWS, 2011c). Oil and gas development and production activities require polar bear interactions plans, which develop and describe appropriate responses and procedures to encounters that are designed to avoid injury to people and to avoid lethal take of polar bears in defense of human life.

Polar bears may be attracted to camp facilities or construction sites by food odors. Attraction to construction sites may increase the potential for polar bear–human interactions or lead to male polar bears killing females and cubs in dens (USFWS, 2011c). The GTP and camp facilities would implement waste management plans that avoid and minimize potential access to food wastes and other attractants.

Activities at West Dock include screeding, filling, and barge delivery, causing disturbances for multiple months during the winter and summer seasons over a total of 6 years. The repeated and regular presence of human activity in these areas during operation could cause polar bears to avoid using those areas initially, then as they become accustomed to the activity, the likelihood of interactions with humans increases (USFWS, 2011c).

While the level of activity during operation would be reduced from the levels during construction, the potential for disturbance would remain during Project operation. Workers would continue to come and go from the facilities and from Mainline and PTTL pipeline right-of-way monitoring and maintenance. Polar bears emerging from dens near routine industrial noise and human activity may habituate, or become accustomed, and less wary, to activity (Smith et al., 2007; USFWS, 2011c). Habituation to stimulus, such as vehicle traffic and noise, can be positive because polar bears may experience less stress; however, habituation may increase the risk of human–bear encounters (USFWS, 2011c).

6.7.2.3 Noise

Complete noise analysis calculation results using the NMFS Technical Guidance and airborne noise guidance are included in appendix L-1 of the EIS; summaries of Level A and B harassment areas are provided in tables 6.5.2-2 and 6.5.2-3.

Underwater Noise

Much anthropogenic underwater noise frequencies are similar to frequencies that Arctic marine mammals use for communicating. Activities such as pile driving, cargo vessels, and screeding can mask and interfere with marine mammal sounds, as well as cause injury and behavioral disturbances (Moore et al., 2012). Some Project activities' underwater sound levels are predicted to exceed thresholds established by NMFS as levels that could potentially result in effects on marine mammals (NMFS, 2018a; see table 6.5.2-1). Pile driving would be unlikely to cause injury (Level A harassment) to polar bears (see table 6.5.2-2). Polar bears may experience disturbance (Level B harassment) thresholds from pile driving and screeding (see table 6.5.2-3). They may also be disturbed by barge bridge construction and vessel movement. Generally, underwater noise is not expected to be a significant impact on polar bears since they swim with their heads above water.

Airborne Noise

Airborne noise may affect polar bears on sea ice or on land. These noises could cause startle reactions, or cause polar bears to avoid or move away from the areas where the noise is generated. Polar bears would be exposed to airborne noise from GTP and PTTL construction, aircraft flights, and sheet piling and barge bridge construction at West Dock (see table 6.5.2.4). NMFS has established an airborne disturbance threshold of 90 dB re 20 μPa (un-weighted) for harbor seals and 100 dB re 20 μPa (un-weighted) for other seal species. Because polar bears are primarily found on land or sea ice and would be susceptible to airborne noise harassment, we are using the thresholds for "other seal species" for other marine mammals, including polar bears. Table 6.5.2-4 summarizes airborne noise impacts on marine mammals.

Polar bears traveling near the GTP would be subject to background noise levels from the CGF and other surrounding facilities. The additional contribution of noise from the GTP could increase background levels. GTP operation would generate noise above ambient levels. Noise from the GTP would add to noise for the existing nearby facilities and may decrease the suitability of the area for polar bears. The CGF, east of the GTP, contributes to the ambient noise levels in this region (Anderson et al., 1992). Noise would be expected to dissipate to background levels within about 2.25 miles of the facility, and would contribute to degradation of an estimated 16 square miles of critical habitat. Polar bears would likely avoid denning in this area for the life of the Project due to the increased noise levels. Pile driving noise for the Dock Head 4 construction may disturb and displace polar bears from the vicinity of the activity; most of the pile installation would be done with an impact hammer. Airborne noise generated during pile driving would be unlikely to rise to disturbance levels for polar bears unless the animal is immediately adjacent to the activity. Polar bears would be anticipated to avoid pile driving activities and thereby would avoid Level B harassment. Construction noise for the Gas Treatment Facilities could reach disturbance levels for polar bears 0.2 mile from the facilities (see table 6.5.2-4). No blasting is planned in the Arctic Coastal Plain for the Mainline Pipeline or Gas Treatment Facilities; however, blasting could be required in permafrost and frozen tundra areas where polar bears transit or den. Similarly, for other noise generating activities, blasting could cause polar bears to leave the area or vacate dens. With information on den site locations obtained from the den surveys described in section 2.3.4, disturbance to denning polar bears would be minimized through avoidance.

Polar bears may run from sources of noise and the sight of icebreakers, other vessels, and aircraft, especially helicopters, during construction. Polar bears may respond by running, trotting, or walking away from the source or by jumping into the water if available (USFWS, 2011c). Aerial pipeline inspections would be a potential source of operational disturbance. A helipad at Mainline MP 0.6 would be within polar bear habitat. During construction, there would be a peak of six helicopter trips per day at construction camps, averaging three per day. While small airplanes and helicopters used for the Project may not generate noise levels that reach NMFS disturbance levels, research has shown that polar bears are affected by aircraft overflights. Polar bears may run from aircraft, especially helicopters that approach at low altitude (USFWS, 2011c). The effects of fleeing are likely to be minimal if the event is temporary, the weather is cool, mother and cub are not separated, and the animal is otherwise unstressed (USFWS, 2011c). During warm spring or summer days, however, even a short run may be sufficient to overheat a polar bear, and a bear already stressed from a long swim could require a longer rest period to recover from the disturbance (USFWS, 2011c).

6.7.2.4 Prey Impacts

The Project could indirectly affect polar bears by reducing or altering ringed seal availability or abundance through disturbance and displacement of seals from West Dock during construction, vessel activity at West Dock, or spills. Ringed seals are the primary prey of polar bears; potential Project-related effects on ringed seals are described in section 7.9 below. Disturbance and displacement of ringed seals during winter construction would be most likely to have indirect effects on polar bears. The Project could adversely affect ringed seals during construction activities at West Dock primarily through noise, but also potentially through injury or mortality from on-ice construction.

6.7.2.5 Vehicle Collisions

For the Gas Treatment Facilities, about 26 miles of gravel and ice roads and ice pads would be used. In addition, about 4 miles of gravel access roads and 3 miles of ice roads and ice pads for the Mainline Pipeline would be in polar bear denning habitat. Increased vehicular traffic during construction and operation would increase the potential for collisions with polar bears. Over time, polar bears could become used to human presence during construction, thereby increasing the likelihood of vehicle collisions. Movements of female polar bears with small cubs between land-based den sites and shorefast ice habitats where their primary prey, ringed seals, would intersect ice roads and ice pads used for PTTL construction, increasing the chance for collisions. Vehicle or machinery traffic on granular and ice roads and ice pads could collide with polar bears and cause injury or mortality, although collisions would be unlikely.

6.7.2.6 Vessel Strikes

Vessels would be transiting to West Dock in the summer, and typically, polar bears would be on land during this time. Disturbance of nearshore or offshore transient or hunting polar bears would likely result in small-scale alterations of bear movements to avoid the vessel (USFWS, 2011c). Vessel strikes on polar bears would be unlikely and there is no evidence of vessels striking polar bears in Alaska.

6.7.2.7 Spills

The risk of spills in Prudhoe Bay would be similar as described for the Pacific walrus in section 6.6.2.4.

Spills and leaks of oil or wastewater from Project activities could directly affect the health of exposed polar bears. Ingestion of contaminated prey could cause acute irritation to the digestive tract, including vomiting and aspiration into the lungs, which could result in pneumonia or death (NMFS, 2017a).

In addition, spills could affect polar bear's ability to thermo-regulate (USFWS, 2016b). Oil and fuel spills occurring over the winter would likely remain on the ice surface as long as the ice surface remains solid. Cleanup on frozen ice could be very effective if done immediately after the spill. Blowing snow could combine with the spilled oil, moving oil across large distances and potentially into open water areas. Spills occurring during fall freeze up would be trapped in freezing ice, later melting out in summer if the spill was not collected and cleaned up prior to melting. During spring thaw, spilled material would become trapped in melt pools between ice floes. Oil or fuel on the ice floes would travel with them as winds moved the ice. Material spilled during summer when no ice is present would travel with the currents. Oil and fuel spill response resources are limited in the Arctic, making a quick response that would minimize impacts unlikely (BLM, 2012).

6.7.2.8 Critical Habitat

The PCEs for polar bear critical habitat include sea ice for feeding, breeding, denning, and movements; terrestrial denning habitat and barrier island habitat for denning, refuge from humans, and movements. Effects on sea ice would be limited to vessel traffic transiting to West Dock during construction. Vessels would transit during summer months, minimizing the effects on sea ice used by polar bears.

As described above, temporary and permanent impacts on denning habitat would occur from construction and operation of facilities on the North Slope. The PTTL would parallel the coast through known terrestrial denning habitat. While the pipeline itself would not create a physical barrier to polar bear movement, the structure, permanent access road, and associated disturbance from operational activities could interfere with the ability of polar bears to use critical habitat. In addition, some vertical support members would be placed in stream beds, which could cause a loss of denning habitat in critical habitat areas. Vessels in transit to West Dock would temporarily anchor at the PBOSA near Reindeer Island. Vessels would remain about 0.5 mile offshore of Reindeer Island, a barrier island; however, their proximity to this barrier island may disturb polar bears using this critical habitat.

Designated critical habitat for polar bears is mapped into four categories: 95 percent den habitat, feeding, no disturbance zone, and barrier islands. We have recommended that AGDC provide updated acreages of impacts on designated critical habitat for polar bears; however, preliminary calculations indicate the Project would affect the following acres of designated critical habitat for polar bears. About 1,700 to 2,500 acres of 95 percent den habitat would be affected during construction and 1,500 to 2,200 acres during operation. About 60 to 90 acres of feeding habitat would be affected during construction and 90 to 130 acres during operation. About 130 to 190 acres within the no disturbance zone would be affected during construction and 90 to 140 acres during operation. Vessels using the PBOSA for staging would occur within barrier island critical habitat.

6.7.2.9 Cumulative Impacts

As provided in appendix X-1 and referenced in section 4.19.3 of the EIS, the following projects would overlap with polar bear suitable and occupied habitat, and designated critical habitat:

- Alliance Exploration;
- PTU Expansion Project; and
- PBU MGS Expansion Project.

Activities that may be associated with these projects that could cumulatively increase effects on polar bears include:

- noise from dredging and exploratory drilling;
- habitat loss or alteration;
- human interactions;
- vessel traffic disturbances; and
- aircraft overflight disturbances.

The above activities could directly or indirectly affect polar bears and critical habitat by making it unavailable for use during feeding, breeding, and denning as defined under 75 FR 76086. Due to the ephemeral nature of polar bear habitat (i.e., seasonally available sea ice and variable denning habitat) and the non-concurrent timing of most of these activities, we do not expect cumulative impacts to be significant on polar bear critical habitat.

6.7.3 Determination of Effect

The Project **may affect** polar bears because:

- polar bears would occur within the Project area on the North Slope during construction and operation of the Project;
- the Project would permanently and temporarily affect polar bear habitat;
- the Project would increase the risk of polar bear–human interactions; and
- there is potential for disturbance and spills from Project-related vessels and vehicle traffic through occupied habitat.

The Project is **likely to adversely affect** polar bears because:

- the proposed action would disturb denning polar bears on land;
- construction and operational activities would cause polar bear–human interactions which could lead to harassment or fatalities of polar bears for protection of human life; and
- the Project would cause permanent loss of denning habitat.

The Project **may affect** polar bear critical habitat because:

- permanent facilities would be placed in, and near, critical habitat; and
- the Project would cause temporary disturbances to critical habitat.

The Project is **likely to adversely affect** critical habitat because:

- there would be temporary and permanent losses of denning habitat.

6.8 WOOD BISON

Wood bison were listed in 1973 as endangered, and reclassified as threatened in 2012. The species historically was found throughout Alaska, but declined due to overhunting. The ADF&G is now reintroducing individuals to Alaska from populations in Canada. The populations in Alaska are classified as a nonessential experimental population (ADF&G, 2018). Within the nonessential experimental population area and outside national parks or wildlife refuges, reintroduced wood bison are considered a proposed species under ESA 10(j); within national parks or wildlife refuges, they are protected as a threatened species. The Project does not cross national parks or wildlife refuges where the bison have been reintroduced.

Wood bison are a subspecies of American bison. Male wood bison can weigh nearly 2,000 pounds; females are slightly smaller typically weighing 1,200 pounds. Wood bison have a characteristic hump on their back and curving horns. Wood bison are found in meadows, near lakes and rivers, or near recent burn areas. Cows and young bison live in large groups grazing primarily on forbs, grasses, and sedges. Females give birth to a single calf every 3 years; calves are born between April and August (ADF&G, 2018).

The nearest location where wood bison have been introduced is the lower Innoko/Yukon River site which is nearly 300 miles west of the Mainline Pipeline; individuals are not expected to range into the Project area (see figure 6.8-1). There are no current plans to reintroduce wood bison to Minto Flats State Game Refuge. The Project is expected to have **no effect** on the wood bison; therefore, no further discussion of wood bison is included.

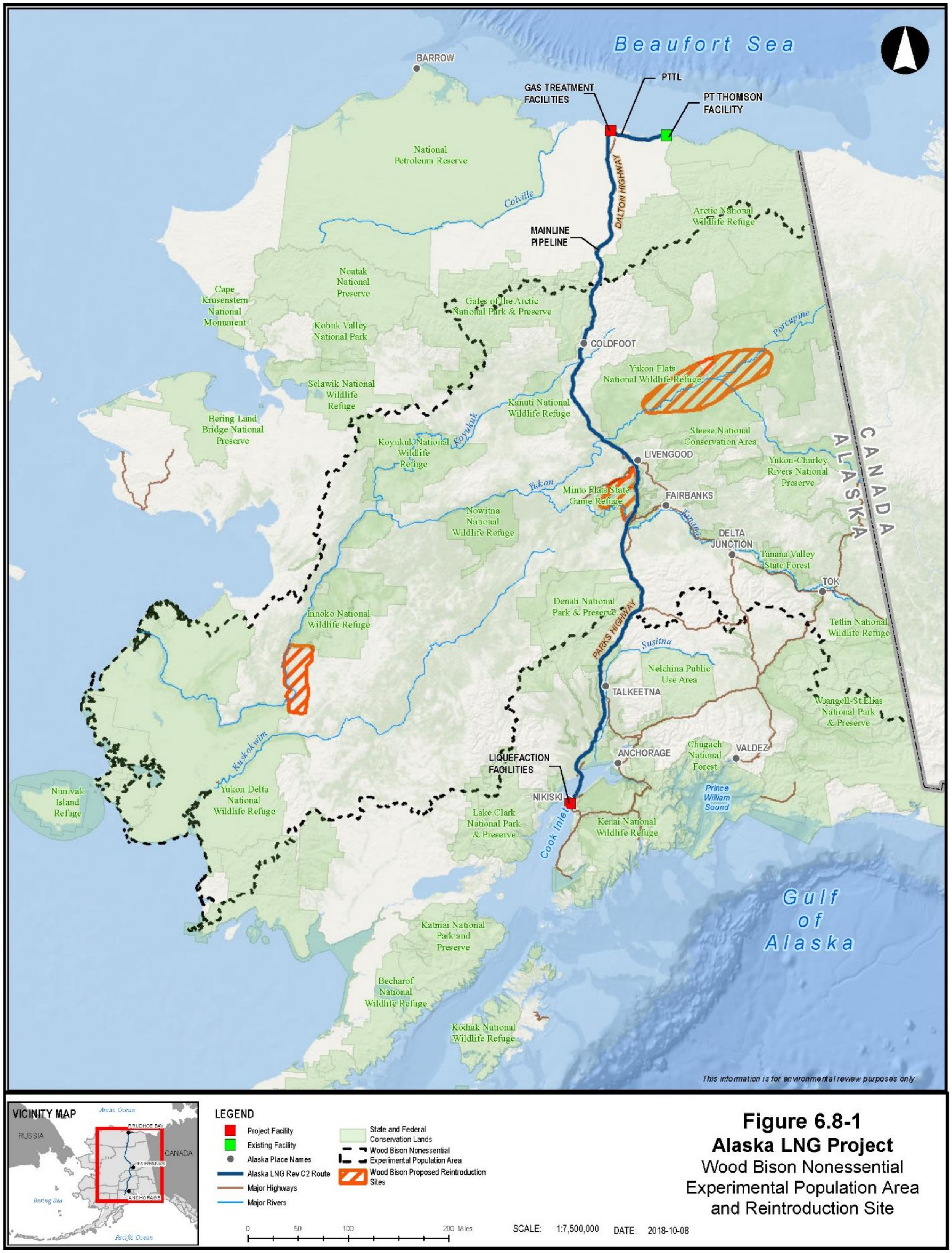


Figure 6.8-1
Alaska LNG Project
Wood Bison Nonessential Experimental Population Area and Reintroduction Site

7.0 NATIONAL MARINE FISHERIES SERVICE SPECIES

7.1 BEARDED SEAL

7.1.1 Species Description and Potential Presence in the Action Area

The bearded seal was listed as threatened in 2012. In 2014, the U.S. District Court for the District of Alaska determined the listing decision was arbitrary and capricious. The court vacated the rule, and remanded the rule back to NMFS for reconsideration. NMFS filed with the Federal Appeals Court in 2015. In early 2018, the U.S. Supreme Court left intact a lower court ruling such that the species remains listed as threatened. Critical habitat has not been designated for the bearded seal.

The bearded seal, Beringia DPS or Alaska stock, is found off the coast of Alaska over continental shelf waters in the Bering, Chukchi, and Beaufort Seas (see figure 7.1.1-1). A reliable population estimate is not available for the entire stock at this time (Muto et al., 2016). Bearded seals are closely associated with sea ice, in particular pack ice, and their movements typically follow the ice. Bearded seals will move north in late spring and summer as the ice retreats, and move south in the fall as sea ice forms (NOAA, 2018). Ice is important for critical life history periods such as molting and reproduction and they prefer ice that has natural openings of open water for access to foraging habitats (Cameron et al., 2010). A small number of bearded seals, mostly juveniles, can be found on land near the coast in the summer months, and have been observed traveling up rivers (Cameron et al, 2010). Females give birth and nurse young on the broken pack ice in winter and spring (Cameron et al., 2010).

Bearded seals feed primarily on benthic organisms such as invertebrates and fish (Cameron et al., 2010; ADF&G, 2018). They generally feed in waters less than 650 feet deep and are solitary (ADF&G, 2018). Bearded seals may occur along vessel transit routes through the Bering, Chukchi, and Beaufort Seas. Bearded seals are expected to occur near the West Dock Causeway year-round.

7.1.2 Effects Analysis

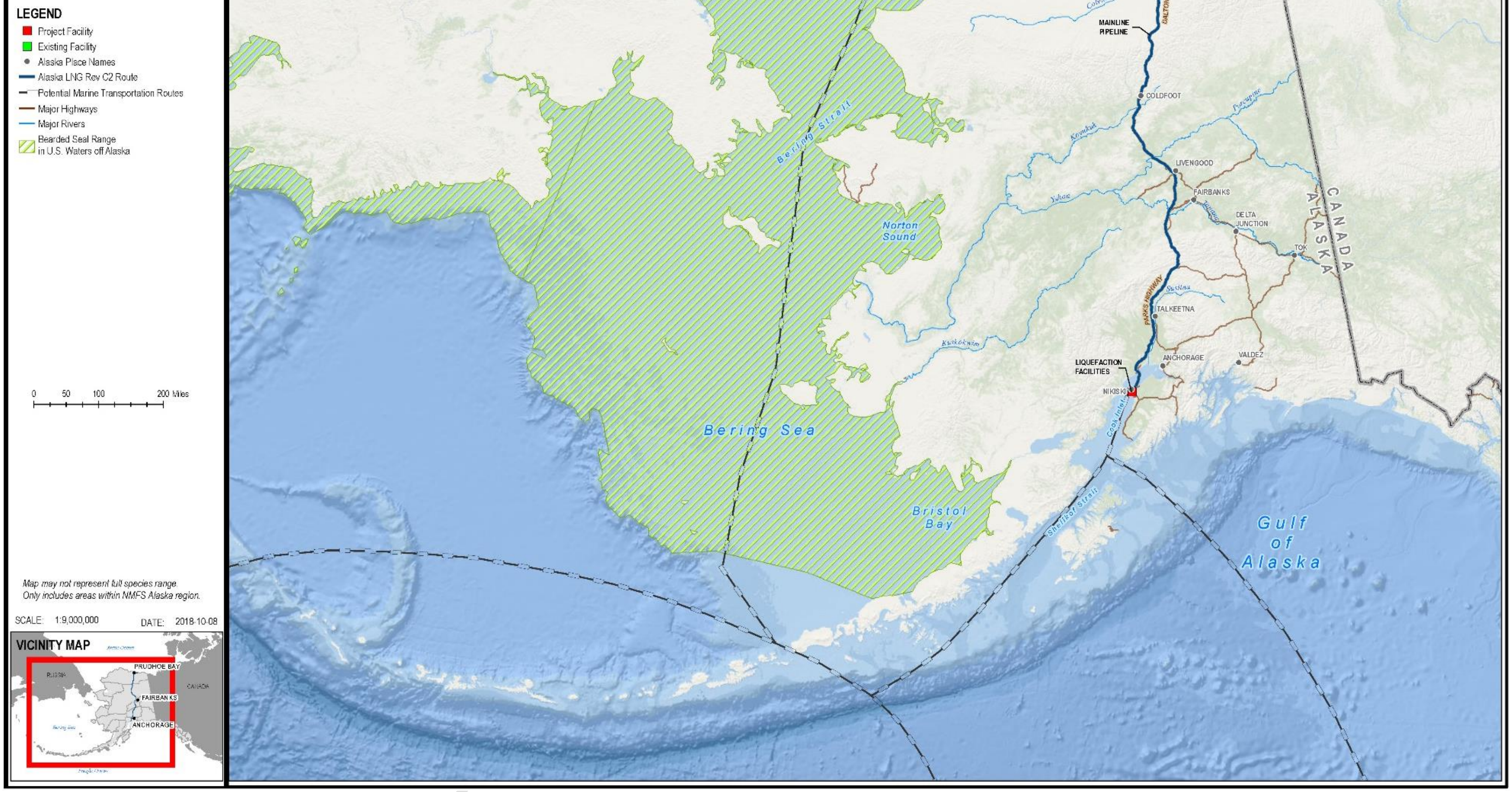
7.1.2.1 Habitat Loss or Degradation

Project-related activities could cause permanent habitat loss from installation of in-water structures, and temporary foraging loss due to screeding activities. Bearded seals may occasionally occur on land but more likely would occur on sea ice in the Project area in Prudhoe Bay coastal areas. Bearded seals may be disturbed by construction activity and noise, which could make the area unsuitable and cause seals to avoid areas of construction. Placement of the West Dock structures would affect the availability of sea ice in the area. Winter activities at the GTP (prepping the seabed for the barge bridge) when ice is present, could disturb adults and pups on the sea ice.

Sealifts to West Dock would be conducted when surface ice coverage is equal to or less than 30 percent (the average ice-free period is 61 days, with the earliest opening on July 15 and the latest closing on November 4). If ice is present, bearded seals may be present; however, activities would occur outside their more vulnerable period (during whelping, mating, and molting from mid-March through June) minimizing the risk of vessels striking or disturbing seals resting on ice (Boveng et al., 2008, 2009).

Construction of West Dock at Dock Head 4 would result in loss and alteration of about 166 acres of benthic marine substrates. The seabed would be disturbed prior to each sealift, and barges would be grounded during module deliveries. At West Dock, the seabed would be graded/screeded in the summer before each sealift. Bearded seals may be displaced by these screeding activities. This area of marine and benthic habitat used for foraging by bearded seals would be lost during these activities. Once barge deliveries are complete, the benthic community would be anticipated to recolonize the area rapidly following seafloor disturbance since it is adapted to annual seafloor disturbance (i.e., ice scour).

Figure 7.1.1-1
Alaska LNG Project
Bearded Seal Range



7.1.2.2 Noise

Complete noise analysis calculation results using the NMFS Technical Guidance and airborne noise guidance are included in appendix L-1 of the EIS; summaries of Level A and B harassment areas are included in tables 6.5.2-2 and 6.5.2-3.

Underwater Noise

Material deliveries to West Dock with vessels would generate noise that could disturb bearded seals along vessel transit routes and while vessels are staged at the PBOSA. Vessels are expected to transit during periods of open ice in the summer months. Bearded seals would occur in vessel transit routes during the summer months. Vessel noise impacts on bearded seals would be similar to those described for the Pacific walrus.

Dock Head 4 construction would require installing piles (sheet piling), most of which would be placed using an impact hammer in summer, and installing four dolphins required for affixing the temporary barge bridge across the causeway (see appendix L-1 of the EIS). Dock Head 4 piles and sheet piles would be installed between June and August. A few bearded seals may occur near West Dock during pile driving activities and could be affected by pile driving noise. Bearded seals would be exposed to Level A harassment (injury) within 0.1 square mile of pile driving and Level B harassment (disturbance) within 0.1 to 6.2 square miles (see tables 6.5.2-2 and 6.5.2-3).

Screeding would occur at West Dock during summer months to accommodate vessels. Noise generated by screeding vessels could exceed thresholds established by NMFS (see tables 6.5.2-2 and 6.5.2-3). Bearded seals within 330 feet of screeding activities would be exposed to Level B disturbance. Use of PSOs to monitor and shut down activities when marine mammals enter the Level B harassment zone would not be possible under low light conditions; therefore, if activities occur during low lighting or inclement weather, some bearded seals may be exposed to Level B harassment from screeding due to lack of visibility and the inability of PSOs to implement shutdown procedures.

Airborne Noise

Sources of airborne noise above disturbance thresholds include pile driving, onshore vehicles, some construction equipment, and aircraft overflights. NMFS has established an airborne disturbance threshold of 90 dB re 20 μPa (un-weighted) for harbor seals and 100 dB re 20 μPa (un-weighted) for other seal species. Table 6.5.2-4 summarizes airborne noise impacts on marine mammals. Airborne sounds over water may affect bearded seals at the surface or when hauled out. These noises could cause startle reactions, or cause bearded seals to avoid or move away from the areas where the noise is generated.

Noise generated by the GTP during operation is not expected to reach harassment levels for bearded seals. Airborne noise generated during pile driving would be unlikely to rise to disturbance levels for bearded seals unless the animal is immediately adjacent to the activity. Bearded seals would be anticipated to avoid pile driving activities and thereby not be exposed to Level B disturbance. Airborne noise generated during general construction activities on land or over water would reach NMFS disturbance levels (Level B) for bearded seals within 0.2 mile of West Dock. No blasting is planned near the Beaufort Sea coast for the Mainline Pipeline or Gas Treatment Facilities; therefore, no blasting impacts on bearded seals are expected.

Project-related air traffic would use airstrips in Point Thomson. During construction, there would be a peak of six helicopter trips per day at construction camps, averaging three per day. While small airplanes and helicopters used for the Project may not generate noise levels that reach NMFS disturbance levels for non-harbor seal species, research has shown that bearded seals are affected by aircraft overflights.

Noise and visual stimuli from aircraft (helicopter and airplane) overflights have the potential to disturb bearded seals. Marine mammals disturbed by aircraft typically will surface for shorter periods, dive, swim, or turn away from the noise or sight, or breach (Patenaude et al., 2002). Helicopters tend to be more disturbing than fixed-wing aircraft (Luksenburg and Parsons, 2009; Born et al., 1999). Pinnipeds tend to react to aircraft overflights by becoming alert and/or entering the water (Luksenburg and Parsons, 2009; Born et al., 1999). Pinnipeds would most likely be affected by low flying aircraft if they were hauled out on land or ice and would react by diving into water. Bearded seals are watchful of their environment, and would likely escape to the water if disturbed by aircraft noise (ADF&G, 2018).

Many researchers have described behavioral reactions of marine mammals to the presence of humans, boats, and aircraft (Richardson et al., 1995). Although most of the data are anecdotal, they provide useful information about situations in which some species react strongly, weakly, or inconsistently, or do not react at all. No specific data on received sound levels are available for most of these incidents (Richardson et al., 1995). Aircraft noise could affect seals that may be resting out of water, but noise from aircraft flying overhead may also propagate into the water where seals are swimming (Blackwell and Greene, 2003). Even small aircraft may produce loud sounds that exceed 120 dB re 20 μPa at 3.28 feet (1 meter) and could affect marine mammals found along typical flight paths, such as those near airports or landing pads (Luksenburg and Parsons, 2009). The severity or lack of response to aircraft overflight noise varies by species and is dependent on the behavior of the animal at the time of disturbance (i.e., resting versus traveling) (Luksenburg and Parsons, 2009). Bearded seals may occur in Prudhoe Bay either on ice or potentially on land where flights would be seen and/or heard by individuals.

7.1.2.3 Turbidity/Prey Impacts

Benthic invertebrates and fish are important prey sources for bearded seals. Prey habitat loss and alteration could occur from disturbance related to screeding in Prudhoe Bay, facility construction (e.g., benthic construction and noise from construction equipment) at West Dock, and barge bridge grounding at West Dock. Some prey could be injured or killed if they occur near pile driving activities, but generally, fish are expected to avoid habitats around Project construction activities. Benthic communities would be temporarily lost during screeding and barge bridge placement activities at West Dock. Temporary loss of benthic food sources is not expected to be significant since the area around West Dock is often subject to disturbance from seasonal ice scour.

In-water activities, such as pile driving and screeding, would increase turbidity in the surrounding water column. Increased turbidity could make it harder for bearded seals to find food. Effects on bearded seals' ability to find prey resources from increased turbidity during construction would be temporary and similar to turbidity generated during spring ice breakup or summer/fall storms.

7.1.2.4 Vessel Strikes

Available data are limited for how often bearded seals are struck by vessels; however, increased vessel activity is a concern for this species (NMFS, 2018b). The total number of vessel trips associated with Project construction and operation is provided in appendix L-2 of the EIS; up to 186 vessel round trips could be made to West Dock during construction over 6 years. The risk of a vessel striking a resting adult seal is low due to their alertness and mobility. Bearded seals would be nursing young on broken pack ice when vessels are in transit to West Dock during spring months. Ice breaking vessels have been reported to negatively affect ice-breeding seals, such as bearded seals, by directly striking seals on ice or by separating mothers and pups (Hauser et al., 2018).

7.1.2.5 Spills

Construction and operation of the Gas Treatment Facilities would require fuel transport and staging. Pipeline and materials would be transported to and from various ports in Alaska and to West Dock. Potential fuel spills in bearded seal habitats could occur from fuel transfers and an increase in vessel traffic.

The most likely source of exposure to an oil or fuel spill in the Beaufort Sea would be from a barge grounding, with a subsequent fuel release. There is insufficient data on oil spills offshore in the Arctic (Holland-Bartels and Pierce, 2011). Impacts from a significant oil spill in the Arctic may be severe due to the remoteness and lack of spill response infrastructure in the region. Oil spill response plans would be available for vessel groundings or other accidental oil releases.

Spills could affect bearded seals and their prey if present around West Dock or the Beaufort and Chukchi Seas at the time of the spill. Spills and leaks of oil or wastewater from Project activities that reach marine waters could directly affect the health of exposed seals. If contaminants spill into the ocean, the material would travel with currents. Individual bearded seals could show acute irritation or damage to their eyes and skin and respiratory distress from the inhalation of vapors (NMFS, 2017a). Ingestion of contaminants could cause acute irritation to the digestive tract, including vomiting and aspiration into the lungs, which could result in pneumonia or death (NMFS, 2017a). A spill during winter could be particularly harmful to bearded seals that use leads and polynyas for breathing or feeding (Smith, 2010). Oil and fuel spills occurring over the winter would likely remain on the ice surface as long as the ice surface remained solid. Cleanup on frozen ice could be very effective if done immediately after the spill. Blowing snow could combine with the spilled oil, moving oil across large distances and potentially into open water areas. Spills occurring during fall freeze up would be trapped in freezing ice, later melting out in summer if the spill is not collected and cleaned up prior to melting. During spring thaw, spilled material would become trapped in melt pools between ice floes. Oil or fuel on the ice floes would travel with them as winds moved the ice. Material spilled during summer when no ice is present would travel with the currents. Oil and fuel spill response resources are limited in the Arctic, making a quick response that would minimize impacts unlikely (BLM, 2012).

7.1.2.6 Cumulative Impacts

As provided in appendix X-1 and referenced in section 4.19.3 of the EIS, the following projects would overlap with bearded seal habitat:

- Alliance Exploration;
- PTU Expansion Project; and
- PBU MGS Expansion Project.

Activities that may be associated with these projects that could cumulatively increase effects on bearded seals include:

- noise from dredging and exploratory drilling;
- habitat loss or alteration;
- vessel traffic disturbances; and
- aircraft overflight disturbances.

The above activities could directly or indirectly affect bearded seals and their habitats by making it unavailable for use during feeding, breeding, and denning due to increased noise and vessel traffic. Given that bearded seals rely on transient sea ice and the non-concurrent timing of most of these activities, we would not expect cumulative impacts on bearded seals to be significant.

7.1.3 Determination of Effect

The Project **may affect** bearded seals because:

- bearded seals would occur within the Project area during construction and operation of the Project;
- the Project would temporarily affect bearded seal habitat; and
- there is potential for disturbance and spills from Project-related vessel traffic through occupied habitat.

The Project is **likely to adversely affect** bearded seals because:

- the Project would cause Level A and Level B harassment to bearded seals from underwater noise; and
- vessel traffic could cause injury to adult seals and pups.

7.2 BLUE WHALE

7.2.1 Species Description and Potential Presence in the Action Area

The blue whale was listed as endangered in 1970. Critical habitat has not been designated for the species. The Eastern and Central North Pacific (formerly the California/Mexico and Western North Pacific) stocks intermix in Alaskan waters (ADF&G, 2018). Blue whales average 85 feet in length, and may travel alone or in pairs in pelagic waters, as well as occur near the ice edge while migrating. Blue whales use baleen plates to filter feed primarily on euphausiids (small shrimp-like crustaceans also referred to as krill). Blue whales reach sexual maturity at 10 years, may live for 80 years, and breed and give birth primarily in winter. A single calf is born every 2 to 3 years in southern regions off Mexico, Central America, and California. The Gulf of Alaska, along the Aleutian Islands, and the Bering Sea are used as summer feeding grounds (NMFS, 2017a).

Typically, blue whales move poleward in spring to feed, and in the fall move toward the subtropics to conserve energy and reproduce (ADF&G, 2018). Although blue whales are found in coastal waters, they are typically associated with the edges of continental shelves (ADF&G, 2018).

Threats to blue whales in Alaska include human-caused underwater noise and ship strikes (ADF&G, 2018; Muto et al., 2015). It is unknown if populations are increasing or decreasing, and population estimates in Alaskan waters are unknown (Muto et al., 2015; ADF&G, 2018). Blue whales may occur in vessel traffic routes in the Gulf of Alaska (see figure 7.2.1-1).

7.2.2 Effects Analysis

7.2.2.1 Noise

Vessels transiting through the Gulf of Alaska could encounter blue whales during spring and summer when they are further north feeding. Vessel noise impacts on blue whales would be similar to those described for the Pacific walrus. Due to the ephemeral nature of vessels in transit, vessel noise impacts would be expected to be minor.

Figure 7.2.1-1
Alaska LNG Project
Blue Whale Range

LEGEND

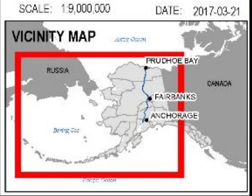
- Project Facility
- Existing Facility
- Alaska Place Names
- Alaska LNG Rev C2 Route
- Potential Marine Transportation Routes
- Major Highways
- Major Rivers
- Blue Whale Range in U.S. Waters off Alaska

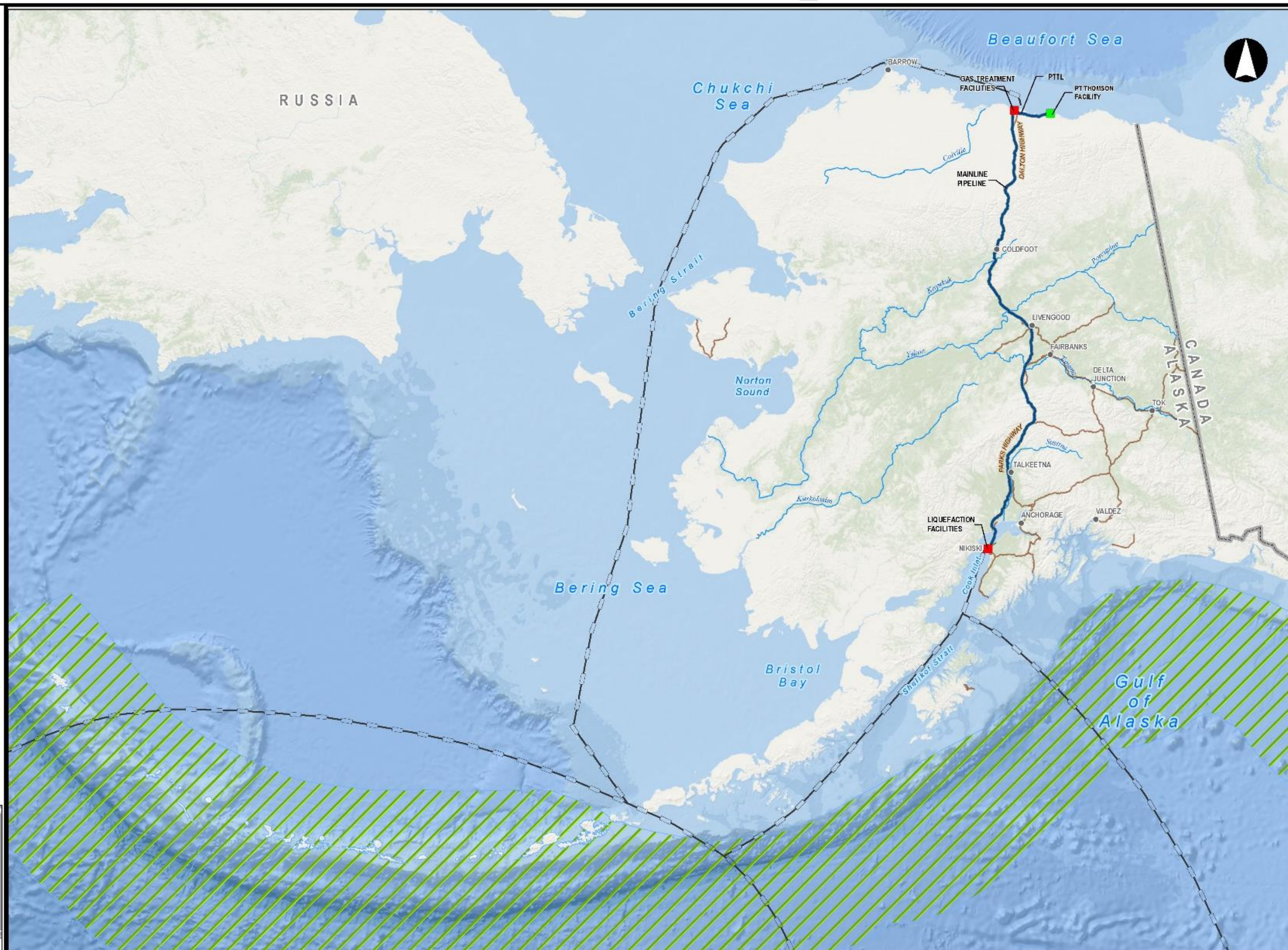
0 50 100 200 Miles

Map may not represent full species range. Only includes areas within NMFS Alaska region.

SCALE: 1:9,000,000 DATE: 2017-03-21

VICINITY MAP





7.2.2.2 Vessel Strikes

Vessels may collide with blue whales, resulting in injury or death. Whale mortalities are usually caused by blunt force trauma from striking the ship bow, or by lethal wounding from propeller cuts. Vessel speed is the primary factor in the probability of a vessel strike and of the strike being lethal (Vanderlaan and Taggart, 2007). The percent of lethal whale strikes is significantly reduced by vessels traveling at less than 12 knots (13.8 miles per hour) (Vanderlaan and Taggart, 2007).

Vessels travelling through the Gulf of Alaska to Cook Inlet could strike blue whales. The total number of vessel trips associated with Project construction and operation is provided in appendix L-2 of the EIS; about 1,243 vessel round trips would occur during construction to Cook Inlet and up to 10,921 vessel round trips would occur during operations to Cook Inlet. A variety of vessels would be in use for different phases of construction and operation. Vessel transit speeds vary from less than 10 knots up to 26 knots. A summary of projected vessel strikes is included in table 7.2.2-1.

While there are no known records of blue whale strikes in Alaska waters, globally, ship strikes were implicated in the deaths of nine blue whales between 2007 and 2011 (Carretta et al., 2015). Blue whale mortality and injuries attributed to ship strikes in California waters averaged 1.9 per year from 2007 to 2011. No blue whale ship strikes were documented in Alaskan waters from 1978 to 2011 (Neilson et al., 2012). Blue whales are more at risk of a vessel strike in busy shipping lanes near the coast. While there would be a potential for ship strikes in Project LNG carrier and HLV shipping routes, the risk of potential strikes would be low because vessels would transit further from the coast in potentially occupied blue whale waters.

TABLE 7.2.2-1

Estimated Marine Mammal Vessel Strikes

	Estimated Number of Strikes per Year [a]		
Species	Construction	Operation	Total Number of Strikes
Seals and Sea Lions			
Bearded seal	NA [b]	NA [b]	NA [b]
Ringed seal	NA [b]	NA [b]	NA [b]
Steller sea lion	NA [b]	NA [b]	NA [b]
Whales			
Blue whale	NA [b]	NA [b]	NA [b]
Bowhead whale	NA [b]	NA [b]	NA [b]
Cook Inlet beluga whale	0.04	0.23	0.26 [c]
Fin whale	0.14	0.91	1.05
Gray whale	0.04	0.23	0.26
Humpback whale	0.79	5.00	5.79
North Pacific right whale	NA [b]	NA [b]	NA [b]
Sei whale	NA [b]	NA [b]	NA [b]
Sperm whale	0.11	0.68	0.79

NA = Not available

[a] Potential strikes were only calculated for activities in Cook Inlet and Gulf of Alaska (e.g., LNG carriers for operation, and vessels to the Mainline and Marine Terminal MOFs). Due to a lack of available strike data, potential strikes were not calculated for activities in Prudhoe Bay or for vessels transiting the Bering, Chukchi, and Beaufort Seas.

[b] No records of individual strikes in Alaska were available to calculate the potential strike rate from Project activities. However, literature suggests these species are vulnerable to be struck and injured or killed by vessels.

[c] Does not include vessels for pipelay activities for Mainline Pipeline construction in Cook Inlet.

7.2.2.3 Spills

Construction and operation of the Gas Treatment Facilities, Mainline Pipeline, and Liquefaction Facilities would require fuel transport. Pipeline and materials would be transported to and from various ports in Alaska, and to the Marine Terminal and Mainline MOFs through blue whale habitat. Potential fuel spills in blue whale habitat could occur from an increase in vessel traffic.

If contaminants spill into the ocean, the material would travel with the currents. Individual blue whales exposed to contaminants could show acute irritation or damage to their eyes, blowhole, and skin; fouling of baleen, which could reduce feeding efficiency; and respiratory distress from the inhalation of vapors (NMFS, 2017a). Ingestion of contaminants could cause acute irritation to the digestive tract, including vomiting and aspiration into the lungs, which could result in pneumonia or death (NMFS, 2017a). A spill during winter could be particularly harmful to marine mammals that use leads (a linear area of open water within the sea ice) for breathing or feeding (Smith, 2010). A large spill in marine waters could potentially have a significant and long-term effect on marine mammals, including blue whales; however, with implementation of the conservation measures listed above, a large spill would be unlikely to occur.

7.2.3 Determination of Effect

The Project **may affect** blue whales because:

- construction and operational vessels would transit through blue whale habitat.

The Project is **not likely to adversely affect** blue whales because:

- the risk of potential strikes would be minimized with implementation of vessel traffic conservation measures; and
- the risk of potential strikes is low because vessels would not transit near the coast where blue whales are more likely to occur.

7.3 BOWHEAD WHALE

7.3.1 Species Description and Potential Presence in the Action Area

The bowhead whale was listed as endangered in 1970. Critical habitat has not been designated for the bowhead whale. The Western Arctic stock occurs in Alaskan waters. Adults weigh 75 to 100 tons and are 45 to 60 feet long; their bow-shaped skull accounts for roughly a third of that length (NMFS, 2017a). Bowhead whales reach sexual maturity at about 35 to 40 feet long, and they likely mate in the Bering Sea during late winter and spring (NMFS, 2017a; ADF&G, 2018). Females typically have one calf every 3 to 4 years, giving birth between April and early June (NMFS, 2017b; Alaska Fisheries Science Center [AFSC], 2015). Calves are 13 to 14 feet long, weigh 1 ton, and are gray (NMFS, 2017b; ADF&G, 2018). Bowhead whales use baleen plates to consume zooplankton (i.e., crustaceans), other invertebrates, and fish (NMFS, 2017b). Their life expectancy is unknown, but they may live over 100 years (NMFS, 2017b).

Bowhead whales overwinter in the central and western Bering Sea (Rugh et al., 2003). As sea ice begins to retreat in April, bowhead whales begin migrating north to the Chukchi and Beaufort Seas. Most bowhead whales continue to migrate eastward into the Beaufort Sea from April through June and remain at summer foraging grounds until late August or early September before migrating westward again toward the Bering Sea (Rugh et al., 2003; Hannay et al., 2013). Bowhead whales occupying the Arctic Ocean and surrounding seas spend winters associated with the southern limit pack ice and move north in the spring, following the ice and using leads to reach their summer feeding grounds in the Beaufort Sea (NMFS, 2017b; Hannay et al, 2013). Biologically important areas (BIAs) for feeding have been identified near Saint Lawrence Island in winter during November through April, and throughout the Beaufort Sea in fall during September through October (NMFS, 2017c). BIAs for migration have been identified northward through the Bering Sea from March through June; northward and eastward through the eastern Chukchi and Alaskan Beaufort Seas from April through May; and westward through the Alaskan Beaufort Sea from September through October (NMFS, 2017c). BIAs for bowhead whale reproduction include the Alaskan Beaufort Sea during September and October, the eastern Alaskan Beaufort Sea during July and August, and the Barrow Canyon region during April through June (NMFS, 2017c). Figure 7.3.1-1 shows the range of the bowhead whale in Alaska and the BIAs.

Threats to bowhead whales in Alaska include ship strikes, pollutants from vessels, human-caused underwater noise, climate change, and entanglement in commercial fishing gear (Muto et al., 2016). The current minimum population estimate for bowhead whales in Alaska is about 16,000 (Muto et al., 2018). Bowhead whale populations in Alaska are recovering and have been increasing since the late 1970s (ADF&G, 2018). However, as sea ice continues to decline due to climate change, increased vessel traffic in Artic waters could cause an increased risk of vessel strikes on bowhead whales (NMFS, 2018b).

Bowhead whales may occur in vessel traffic routes in the Bering, Chukchi, and Beaufort Seas, and may occur at the PBOSA. They are likely to be affected by traffic and construction noise during their fall migration through the Beaufort and Chukchi Seas.

7.3.2 Effects Analysis

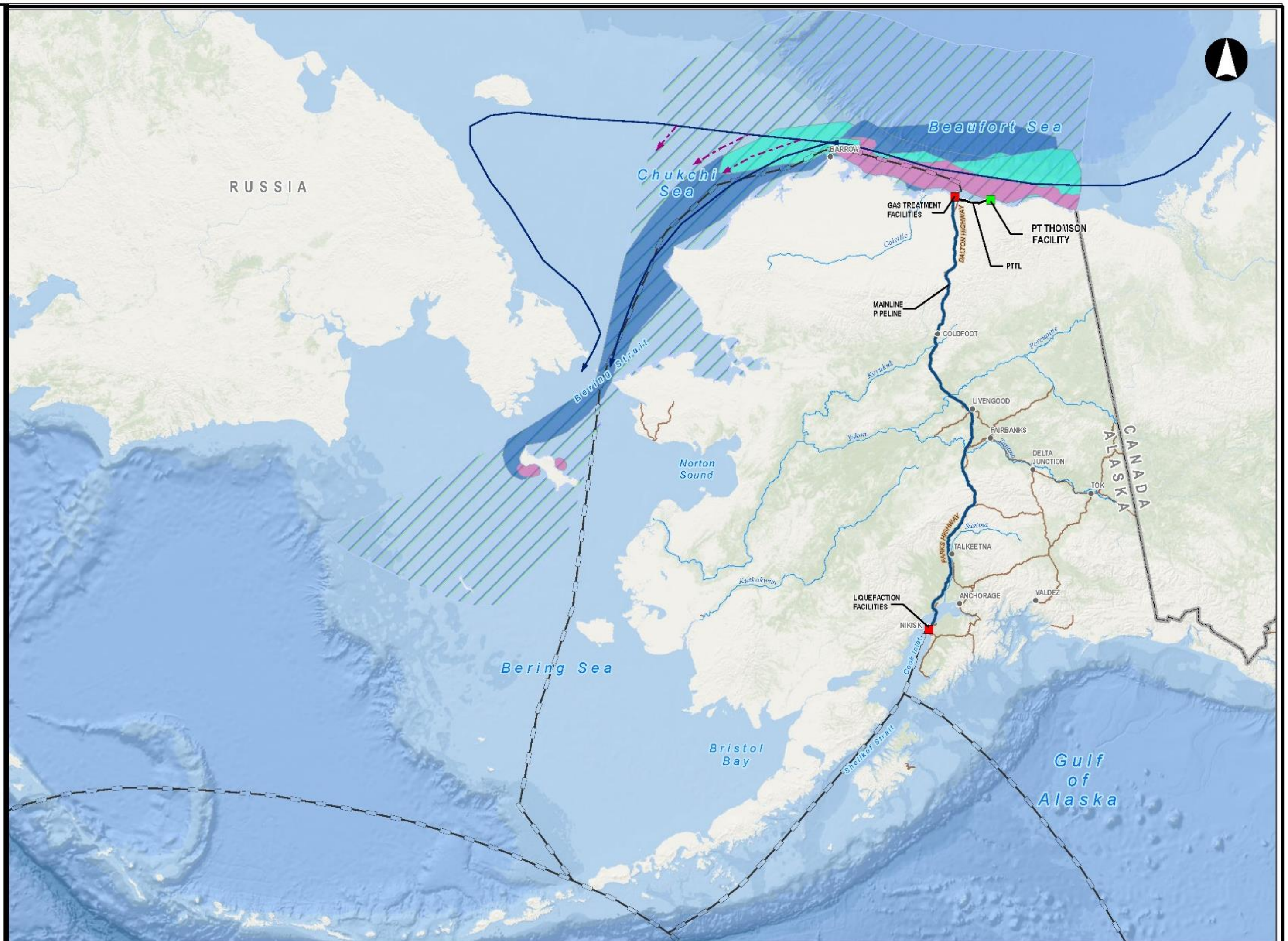
7.3.2.1 Noise

In particular, transiting vessel noise would be most likely to disturb bowhead whales as they travel through BIAs for feeding and reproduction. Bowhead whales would be migrating through the Bering, Chukchi, and Beaufort Seas where they could encounter vessel traffic and noise. Vessel noise impacts on bowhead whales would be similar as described for the Pacific walrus. Vessels would arrive at West Dock during the ice-free period for 6 sealift seasons (see appendix L-2 of the EIS). Vessel noise could interfere with bowhead whales' ability to reach their summer breeding grounds. Due to the infrequent ship transits through migratory habitat, however, the impacts would not be significant.

Dock Head 4 construction would require installing piles (sheet piling), most of which would be placed using an impact hammer in summer, and installing four dolphins required for affixing the temporary barge bridge across the causeway (see appendix L-1 of the EIS). Dock Head 4 piles and sheet piles would be installed between June and August, outside the bowhead whale sensitive periods; therefore, noise from pile driving would not affect reproducing bowhead whales.

Screeding would occur at West Dock during summer months to accommodate vessels. Noise generated by screeding vessels and their activities could generate noise levels above thresholds established by NMFS (see tables 6.5.2-2 and 6.5.2-3). While screeding would occur outside of the sensitive time periods for bowhead whales, some individual whales could be exposed to Level B disturbance within 330 feet of screeding activities. Use of PSOs to monitor and shut down activities when marine mammals enter the Level B harassment zone would not be possible under low light conditions; therefore, if activities occur during low lighting or inclement weather, some bowhead whales could be exposed to Level B harassment from screeding due to lack of visibility and the inability of the PSOs to implement shutdown procedures.

Figure 7.3.1-1
Alaska LNG Project
Bowhead Whale Range Fall Migration Routes and Biological Important Areas



LEGEND

- Project Facility
- Existing Facility
- Alaska Place Names
- Potential Marine Transportation Routes
- Alaska LNG Rev C2 Route
- Major Highways
- Major Rivers
- Western Arctic Bowhead Whale Stock

Biologically Important Area (BIA)

- Feeding
- Migration
- Reproduction

Fall Migration Routes

- Identified Migration Route
- Possible Migration Route

0 40 80 160 Miles

Map may not represent full species range. Only includes areas within NMFS Alaska region.

SCALE: 1:9,000,000 DATE: 2018-10-08

VICINITY MAP

7.3.2.2 Vessel Strikes

Vessels may collide with bowhead whales, resulting in injury or death. Whale mortalities are usually caused by blunt force trauma from striking the ship bow, or by lethal wounding from propeller cuts. Vessel speed is the primary factor in the probability of a vessel strike, and of the strike being lethal (Vanderlaan and Taggart, 2007). The percent of lethal whale strikes is significantly reduced by vessels traveling at less than 12 knots (13.8 miles per hour) (Vanderlaan and Taggart, 2007).

Vessels travelling through the Bering, Beaufort, Chukchi, and Bering Seas en route to the GTP/West Dock during construction could strike bowhead whales. Risks of vessel strikes would be higher in BIAs, where bowhead whales concentrate to feed and reproduce. The total number of vessel trips, vessel types, and typical speeds associated with Project construction and operation is provided in appendix L-2 of the EIS; up to 186 vessel round trips could be made to West Dock during construction over 6 years. A variety of vessels would be in use for different phases of construction and operation. Vessel transit speeds vary from less than 10 knots up to 26 knots. A summary of projected vessel strikes is included in table 7.2.2-1. While there are no known records of bowhead whale strikes in Alaskan waters, evidence of ship propeller injuries has been found on bowhead whales (Muto et al., 2016). With the increase of vessel traffic in bowhead whale habitats, vessel strikes are possible, but at this time unquantifiable due to lack of information.

7.3.2.3 Spills

Construction and operation of the Gas Treatment Facilities would require fuel transport and staging. Pipeline and materials would be transported to and from various ports in Alaska and to West Dock. Potential fuel spills in marine mammal habitats could occur from fuel transfers and an increase in vessel traffic.

The most likely source of exposure to an oil or fuel spill in the Beaufort Sea would be from a barge grounding, with a subsequent fuel release. There is insufficient data on oil spills offshore in the Arctic (Holland-Bartels and Pierce, 2011). Impacts from a significant oil spill in the Arctic may be severe due to the remoteness and lack of spill response infrastructure in the region. Oil spill response plans would be available for vessel groundings or other accidental oil releases.

If contaminants spill into the ocean, the material would travel with the currents. Individual bowhead whales exposed to contaminants could show acute irritation or damage to their eyes, blowhole or nares (nostrils), and skin; fouling of baleen, which could reduce feeding efficiency; and respiratory distress from the inhalation of vapors (NMFS, 2017a). Ingestion of contaminants could cause acute irritation to the digestive tract, including vomiting and aspiration into the lungs, which could result in pneumonia or death (NMFS, 2017a). A spill during winter could be particularly harmful to marine mammals that use leads and polynyas for breathing or feeding (Smith, 2010). Oil and fuel spill response resources are limited in the Arctic, making a quick response that would minimize impacts unlikely (BLM, 2012).

7.3.3 Determination of Effect

The Project **may affect** bowhead whales because:

- construction and operational vessels would transit through bowhead whale habitat; and
- construction activities at West Dock could expose bowhead whales to Level B harassment noise levels.

The Project is **not likely to adversely affect** bowhead whales because:

- the risk of potential strikes would be minimized with implementation of the vessel traffic conservation measures; and

- pile driving would be conducted outside the sensitive bowhead whale periods.

7.4 COOK INLET BELUGA WHALE

7.4.1 Species Description and Potential Presence in the Action Area

The Cook Inlet beluga whale was listed as endangered in 2008. A BIA for the small and resident population of Cook Inlet beluga whale occurs in Upper Cook Inlet and along the western coast of Cook Inlet (NMFS, 2017b). In 2011, NMFS designated critical habitat for Cook Inlet beluga whales (76 FR 20180) in the following two areas of Cook Inlet (shown on figures 7.4.1-1, 7.4.1-2, and 7.4.1-3).

- Area 1. All marine waters of Cook Inlet north of a line from the mouth of Threemile Creek (61°08.5′ N, 151°04.4′ W) connecting to Point Possession (61°02.1′ N, 150°24.3′ W), including waters of the Susitna River south of 61°20.0′ N, the Little Susitna River south of 61°18.0′ N, and the Chickaloon River north of 60°53.0′ N.

- Area 2. All marine waters of Cook Inlet south of a line from the mouth of Threemile Creek (61°08.5′ N, 151°04.4′ W) to Point Possession (61°02.1′ N, 150°24.3′ W) and north of 60°15.0′ N, including waters within 2 nautical miles seaward of mean high water along the western shoreline of Cook Inlet between 60°15.0′ N and the mouth of the Douglas River (59°04.0′ N, 153°46.0′ W), all waters of Kachemak Bay east of 151°40.0′ W, and waters of the Kenai River below the Warren Ames Bridge at Kenai, Alaska.

The waters off Joint Base Elmendorf-Richardson and the Port of Anchorage were excluded from the designation under the provisions of Section 4(b)(2) of the ESA. Physical or Biological Features Essential for Conservation (i.e., PCE) associated with critical habitat include those listed below.

PCE1. Intertidal and subtidal waters of Cook Inlet with depths less than 30 feet (9.1 meters) mean lower low water (MLLW) and within 5 miles (8 kilometers) of high and medium flow anadromous fish streams.

PCE2. Primary prey species consisting of four species of Pacific salmon (Chinook, sockeye [*Oncorhynchus nerka*], chum [*Oncorhynchus keta*], and coho [*Oncorhynchus kisutch*]), Pacific eulachon (*Thaleichthys pacificus*), Pacific cod (*Gadus microcephalus*), walleye pollock (*Theragra chalcogramma*), saffron cod (*Eleginus gracilis*), and yellowfin sole (*Limanda aspera*).

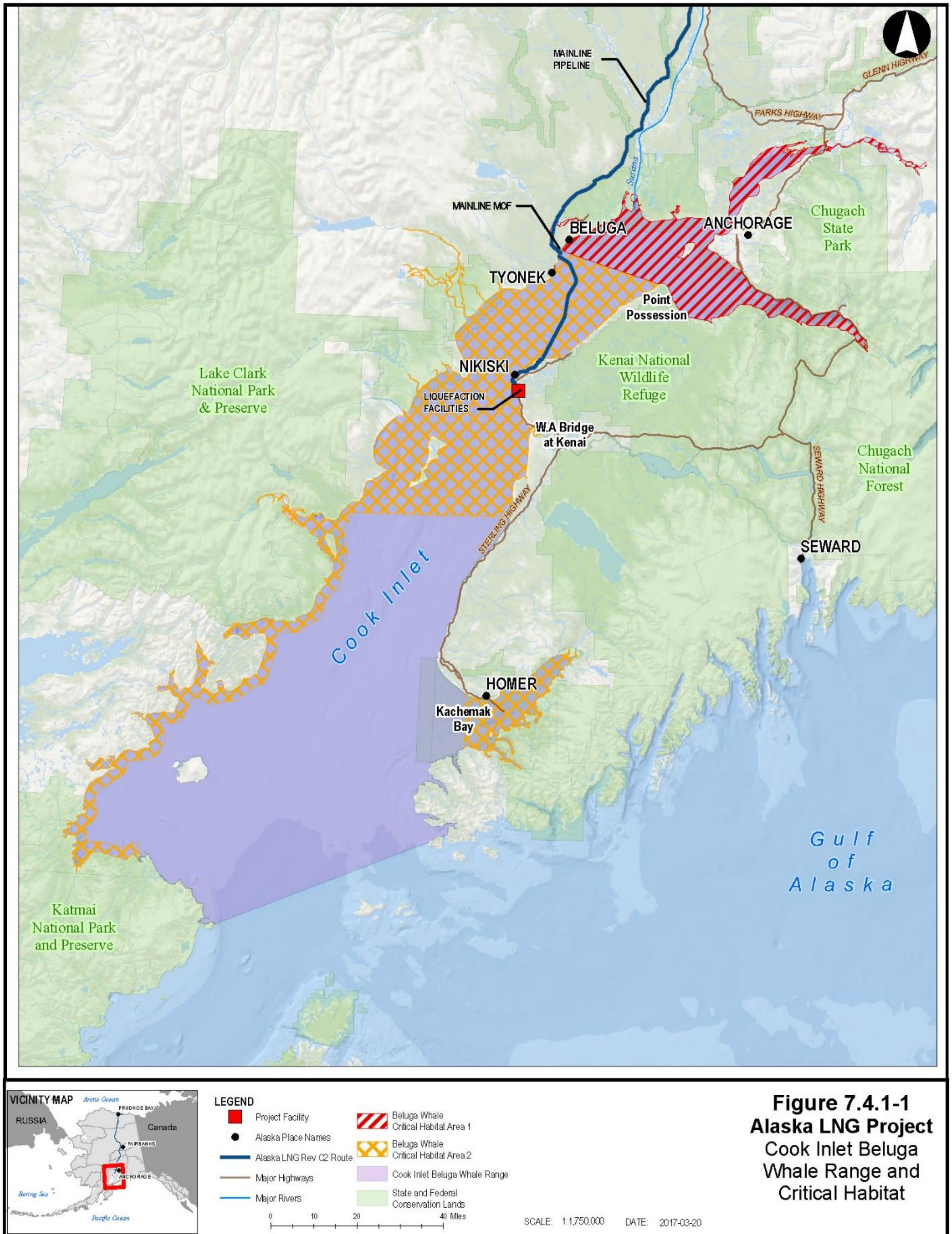
PCE3. Waters free of toxins or other agents of a type and amount harmful to Cook Inlet beluga whales.

PCE4. Unrestricted passage within or between the critical habitat areas.

PCE5. Waters with in-water noise below levels resulting in the abandonment of critical habitat areas by Cook Inlet beluga whales (50 CFR 226).

Beluga whale adults are white, toothed, and have a large melon (i.e., bulbous structure on their forehead) (ADF&G, 2018). They have a ridge down their back rather than a dorsal fin, are about 11 to 15 feet long, and can weigh 1,000 to 3,300 pounds. Females are smaller than males (ADF&G, 2018). Beluga whales may live 60 to 70 years, reach sexual maturity anywhere between 4 and 15 years of age, and change colors as they mature from gray to white between 9 and 17 years of age (NMFS, 2016a). Mating is believed to occur between late winter and early spring. Most calves are born between May and August, but calving season can extend into October. Calves are nursed for about 2 years (NMFS, 2016a).

In Cook Inlet, beluga whales feed extensively on spawning eulachon in spring, shifting to salmon as eulachon runs diminish and salmon runs begin in the summer months. Winter prey is not well known; however, it is presumed that Cook Inlet beluga whales forage more on benthic fish and invertebrates at that time of year (NMFS, 2016a). The minimum population estimate of Cook Inlet beluga whales is 287 (Muto et al., 2018).



LEGEND

- Project Facility
- Alaska Place Names
- Alaska LNG Rev C2 Route
- Major Highways
- Major Rivers
- Beluga Whale Critical Habitat Area 1
- Beluga Whale Critical Habitat Area 2
- Cook Inlet Beluga Whale Range
- State and Federal Conservation Lands

0 10 20 40 Miles

SCALE: 1:1,750,000 DATE: 2017-03-20

Figure 7.4.1-1
Alaska LNG Project
Cook Inlet Beluga Whale Range and Critical Habitat

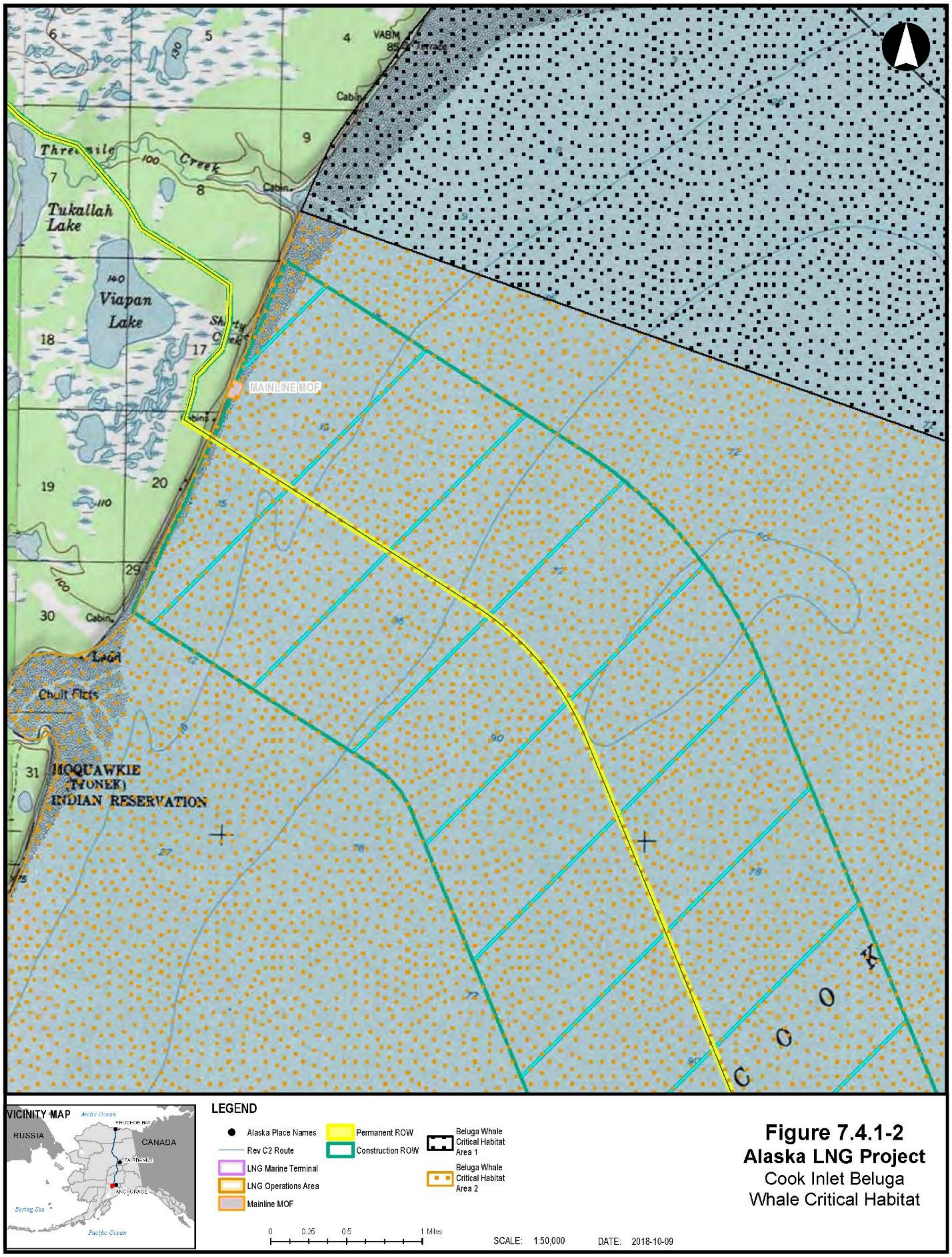


Figure 7.4.1-2
Alaska LNG Project
Cook Inlet Beluga Whale Critical Habitat

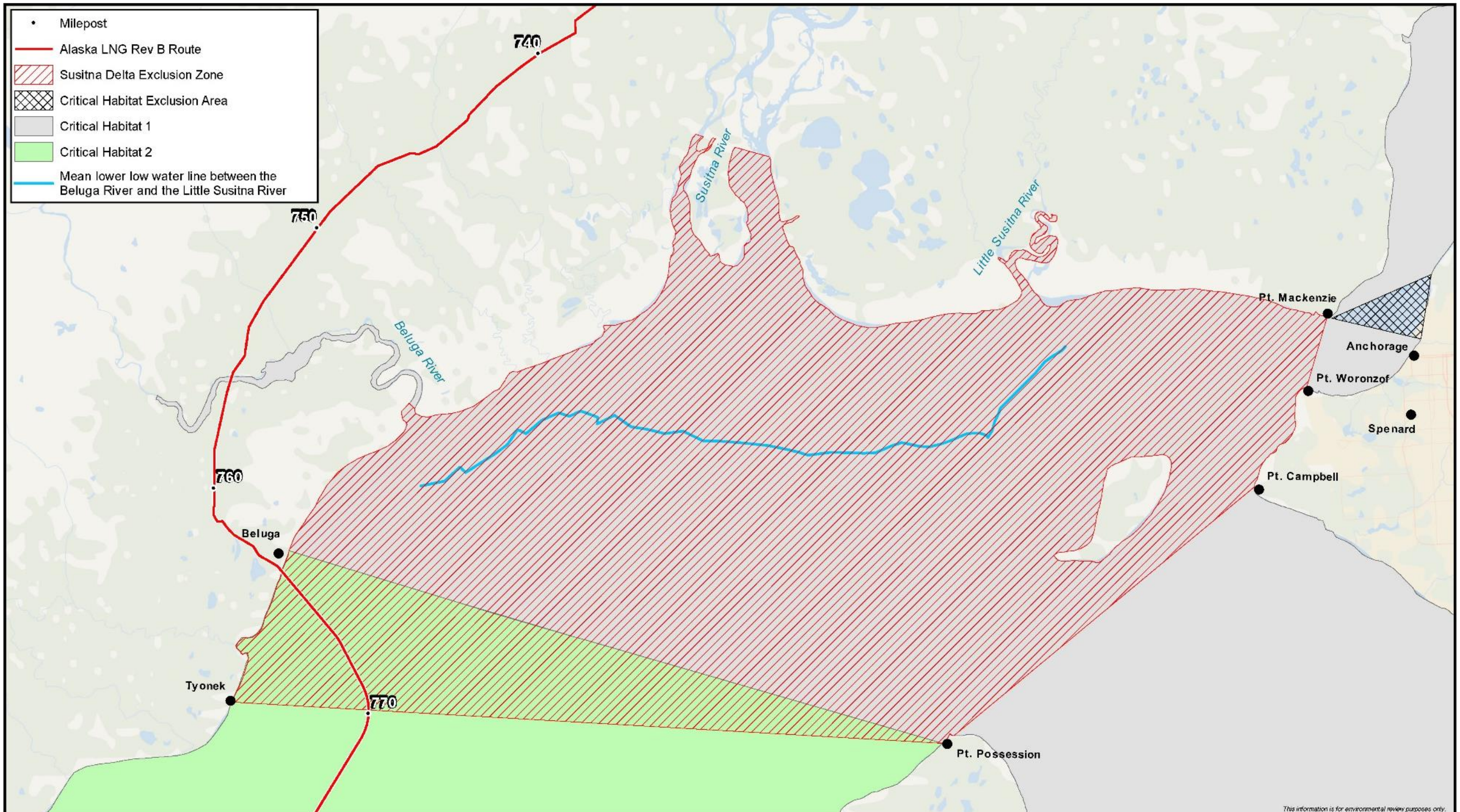


Figure 7.4.1-3
Alaska LNG Project
Beluga Critical Habitat Areas

REVISED: 03/16/2018 | SCALE: 1:200,000 when printed at 11x17

DRAWN BY: MBG

Cook Inlet beluga whales occur in Cook Inlet year-round. Although beluga whales may be found throughout Cook Inlet at any time of year, they generally spend the ice-free months in Upper Cook Inlet and expand their distribution south and into more offshore waters of Upper Cook Inlet in winter. These seasonal movements appear to be related to changes in the physical environment from sea ice and currents, to shifts in prey resources (NMFS, 2016a). Shallow water habitats in Upper Cook Inlet may be important for calving because they provide warmer water for newborn calves and refuge from killer whale predation. Specific calving areas in Cook Inlet have not been identified, although newborn calves have been observed in Upper Cook Inlet (Susitna River Delta, Knik Arm, Chickaloon Bay/Southeast Fire Island, and Turnagain Arm), as well as the lower Kenai River and delta (NMFS, 2008a). From the Beluga River to the Little Susitna River is a vital location for Cook Inlet beluga whales to give birth, nurse, and rear their young, as well as a significant area for feeding on eulachon and salmon runs during the summer months (NMFS, 2018b). Nearly the entire population of Cook Inlet beluga whales is found in the Susitna Delta area in June and July (NMFS, 2018c; McGuire et al., 2014). On the eastern side of Cook Inlet near the Kenai and Kasilof Rivers, Cook Inlet belugas are found in small groups during the spring and fall fish runs (NMFS, 2018c).

Threats to Cook Inlet beluga whales include strandings, predation by killer whales, human-induced disturbances including noise and ship strikes, pollutants, climate change, and physical habitat modifications from development. The population is decreasing (Muto et al., 2016).

Cook Inlet beluga whales are most likely to be encountered by vessel traffic in Cook Inlet, and during construction and operational activities of the Mainline Facilities and Liquefaction Facilities.

7.4.2 Effects Analysis

7.4.2.1 Habitat Loss or Degradation

Project-related activities could cause permanent habitat loss from installation of in-water structures, and temporary foraging loss due to dredging activities and temporary facilities. The Marine Terminal PLF, Mainline MOF, and Mainline Pipeline would cause permanent loss of habitat; the Mainline MOF, Mainline, Marine Terminal PLF, Marine Terminal MOF, and dredging would cause temporary loss of habitat for Cook Inlet beluga whales in Cook Inlet (see table 7.4.2-1). Permanent structures, such as the Mainline MOF, Marine Terminal, and PLF could affect flows and habitat characteristics which would make the habitat unsuitable for Cook Inlet beluga whales to use for feeding, resting, or reproduction (NMFS, 2016a). Cook Inlet beluga whales may avoid the area immediately around the Marine Terminal Facilities due to the additional disturbance from vessel traffic and human presence during construction and operation. The Mainline MOF would be left in place after use by this Project, and could continue to be used. These habitats could become unsuitable for Cook Inlet beluga whales due to habitat loss and noise from human activity, and would not likely be used by Cook Inlet beluga whales for feeding, resting, or reproduction.

TABLE 7.4.2-1 **Cook Inlet Beluga Whale Critical Habitat Affected**		
Facility	Temporary (Construction) Impacts (acres)	Permanent Impacts (acres)
Mainline MOF	6	6
Mainline Pipeline	5,070	330
Marine Terminal PLF	19	19
Marine Terminal MOF	30	<1
Dredging at Marine Terminal	51	N/A
Dredged Material Disposal	1,200	N/A
N/A = Not applicable		

7.4.2.2 Noise

Complete noise analysis calculation results using the NMFS Technical Guidance and airborne noise guidance are included in appendix L-1 of the EIS. Summaries of Level A and B harassment areas are provided in tables 6.5.2-2 and 6.5.2-3.

Underwater Noise

Project-related vessel traffic would indirectly affect Cook Inlet beluga whales through potential habitat degradation caused by increased shipping noise. The total number of vessel trips associated with Project construction and operation is provided in appendix L-2 of the EIS. Many reactions by marine mammals to ships or boats are presumably reactions to noise and often follow changes in engine and propeller speed (Richardson et al., 1995).

Cook Inlet is a noisy acoustic environment with anthropogenic noise sources such as vessels, oil platform activities, and aircraft overflights, as well as natural noise sources such as bottom substrate transport by high currents from large tidal fluxes (Blackwell and Greene, 2003). Based on captive studies, Cook Inlet beluga whales typically hear best at frequencies between 10 and 100 kilohertz; most industrial activities occur at lower frequencies (Norman, 2011). Cook Inlet beluga whales are typically found in areas in Cook Inlet with the lowest ambient noise levels; e.g., the mouth of the Susitna River and east Knik Arm near Birchwood (Norman, 2011).

During Project operation, LNG carriers are expected to visit the Marine Terminal year-round. Some vessels may generate noise that has potential to cause level B harassment of marine mammals. Vessel noise could cause Cook Inlet beluga whales to avoid the area near the transiting vessel. Noise sources on vessels include propeller cavitation, thrusters, engines, and depth sounders. Of these sources, SPLs associated with LNG carriers docking at the PLF could exceed threshold values for injury or harassment of Cook Inlet beluga whales. The onset of thruster noise is generally sudden and can cause a startle reaction in nearby marine mammals. Vessel use during Liquefaction Facilities construction, at the Mainline MOF, and during pipeline construction at the Marine Terminal MOF could generate noise at levels that would disturb Cook Inlet beluga whales. Anchor handling vessels during Mainline Pipeline pipelay could cause level B harassment to Cook Inlet beluga whales within 1.3 miles. Use of PSOs to monitor when marine mammals enter the Level B harassment zone would not be possible under low light conditions. Therefore, if activities occur during low lighting or inclement weather, some Cook Inlet beluga whales could be exposed to Level B harassment. Anthropogenic noise may also indirectly affect the survival and reproductive success of Cook Inlet beluga whales by having a negative effect on their prey.

Pipeline and materials would be transported to various ports in Alaska. Tug and barge combinations would be used to transport pipeline to the Mainline MOF during the open water period in Upper Cook Inlet. Most noise and disturbance associated with this traffic would occur during docking from tug propellers and thrusters and from anchor handling tugs during Mainline Pipeline installation on the Cook Inlet seafloor. Transiting vessel impacts would be similar to those described for the Pacific walrus.

Impact and vibratory pile driving would occur for Mainline MOF construction. Impact pile driving would also occur for Marine Terminal MOF and PLF construction. Removal of the Marine Terminal MOF piles would occur with a vibratory hammer (see tables 6.5.2-2 and 6.5.2-3, and appendix L-1 of the EIS). Pile driving, for installation, would occur between April and August. Pile driving at the Marine Terminal MOF and PLF would occur in the ice-free window over a 3-year period; both impact and continuous vibratory pile drivers are planned for use. Cook Inlet beluga whales would be present during pile driving for the Mainline MOF, Marine Terminal MOF, and PLF. About half the pile driving for the Mainline MOF would occur when the tide is out, minimizing underwater noise impacts on Cook Inlet beluga whales for that portion of the sheet piling. The remaining pile driving for the Mainline MOF would be accomplished using vibratory and impact hammer techniques. Pile driving would cause Level A harassment (injury) to Cook Inlet beluga whales that are at the source of the noise and up to 443 feet (see table 6.5.2-2). Pile driving would cause Level B harassment (disturbance) to Cook Inlet beluga whales between 0.6 mile and 13.4 miles from the activity, depending on pile type (see table 6.5.2-3). Implementation of FERC's recommendation to avoid pile driving during the months of June and July would minimize impacts on Cook Inlet beluga whales near the Susitna Delta from noise generated during these activities (see sections 4.6.3.2 and 4.8.1.3).

Shoreline trenches for the Mainline Pipeline in Cook Inlet would be dug by amphibious or barge-based excavators to a depth where a dredge vessel would then be used to complete the trenching. A backhoe dredge or trailing suction hopper dredge could also be used depending on conditions. These vessels would generate continuous and intermittent noise levels. If alternative dredging or burial techniques (such as plowing or jetting) are determined necessary after geotechnical investigations, AGDC would conduct a noise analysis for these methods. Cook Inlet beluga whales would occur in Cook Inlet during Mainline Pipeline installation. Excavation for the Mainline Pipeline would cause Level B harassment (disturbance) from 140 feet to 1.9 miles from the activity (depending on equipment used) for Cook Inlet beluga whales (see table 6.5.2-3). If DMT should be used in place of trenching at the shoreline, these activities would generate Level B harassment (disturbance) 183 feet from the equipment.

Before conducting pipeline construction and dredging in Cook Inlet, AGDC would conduct detailed geophysical surveys using single and multibeam echosounders and side scan sonar to determine the bathymetry of the seafloor. Some of these instruments can generate noise at levels that could affect marine mammals (greater than 200 kilohertz). Typically, single beam echosounders operate at frequencies of 3.5 to 750 kilohertz (which have a range that can affect marine mammals), and multibeam echosounders operate at frequencies of 200 to 400 kilohertz (which are not detectable by marine mammals). Echosounders used for geophysical surveys could produce noise that would reach Level B harassment for marine mammals near the activity.[7]

Dredging would occur for 4 years at the Marine Terminal MOF in Cook Inlet; both excavator or clamshell mechanical dredge or hydraulic (cutterhead) or mechanical dredgers would be used. Dredging could generate noise levels above thresholds established by NMFS (see table 6.5.2-3 and appendix L-1 of the EIS). Dredging during the open water season would occur in Cook Inlet beluga whale habitat, and Level B disturbance would occur within 140 to 450 feet of the dredging activity.

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[7] Noise levels would be dependent on vessel speeds and type of equipment used.

Airborne Noise

Cook Inlet beluga whales spend a considerable amount of time at the surface (Goetz et al., 2012b). Activities that could cause airborne noise levels above disturbance thresholds include pile driving, some construction equipment, and aircraft overflights (see table 6.5.2-4). Airborne sounds over water may affect Cook Inlet beluga whales at the surface. These noises could cause startle reactions, or cause individual whales to avoid or move away from the areas where the noise is generated.

Airborne noise generated during pile driving would be unlikely to rise to Level B harassment levels for Cook Inlet beluga whales unless the animal is immediately adjacent to the activity. Cook Inlet beluga whales would be anticipated to avoid pile driving activities and thereby not be exposed to Level B disturbance e. Airborne noise generated during general construction activities on land would reach NMFS disturbance levels within 0.2 mile of the activity. No blasting is planned near the Cook Inlet coast for the Mainline Pipeline or Liquefaction Facilities; therefore, no blasting impacts on Cook Inlet beluga whales would be expected. Noise from operation of the Liquefaction Facilities would not be expected to reach harmful levels for marine mammals.

Most air traffic to support Liquefaction Facilities construction would be for transporting Project personnel to the Kenai Municipal Airport and Ted Stevens Anchorage International Airport. Helicopters would be used for a limited time during construction of a portion of the LNG tank roofs at the Liquefaction Facilities.

Project-related air traffic would use airstrips in Kenai and Beluga near Cook Inlet beluga whale habitat. Additional aircraft traffic would likely occur due to Project-related activities over Cook Inlet, and would cause additional disturbance to Cook Inlet beluga whales in Cook Inlet. Pipeline inspections during operation would typically be conducted by aircraft, which could also disturb Cook Inlet beluga whales in Cook Inlet. Pipeline surveillance overflights for routine pipeline inspections are estimated at 26 flights (helicopter or fixed wing) per year, but would maintain a minimum flight altitude of 1,500 feet over Cook Inlet. At that altitude, received sound levels at the water surface would be below the NMFS threshold value of 120 dB (Nowacek et al., 2007) for continuous sound sources and would result in a minor disturbance of marine mammals.

Helipads would be installed for use at construction camps during Mainline Pipeline construction. Kenai Peninsula helipads may have helicopter traffic for construction and operation that could disturb Cook Inlet beluga whales if in the vicinity during flights. Helipads are planned at Mainline Pipeline MLVs 27, 28, and 29 and at the LNG Plant on the Kenai Peninsula, which would be about 700, 1,500, 800, and 5,000 feet, respectively, from the Cook Inlet shoreline. These helipads would be installed during construction and used during operation to support Mainline Pipeline operation and maintenance. During construction, there would be a peak of six helicopter trips per day at construction camps, averaging three per day.

Aircraft would generate noise that would cause disturbance for Cook Inlet beluga whales within about 80 feet; landing pads or airstrips would not occur that close to the coast. While small airplanes and helicopters used for the Project may not generate noise levels that reach NMFS disturbance levels, research has shown that Cook Inlet beluga whales are affected by aircraft overflights. Noise and visual stimuli from aircraft (helicopter and airplane) overflights have the potential to disturb Cook Inlet beluga whales. Marine mammals disturbed by aircraft typically will surface for shorter periods, dive, swim, or turn away from the noise or sight, or breach (Patenaude et al., 2002). Cetacean reactions to overflights would consist of brief behavioral responses, such as sudden diving or turning away from the sound or visual source, or no response (Nowacek et al., 2007). Helicopters tend to be more disturbing than fixed-wing aircraft (Luksenburg and Parsons, 2009; Born et al., 1999). Cook Inlet beluga whales will often dive for longer periods or swim away from aircraft noise, but are generally less disturbed by aircraft when feeding (Norman, 2011). Cook

Inlet beluga whales are commonly observed in waters near the International Airport or Elmendorf Air Force Base; it is unknown if the whales tolerate the noise disturbances due to the food resources in the area (Norman, 2011).

7.4.2.3 Vessel Strikes

Vessels may collide with marine mammals, resulting in injury or death. Whale mortalities are usually caused by blunt force trauma from striking the ship bow, or by lethal wounding from propeller cuts. Vessel speed is the primary factor in the probability of a vessel strike and of the strike being lethal (Vanderlaan and Taggart, 2007). The percent of lethal whale strikes is significantly reduced by vessels traveling at less than 12 knots (13.8 miles per hour) (Vanderlaan and Taggart, 2007).

Vessels travelling through Cook Inlet could strike Cook Inlet beluga whales. The total number of vessel trips, vessel types, and typical speeds associated with Project construction and operation is provided in appendix L-2 of the EIS; about 1,243 vessel round trips would occur during construction to Cook Inlet and up to 10, 921 vessel round trips would occur during operations to Cook Inlet. A variety of vessels would be in use for different phases of construction and operation. Vessel transit speeds vary from less than 10 knots to up to 26 knots. Using available data on vessel strikes on whales (Jensen and Silber, 2003; Neilson et al., 2012; International Whaling Commission [IWC], 2014) and current vessel traffic in Alaska (Eley, 2006), we calculated the potential vessel strike risk associated with all species that had available data. These data indicate large and fast moving vessels (greater than 12 knots) are most typically associated with whale strikes. In the NMFS database, fin whales were identified as the most frequently reported species involved in vessel collisions, followed by humpback whales. Larger whales are more likely to be reported when struck, and smaller whales such as humpback whales may not be reported due to their smaller size not registering a change in vessel speed or damage to the vessel. Many ship strikes likely go unreported or under-reported if they occur in remote areas or are with smaller whales that that are not detected as a strike (Jensen and Silber, 2003).

In Alaskan waters, between 1978 and 2011, 108 whale-vessel collision were reported, with 25 known to result in the whale's death (Nielson et al., 2012). Most strikes were on humpback whales, but strikes were also reported on fin whales, gray whales, sperm whales, Cuvier's beaked whales, Stejneger's beaked whales, and beluga whales. NMFS recommends speed restrictions between 10 and 13 knots in waters with large whales to reduce ship strikes (NOAA, n.d.). For purposes of this analysis, vessels traveling faster than 10 knots were included. A summary of projected vessel strikes is provided in table 7.2.2-1.

In 2002 in Knik Arm, there was one confirmed vessel strike on a Cook Inlet beluga whale (Nielson et al., 2012; IWC, 2014). During construction and operation, 0.04 and 0.23 Cook Inlet beluga whale could be struck by vessels, respectively (this does not include pipelay activities for the Mainline Pipeline). Over the life of the Project, 0.26 Cook Inlet beluga whale would likely be struck, causing injury or death to that individual.

7.4.2.4 Turbidity/Prey Impacts

Pile driving at the Marine Terminal and Mainline MOF would result in a temporary increase in turbidity. Construction activities for the Liquefaction Facilities' Marine Terminal and the two MOFs (Mainline and Marine Terminal) in Cook Inlet would result in permanent and temporary alteration and destruction of prey habitat from placement of structures on the bottom of Cook Inlet, dredging and dredged material disposal, and shading from permanent overwater structures. Direct impacts from construction excavation in Cook Inlet would include temporary and permanent loss of benthic prey habitat. There would be about 356 acres of prey habitat permanently lost under the Mainline Pipeline, Marine Terminal and

Mainline MOFs, the PLF, and shoreline protection; and about 100 acres of prey habitat temporarily affected from anchor drop scars across the Cook Inlet seafloor and from dredging. Cook Inlet beluga whales typically are found in deeper waters in central Cook Inlet and/or near the ice edge in the winter months where dredging and dredged material disposal activities would occur (NMFS, 2016a). Construction and removal of the MOF would disturb benthic habitats and cause a temporary increase in turbidity near the site. Upon removal of the Marine Terminal MOF, the disturbed shoreline could erode due to the active nature of Cook Inlet and the large tidal range and vessel wake activity, causing a loss of fish habitat.

Cook Inlet beluga whales concentrate near mouths of anadromous rivers in summer to feed (NMFS, 2016a). Figures 7.4.2-1 and 7.4.2-2 show the seasonal concentrations and distribution of Cook Inlet beluga whales. Impacts on habitat near anadromous river mouths, such as for the Mainline MOF, could affect the ability of Cook Inlet beluga whales to find prey in locations they normally visit in the summer.

In-stream activities could have both direct and indirect effects on fish species and their habitats, including increased sedimentation and turbidity, alteration or removal of aquatic habitat cover, streambank erosion, impingement or entrainment of fish and other biota associated with the use of water pumps, downstream scouring, and the potential for spills. The fish community of Upper Cook Inlet is characterized largely by migratory fish—eulachon (*Thaleichthys pacificus*), capelin (*Mallotus villosus*), and Pacific salmon—which are primary prey species for Cook Inlet beluga whales. Construction activities along the shoreline for the Liquefaction Facilities' Marine Terminal Facilities and the two MOFs would occur in spring and summer, during birthing and feeding times for Cook Inlet beluga whales. In particular, activities at the Mainline MOF would interfere with Cook Inlet beluga whales' ability to access food resources in the Susitna Exclusion Zone.

7.4.2.5 Spills

Impacts from spills on Cook Inlet beluga whales, would be similar to those described for blue whales in section 7.2.2.3.

7.4.2.6 Critical Habitat

The Mainline, Mainline MOF, Marine Terminal, PLF, Marine Terminal MOF, dredging for the Marine Terminal, and dredged material disposal sites are in Critical Habitat Area 2. From the Beluga River to the Little Susitna River is a sensitive area within critical habitat (as described above) where NMFS recommends avoiding activities in this area, which is considered an "exclusion zone" from April 15 through October 15, due to its importance for feeding adults and young (see figure 7.4.1-3).

Project facilities would be placed within "intertidal and subtidal waters of Cook Inlet with depths less than 30 feet (9.1 meters) MLLW and within 5 miles (8 kilometers) of high and medium flow anadromous fish streams" (PCE 1). The Mainline Pipeline would be trenched in at the shoreline to a depth of -35 to -45 feet MLLW, and would be within 5 miles of six Anadromous Waters Catalog streams that flow into Cook Inlet on the western side of the inlet. There are no Anadromous Waters Catalog waters on the eastern side of Cook Inlet, within 10 miles of the Mainline or Marine Terminal Facilities (Johnson and Blossom, 2017a,b,c). The Mainline Pipeline and Mainline MOF would contribute to 5,070 acres of temporary habitat loss and 336 acres of permanent critical habitat loss (the Mainline MOF would be left in place after use, so it is considered a permanent impact). Only 6 acres of critical habitat lost permanently on the west side of Cook Inlet would meet the criteria of PCE 1. The Marine Terminal (PLF, Marine Terminal MOF, and dredging) would contribute to 100 acres of temporary critical habitat loss and 19 acres of permanent critical habitat loss. Twenty acres of critical habitat lost permanently on the east side of Cook Inlet would meet the criteria of PCE 1.

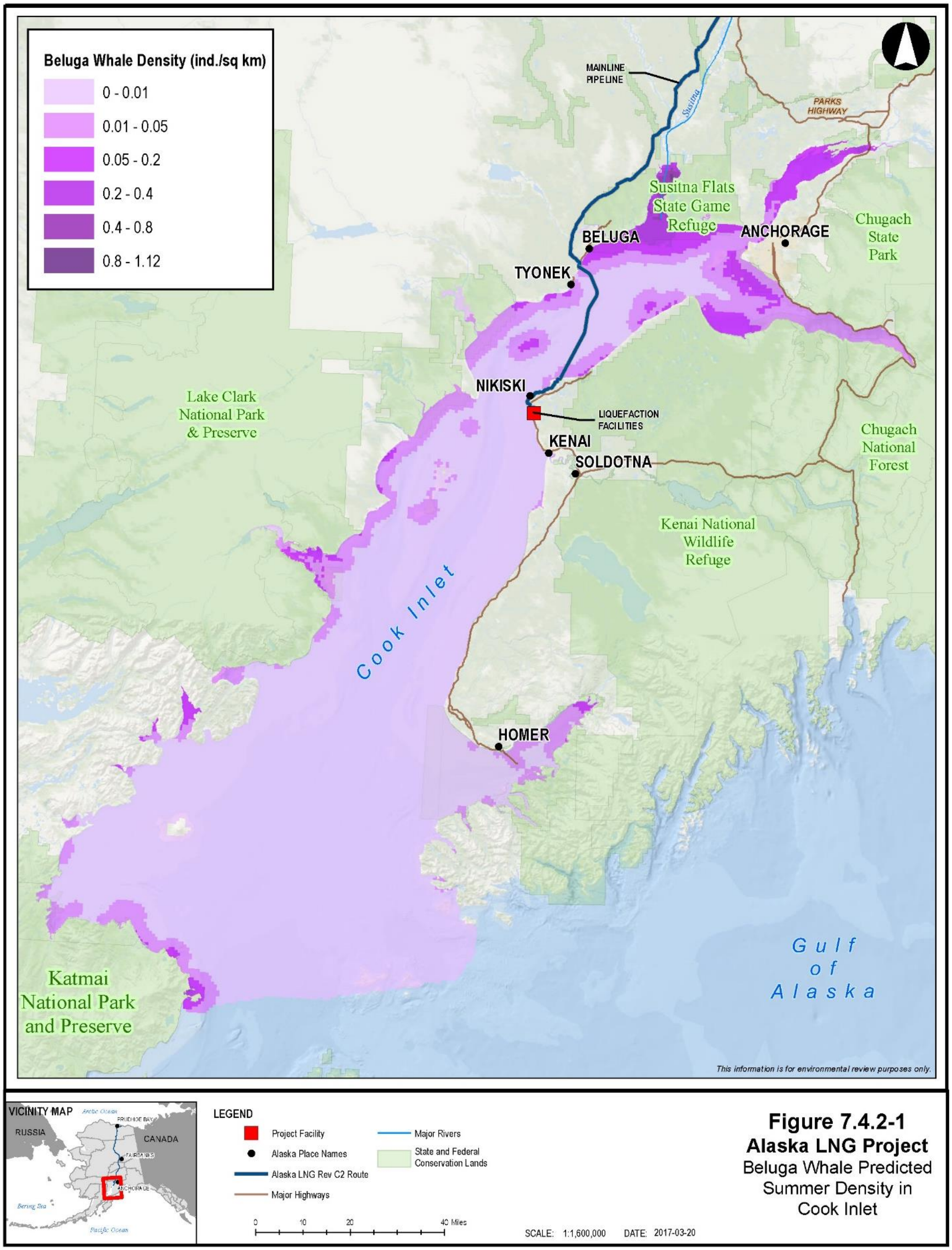


Figure 7.4.2-1
Alaska LNG Project
Beluga Whale Predicted Summer Density in Cook Inlet

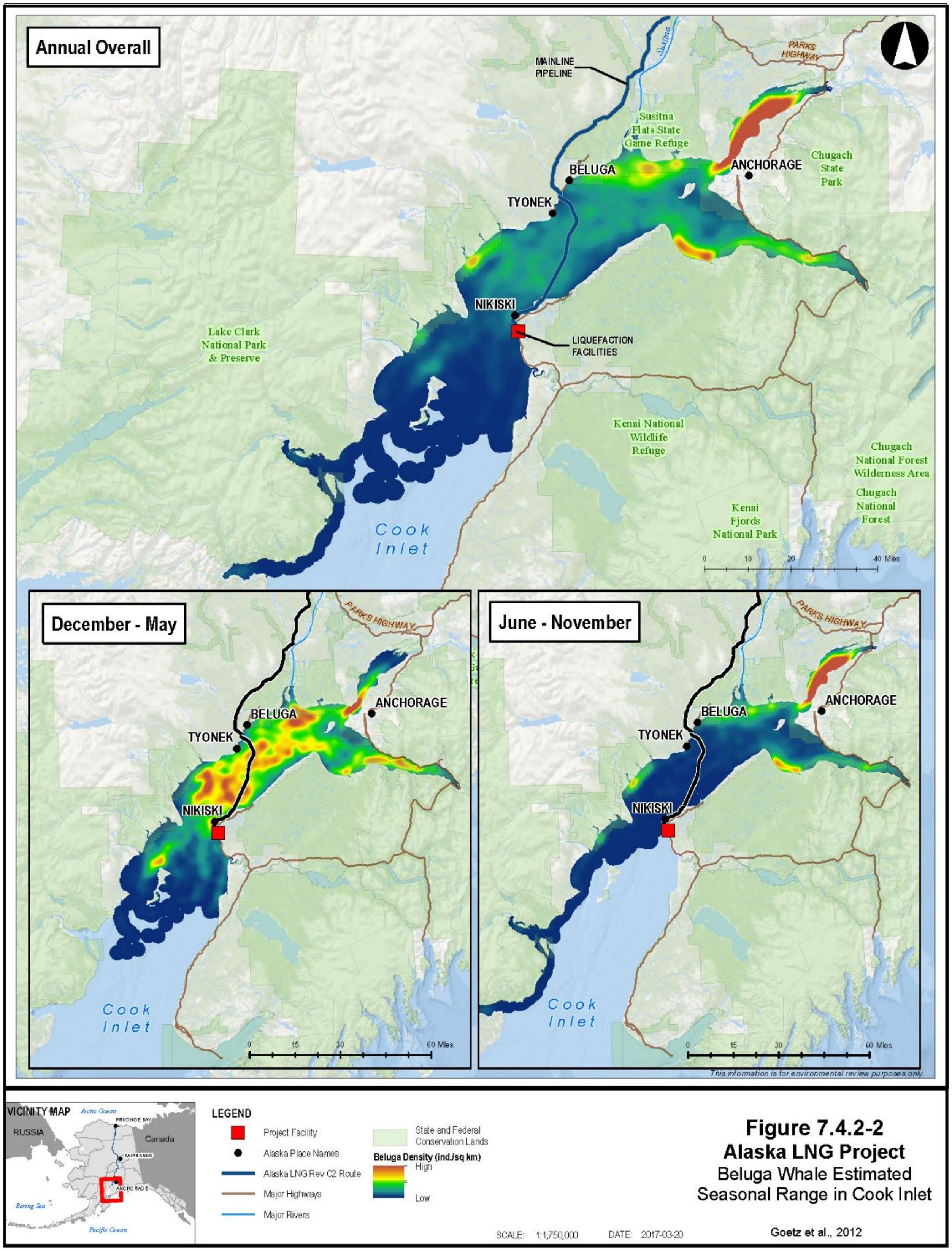


Figure 7.4.2-2
Alaska LNG Project
Beluga Whale Estimated Seasonal Range in Cook Inlet

Construction and operation of Project facilities would affect prey resources for Cook Inlet beluga whales as described above. Impacts on PCE 2 for "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" would be temporary during construction, but these prey species may avoid the area around the Mainline MOF during construction, and shading from the facility may alter the habitat for these prey species permanently.

As described above, spills of fuels and other contaminants would be unlikely and would be minimized with the implementation of the Project SPCC Plan, the SWPPP, and oil spill response plans. Impacts on PCE 3 for "waters free of toxins or other agents of a type and amount harmful to Cook Inlet beluga whales" are not expected to be significant.

Placement of the Mainline Pipeline across Cook Inlet would likely take about 17 months and be conducted during the summer ice-free season (typically May through October). Construction equipment working across Cook Inlet may interfere temporarily with Cook Inlet beluga whale's ability to move between critical habitat areas, affecting PCE 4 for "unrestricted passage within or between the critical habitat areas." In addition, construction of and use of the Mainline MOF in the Susitna Exclusion Zone could interfere with Cook Inlet beluga whale movements along the coast for feeding. In the summer, Cook Inlet belugas would have young with them, as they feed on the anadromous fish that are moving into freshwater rivers from Cook Inlet.

As described above, vessels, pile driving, excavation activities, anchor handling, and dredging would generate underwater noise levels that would reach Level A harassment (injury) and/or Level B harassment (disturbance) of Cook Inlet beluga whales. These anthropogenic noises could interfere with Cook Inlet beluga whales' ability to communicate, migrate, find prey, and avoid predators (such as killer whales). Generation of underwater noise, temporarily, during construction would affect PCE 5 for "waters with in-water noise below levels resulting in the abandonment of critical habitat areas by Cook Inlet beluga whales." These noise sources would be temporary, but would occur over five summer seasons (see tables 6.5.2-2 and 6.5.2-3, and appendix L-1 of the EIS). The Mainline MOF would be left in place, potentially making the habitat in the vicinity unsuitable for Cook Inlet beluga whales.

7.4.2.7 Cumulative Impacts

As provided in appendix X-1 and referenced in section 4.19.3 of the EIS, the following projects would overlap with Cook Inlet beluga whale occupied habitat in Cook Inlet and designated critical habitat:

- the Cook Inlet Gas Gathering System (CIGGS) Marine Pipeline Conversion;
- the Cook Inlet Area Oil and Gas Development; including the
  - Hilcorp Alaska exploration and development in Cook Inlet; and
  - Harvest Alaska exploration and development in Cook Inlet; and
- the Kenai LNG Plant.

Activities that may be associated with these projects that could cumulatively increase effects on Cook Inlet beluga whales include:

- noise from dredging, exploratory drilling, and other underwater noise generating activities;
- habitat loss or alteration from construction activities in Cook Inlet;
- vessel traffic causing an increased risk of strikes and increases in underwater noise; and
- increases in aircraft overflight disturbances.

Any of the above projects occurring within Cook Inlet could contribute to impacts on Cook Inlet beluga whales and critical habitat. Permanent losses of critical habitat for the whale from the Alaska LNG Project, combined with the CIGGS and other development activities, could be significant for important habitat near the Beluga River and Susitna Rivers. Increased noise from vessels, aircraft overflights, and underwater activities could contribute to cumulative impacts on Cook Inlet beluga whales. In addition, the Alaska LNG Project would increase vessel traffic in Cook Inlet by up to 74 percent over existing levels, so the additional vessel traffic associated with the above projects, in particular additional LNG carriers for the Kenai LNG Plant could lead to increases in vessel strikes on Cook Inlet beluga whales. All of Cook Inlet is designated critical habitat for the Cook Inlet beluga whale, except the exclusion area near the Port of Anchorage; cumulative impacts on critical habitat in Cook Inlet could be significant if large amounts of critical habitat no longer meet the PCEs described above due to development in these areas. Cook Inlet beluga whales already receive multiple stressors in their environment, and adding to those stressors would increase the threats to the species (NMFS, 2016a). NMFS has identified cumulative effects as a threat of high relative concern for the recovery of Cook Inlet beluga whales (NMFS, 2016a). The effect of multiple activities in critical habitat could reduce the ability of critical habitat to support Cook Inlet beluga whales. Available data suggests cumulative effects could be impeding recovery of the species (NMFS, 2016a). With the projects listed above, increased noise from seismic testing, pile driving, and vessel traffic could have a significant impact on Cook Inlet beluga whales if these activities occur concurrently and repeatedly over multiple seasons.

7.4.3 Determination of Effect

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

- construction and operational activities would occur in occupied Cook Inlet beluga whale habitats;
- the Project would increase the risk of vessel strikes on Cook Inlet beluga whales; and
- there is potential for disturbance from Project-related vessel and aircraft through occupied habitat.

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

- the Project would result in underwater noise that reached Level A and Level B harassment of Cook Inlet beluga whales;
- the Project would permanently affect Cook Inlet beluga whale habitat; and
- the Project would likely result in vessel strikes.

The Project **may affect** Cook Inlet beluga whale critical habitat because:

- permanent facilities would be placed in, and near, critical habitat; and
- the Project would cause temporary disturbances to critical habitat.

The Project is **likely to adversely affect** critical habitat because:

- permanent loss of critical habitat would occur; and
- Project activities in Cook Inlet and anadromous streams could negatively affect beluga whales and their prey.

7.5 FIN WHALE

7.5.1 Species Description and Potential Presence in the Action Area

Fin whales were listed as endangered in 1970. Critical habitat has not been designated for the fin whale. The Northeast Pacific stock occurs in Alaskan waters near the Project. Fin whales are the second-largest species of whale and are fast swimmers (NMFS, 2017a). Fin whales are 75 feet long in the northern hemisphere (females are slightly longer than males) and weigh more than 80,000 pounds (NMFS, 2017a). They are a migratory species and typically travel in groups of 6 to 10 animals in deep offshore waters (ADF&G, 2018; NMFS, 2017a). Males are sexually mature at 6 to 10 years of age, and females at 7 to 12 years (NMFS, 2017a). Females give birth to one calf every 2 to 3 years in tropical and subtropical areas in the winter (NMFS, 2017a; ADF&G, 2018). Fin whales form social groups of two to seven individuals and feed in large groups with other whales and dolphins (NMFS, 2017a). They are baleen whales foraging on krill, squid, and small schooling fish, but they fast during winter migrations (NMFS, 2017a). The Gulf of Alaska, along the Aleutian Islands, the Bering Sea, and the Chukchi Sea are used as summer feeding grounds (ADF&G, 2018) (see figure 7.5.1-1).

A fin whale BIA for feeding occurs at the mouth of Cook Inlet in the Gulf of Alaska as shown on figure 7.5.1-1. This area is used by fin whales from June through August (NMFS, 2017c). A second BIA for fin whales occurs in the Bering Sea. Fin whales use this area for feeding from June through September (NMFS, 2017c).

Threats to fin whales in Alaska include ship strikes and commercial fishing gear entanglement (Muto et al., 2016). The current fin whale minimum population estimate and population trend in Alaska are unknown (Muto et al., 2016; 2018). Fin whales may occur in vessel traffic routes in the Gulf of Alaska, Bering Sea, and Chukchi Sea during summer months.

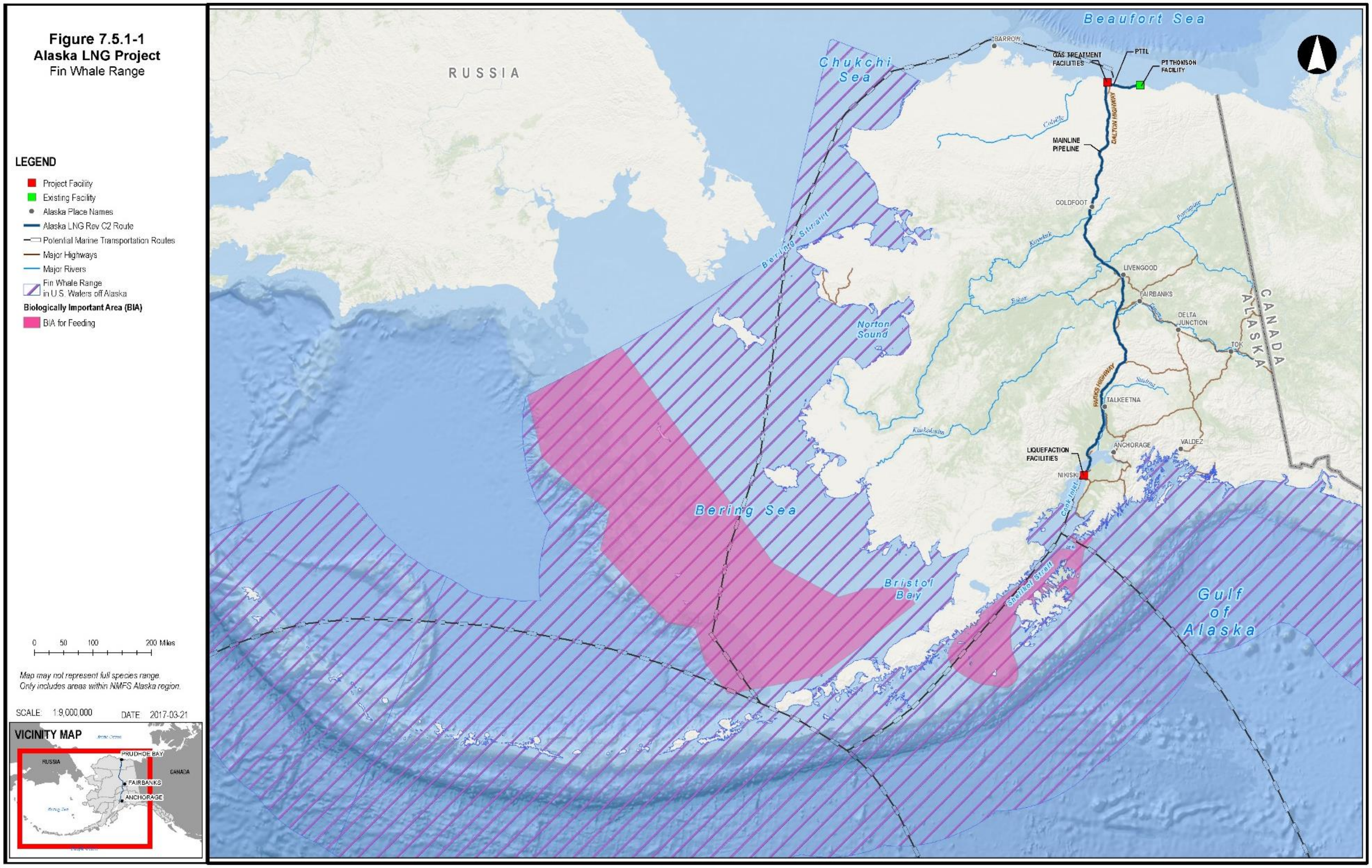


Figure 7.5.1-1
Alaska LNG Project
Fin Whale Range

7.5.2 Effects Analysis

7.5.2.1 Noise

Noise impacts from transiting vessels would be similar for fin whales as described above for blue whales. Pipeline and materials would be transported to various ports in Alaska. Tug and barge combinations would be used to transport pipeline to the Mainline MOF during the open water period in Upper Cook Inlet and would transit through the BIA where vessels could affect feeding fin whales. Material deliveries to West Dock with vessels would generate noise that could disturb marine mammals along vessel transit routes, which pass through the BIA for feeding fin whales in the Bering Sea and while vessels are staged at the PBOSA. Vessels are expected to transit during periods of open ice in the summer months. Due to the ephemeral nature of vessels in transit, vessel noise impacts are expected to be minor from vessels transiting to and from Project facilities in Prudhoe Bay and Cook Inlet during construction and operation.

7.5.2.2 Vessel Strikes

Vessels may collide with fin whales, resulting in injury or death. Whale mortalities are usually caused by blunt force trauma from striking the ship bow, or by lethal wounding from propeller cuts. Vessel speed is the primary factor in the probability of a vessel strike and of the strike being lethal (Vanderlaan and Taggart, 2007). The percent of lethal whale strikes is significantly reduced by vessels traveling at less than 12 knots (13.8 miles per hour) (Vanderlaan and Taggart, 2007).

Vessels travelling through the Gulf of Alaska to Cook Inlet and the Bering, Beaufort, Chukchi, and Bering Seas *en route* to the GTP/West Dock during construction could strike fin whales. Risks of vessel strikes would be higher in BIAs, where fin whales concentrate to feed. The total number of vessel trips, vessel types, and typical speeds associated with Project construction and operation is provided in appendix L-2 of the EIS; up to 186 vessel round trips could be made to West Dock during construction over 6 years and about 1,243 vessel round trips would occur during construction to Cook Inlet and up to 10, 921 vessel round trips would occur during operations to Cook Inlet. A variety of vessels would be in use for different phases of construction and operation. Vessel transit speeds vary from less than 10 knots up to 26 knots. A summary of projected vessel strikes is included in table 7.2.2-1, and calculations are described in section 7.4.2.3. In Alaskan waters, there have been 4 confirmed vessel strikes on fin whales between 2000 and 2010 (Nielson et al., 2012; IWC, 2014). During construction and operation, 0.14 and 0.91 fin whale could be struck by vessels, respectively. Over the life of the project, 1.05 fin whales would likely be struck, causing injury or death to that individual.

7.5.2.3 Spills

Impacts from spills on fin whales would be similar to those described for blue whales and bowhead whales in sections 7.2.2.3 and 7.3.2.3, respectively.

7.5.3 Determination of Effect

The Project **may affect** fin whales because:

- construction and operational vessels would transit through fin whale habitat.

The Project is **not likely to adversely affect** fin whales because:

- the risk of potential strikes would be minimized with implementation of vessel traffic conservation measures.

7.6 GRAY WHALE, WESTERN NORTH PACIFIC DISTINCT POPULATION SEGMENT

7.6.1 Species Description and Potential Presence in the Action Area

Gray whales were listed as endangered in 1970. Critical habitat has not been designated for the gray whale. The two stocks of gray whale are the Eastern and Western North Pacific stocks, which may occur in Alaska (see figure 7.6.1-1). The Eastern North Pacific stock may occur in the Gulf of Alaska, Bering, Chukchi, and Beaufort Seas. In the spring and summer, they feed in the Chukchi, Beaufort, and northwestern Bering Seas. The estimated population of the Eastern North Pacific stock, based on 2010/2011 surveys, is 20,990 whales. The gray whale was historically a subsistence resource for Alaska Natives, but is not currently used (Allen and Angliss, 2014). The Western North Pacific DPS gray whales feed in the summer and fall off the coast of Russia and the eastern Bering Sea; however, some studies have shown tagged individuals along the western U.S. coast in winter and spring months (ADF&G, 2018; Weller et al., 2013). Due to the potential overlap with the Eastern North Pacific DPS in Alaska in winter and spring, the Western North Pacific DPS is treated as potentially occurring in the winter off the coast of Alaska (see figure 7.6.1-1).

Gray whales are slate gray in color with gray and white patches and have a dorsal hump instead of a dorsal fin, and short, gray, paddle-shaped flippers. Adult males are 45 to 46 feet long and weigh 30 to 40 tons; females are slightly larger (ADF&G, 2018). Gray whales are sexually mature at 5 to 11 years (i.e., when they reach 36 to 39 feet in length) (ADF&G, 2018). Females give birth in shallow lagoons and bays in January or February to a single calf every 2 or more years (ADF&G, 2018). Calves are 15 feet long and weigh 1,100 to 1,500 pounds at birth; they nurse for 7 to 8 months (ADF&G, 2018). Gray whales are baleen whales, feeding primarily by dredging through the mud and filtering out bottom-dwelling crustaceans (e.g., amphipods) (ADF&G, 2018). Gray whales live an average of 50 to 60 years (ADF&G, 2018). They often travel in groups of two to three in coastal shallow waters over the continental shelf (ADF&G, 2018).

From late February to May, gray whales migrate north through coastal waters of the Gulf of Alaska, Aleutian Islands, and Bering Sea to summer feeding grounds in the Bering, Chukchi, and Beaufort Seas (ADF&G, 2018). A small number of whales remain off the coast of Alaska near Kodiak Island to feed in summer months (Moore et al., 2007). A gray whale BIA for migration occurs at the mouth of Cook Inlet in the Gulf of Alaska. This area is used by gray whales traveling south from November through January and traveling north from March through May (NMFS, 2017c). An additional BIA occurs around the Alaska Peninsula where gray whales are known to feed from April through July, and where they migrate south from November through January and migrate north from March through May (NMFS, 2017c). A BIA for gray whale migration also occurs in the Bering Sea; gray whales use this area from June through December (NMFS, 2017c). A gray whale BIA for migration also occurs in the southern Chukchi Sea from June to October (NMFS, 2017c). A BIA for gray whales occurs in the Beaufort Sea between Point Lay and Point Barrow where vessels would transit (see figure 7.6.1-1). Gray whales use this area from June through October for feeding and reproduction (NMFS, 2017c).

Threats to gray whales in Alaska include ship strikes, pollutants, prey availability, and incidental catches in coastal fisheries (Muto et al., 2015). From 2002 to 2012, gray whale populations throughout the Western North Pacific Stock have increased (Muto et al., 2015). The current minimum population estimate for gray whales is 135 (Muto et al., 2015, 2017).

Gray whales may occur near West Dock in spring, summer, and fall; in vessel transit routes in the Beaufort and Bering Seas and the Gulf of Alaska in spring, summer, and fall; and near the PBOSA during spring and fall. Observations of gray whale were made near Cape Starichkof near the mouth of Cook Inlet during marine mammal monitoring for the Cosmopolitan State Project (NMFS, 2016c).

Figure 7.6.1-1
Alaska LNG Project
Gray Whale Range

LEGEND

- Project Facility
- Existing Facility
- Alaska Place Names
- Alaska LNG Rev C2 Route
- Potential Marine Transportation Routes
- Major Highways
- Major Rivers
- Gray Whale Range in U.S. Waters off Alaska

Biologically Important Area (BIA)

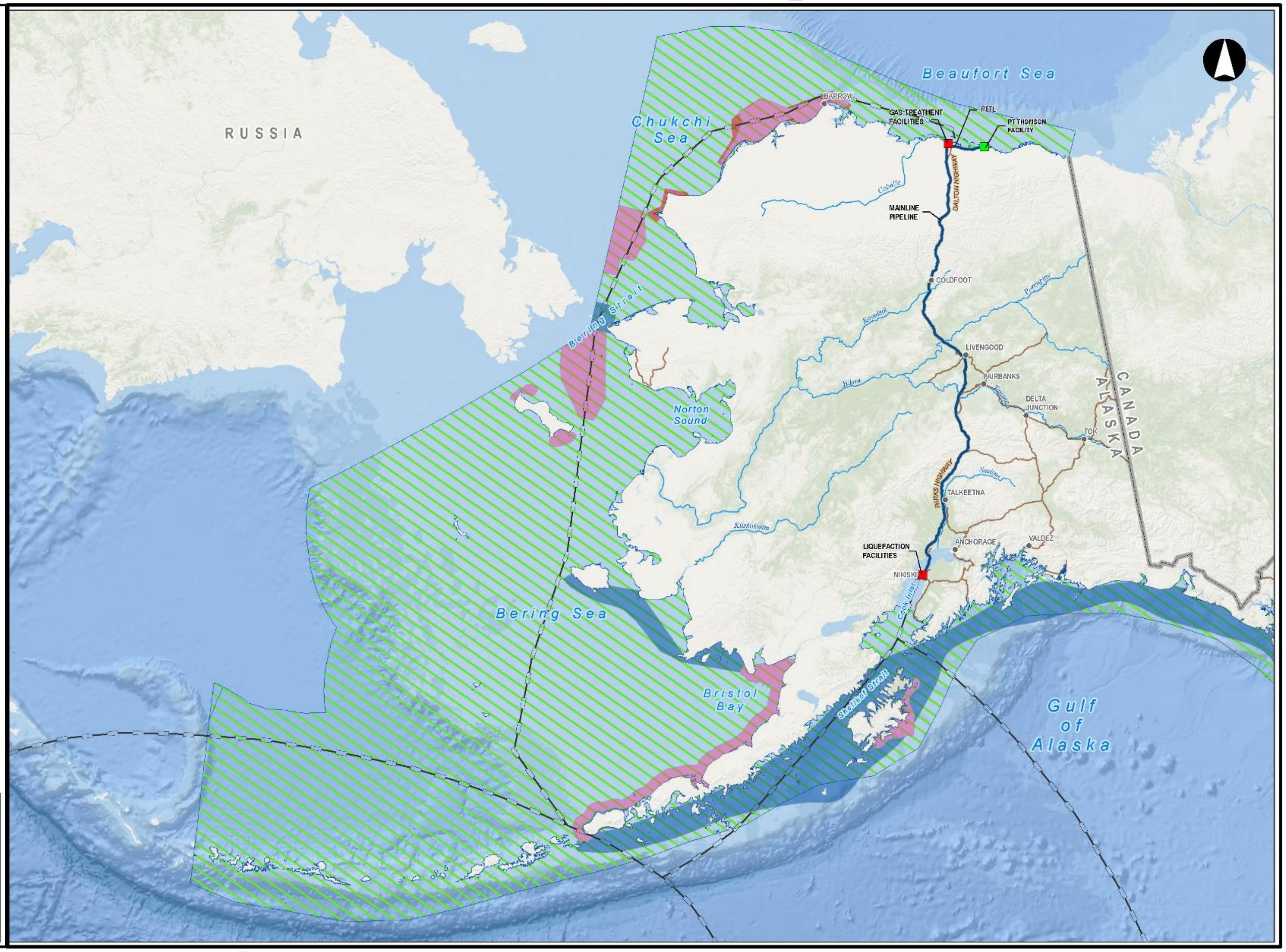
- Feeding
- Migration
- Reproduction

0 50 100 200 Miles

Map may not represent full species range. Only includes areas within NMFS Alaska region.

SCALE 1:9,000,000 DATE: 2017-03-21

VICINITY MAP



7.6.2 Effects Analysis

7.6.2.1 Noise

Noise impacts from transiting vessels would be similar for gray whales, as described for the Pacific walrus. Pipe and materials would be transported to various ports in Alaska. Tug and barge combinations would be used to transport pipeline to the Mainline MOF during the open water period in Upper Cook Inlet; these vessels would transit through the BIA for feeding and migration. Material deliveries to West Dock with vessels would generate noise that could disturb marine mammals along vessel transit routes and while staged at the PBOSA. Vessels are expected to transit during periods of open ice in the summer months. Gray whales would be migrating through the Bering, Chukchi, and Beaufort Seas where they could encounter vessel traffic and noise, in particular in the BIAs for feeding, migration, or reproduction. Vessels would arrive at West Dock during the ice-free season for 6 sealift seasons (see appendix L-2 of the EIS). Vessel noise could interfere with gray whales' ability to communicate during migration; however, due to the infrequent ship transits through migratory habitat, the impacts would not be significant. Due to the ephemeral nature of vessels in transit, vessel noise impacts are expected to be minor from vessels transiting to and from Project facilities in Prudhoe Bay and Cook Inlet during construction and operation.

Dock Head 4 construction would require installing piles (sheet piling), most of which would be placed using an impact hammer in summer, and installing four dolphins required for affixing the temporary barge bridge across the causeway (see appendix L-1 of the EIS). Dock Head 4 piles and sheet piles would be installed between June and August, when gray whales could be near West Dock. Gray whales within a 6.2-square mile area could receive Level B harassment from pile driving noise at West Dock (see table 6.5.2-3).

Screeding would occur at West Dock during summer months to accommodate vessels. Noise generated by screeding vessels and their activities could generate noise levels above thresholds established by NMFS (see table 6.5.2-3). Gray whales within 330 feet of screeding activities would be exposed to Level B disturbance. Use of PSOs to monitor and shut down activities when marine mammals enter the Level B harassment zone would not be possible under low light conditions; therefore, if activities occur during low lighting or inclement weather, some gray whales could be exposed to Level B harassment from screeding due to lack of visibility and the inability of the PSOs to implement shutdown procedures.

7.6.2.2 Vessel Strikes

Vessels may collide with gray whales, resulting in injury or death. Whale mortalities are usually caused by blunt force trauma from striking the ship bow, or by lethal wounding from propeller cuts. Vessel speed is the primary factor in the probability of a vessel strike and of the strike being lethal (Vanderlaan and Taggart, 2007). The percent of lethal whale strikes is significantly reduced by vessels traveling at less than 12 knots (13.8 miles per hour) (Vanderlaan and Taggart, 2007).

Vessels travelling through the Gulf of Alaska to Cook Inlet and the Bering, Beaufort, Chukchi, and Bering Seas *en route* to the GTP/West Dock during construction could strike gray whales. Risks of vessel strikes would be higher in BIAs, where gray whales concentrate for migration, feeding, or reproduction. The total number of vessel trips, vessel types, and typical speeds associated with Project construction and operation is provided in appendix L-2 of the EIS; up to 186 vessel round trips could be made to West Dock during construction over 6 years and about 1,243 vessel round trips would occur during construction to Cook Inlet and up to 10, 921 vessel round trips would occur during operations to Cook Inlet. A variety of vessels would be in use for different phases of construction and operation. Vessel transit speeds vary from less than 10 knots up to 26 knots. A summary of projected vessel strikes is included in table 7.2.2-1; methodology is described in section 7.4.2.3. In Alaskan waters, there has been 1 confirmed vessel strike on gray whales (Nielson et al., 2012; IWC, 2014). During construction and operation, 0.04 and 0.23 gray whale could be struck by vessels, respectively. Over the life of the project, 0.26 gray whale would be likely to be struck, causing injury or death to that individual.

7.6.2.3 Spills

Impacts from spills on gray whales would be similar to those described for blue whales and bowhead whales in sections 7.2.2.3 and 7.3.2.3, respectively.

7.6.3 Determination of Effect

The Project **may affect** gray whales because:

- construction and operational vessels would transit through gray whale habitat; and
- construction activities at West Dock could expose gray whales to Level B harassment noise levels.

The Project is **not likely to adversely affect** gray whales because:

- the risk of potential strikes would be minimized with implementation of vessel traffic conservation measures.

7.7 HUMPBACK WHALE, WESTERN NORTH PACIFIC DISTINCT POPULATION SEGMENT

7.7.1 Species Description and Potential Presence in the Action Area

Humpback whales were listed as endangered in 1970. Critical habitat has not been designated for the humpback whale. The Western North Pacific DPS is an endangered species under the ESA, the Mexico DPS is a threatened species, and the Hawaii DPS is not protected under the ESA. These three DPS are indistinguishable in Alaska; therefore, they are discussed here as one. Whales from the three DPSs overlap to some extent on feeding grounds off Alaska. Humpback whales from any of the three DPSs (Western North Pacific, Mexico, and Hawaii) may occur in vessel transit routes in the Gulf of Alaska, Chukchi and Bering Seas, and Cook Inlet (see figure 7.7.1-1).

Humpback whales are usually found alone or in temporary small groups (ADF&G, 2018). During migration they are found at the surface of the ocean and while feeding and calving they are typically found in shallow waters (NMFS, 2017b). Adult females are 49 feet long and weigh about 35 tons; males are slightly smaller (ADF&G, 2018). Females and males are sexually mature at 5 and 7 years of age, respectively (ADF&G, 2018). Humpback whales spend summers in temperate and subpolar waters (ADF&G, 2018). Breeding and calving take place in tropical and subtropical waters during the winter months, and females give birth to a single calf every 1 to 3 years (ADF&G, 2018). Calves are 10 to 15 feet long, weigh 1.5 tons and nurse for 6 to 10 months (ADF&G, 2018). Humpback whales are baleen whales, feeding primarily on euphausiids (e.g., krill) and small schooling fish; they rarely feed during winter and while migrating (ADF&G, 2018). Humpback whales tend to concentrate in several areas to feed including the Barren Islands at the mouth of Cook Inlet and along the Aleutian Islands. Humpback whales are found as far north as the Chukchi Sea during summer feeding, although there were reports of humpback whales in the Beaufort Sea east of Barrow in 2007 (ADF&G, 2018).

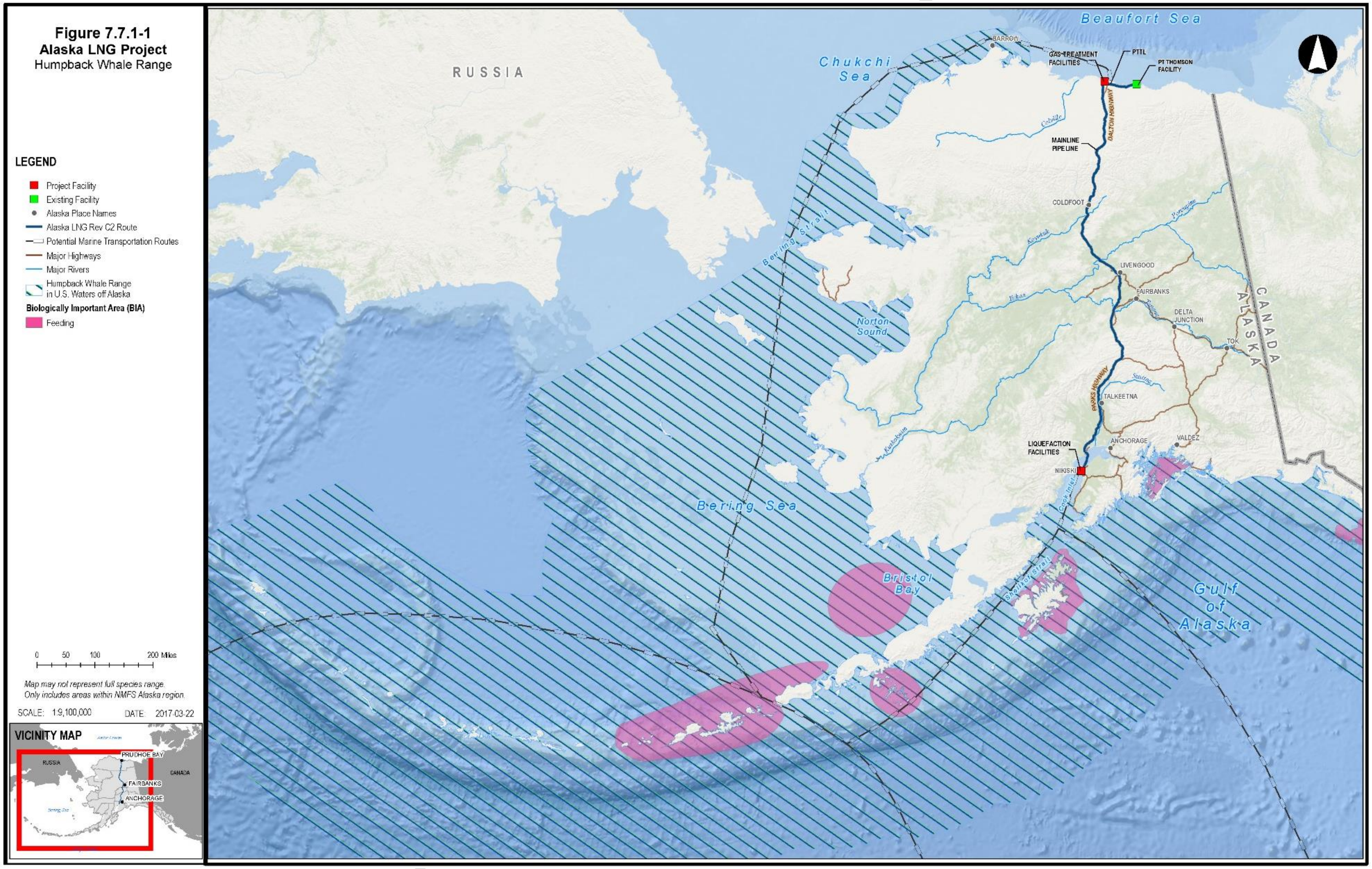


Figure 7.7.1-1
Alaska LNG Project
Humpback Whale Range

A humpback whale BIA for feeding occurs around Kodiak Island in the Gulf of Alaska. Humpback whales are known to feed in this area from July to September (NMFS, 2017c). Another humpback whale BIA occurs around the Aleutian Islands where humpback whales feed from June through September (NMFS, 2017c). A BIA for humpback whales occurs in the Bering Sea around the Aleutian Islands and Kodiak Island where vessels would transit (see figure 7.7.1-1). Humpback whales use the area around the Aleutian Islands from June through September and around Kodiak Island from July through September for feeding (NMFS, 2017c). Construction vessels would cross Environmentally Sensitive Index concentration areas of humpback whales during fall and summer near the Kennedy Entrance.

Threats to humpback whales in Alaska include ship strikes, human-caused underwater noise, climate change, and entanglement with commercial fishing gear and marine debris. The current humpback whale population trend in Alaska is unknown, but is likely increasing in Southeast Alaska; there is no current reliable estimate of population size in Alaska (Muto et al., 2016). Individuals may be found near the Marine Terminal or Mainline Pipeline crossing in Cook Inlet. Humpback whales are primarily seen in Alaska during summer months, but may occur year-round (ADF&G, 2018). Humpback whales may occur in vessel traffic routes near Cook Inlet, in the Gulf of Alaska, the Bering Sea, and the Chukchi Sea; they are rare but could also be found in the Beaufort Sea east of Barrow.

7.7.2 Effects Analysis

7.7.2.1 Noise

Noise impacts from transiting vessels would be similar for humpback whales as described above for the Pacific walrus. Pipeline and materials would be transported to various ports in Alaska. Tug and barge combinations would be used to transport pipeline to the Mainline MOF during the open water period in Upper Cook Inlet; these vessels would transit through BIAs for feeding. Material deliveries to West Dock with vessels would generate noise that could disturb marine mammals along vessel transit routes, which would transit through a BIA for feeding, and while vessels are staged at the PBOSA. Vessels are expected to transit during periods of open ice in the summer months. Due to the ephemeral nature of vessels in transit, noise impacts are expected to be minor from vessels transiting to and from Project facilities in Prudhoe Bay and Cook Inlet during construction and operation.

Impact and vibratory pile driving would occur for Mainline MOF construction. Impact pile driving would also occur for Marine Terminal MOF and PLF construction; removal of the Marine Terminal MOF piles would occur with a vibratory hammer (see tables 6.5.2-2 and 6.5.2-3, and appendix L-1 of the EIS). Pile driving, for installation, would occur between April and August. Pile driving at the Marine Terminal MOF and PLF would occur in the ice-free window over a 3-year period; both impact and continuous vibratory pile drivers are planned for use. Humpback whales would be present during pile driving for the Mainline MOF, Marine Terminal MOF, and PLF. About half the pile driving for the Mainline MOF would occur during low tide, minimizing underwater noise impacts on humpback whales for that portion of the sheet piling. The remaining pile driving for the Mainline MOF would be accomplished using vibratory and impact hammer techniques. Pile driving would cause Level A harassment (injury) to humpback whales at the source of the noise and up to 2.6 miles away (see table 6.5.2-2). Pile driving would cause Level B harassment (disturbance) to humpback whales from 0.6 mile and up to 13.4 miles from the activity (see table 6.5.2-3).

Shoreline trenches for the Mainline Pipeline in Cook Inlet would be dug by amphibious or barge-based excavators to a depth where a dredge vessel would then be used to complete the trenching. A backhoe dredge or trailing suction hopper dredge could also be used depending on conditions. These vessels would generate continuous and intermittent noise. If alternative dredging or burial techniques (such as plowing or jetting) are determined necessary after geotechnical investigations, AGDC would conduct a noise analysis for these methods. Humpback whales could occur in Cook Inlet during Mainline Pipeline installation. Excavation for the Mainline Pipeline would cause Level B disturbance from 140 feet to 1.9 miles from the activity (depending on equipment used) for humpback whales (see table 6.5.2-3). If DMT is used in place of trenching at the shoreline, these activities would generate Level B harassment (disturbance) 183 feet from the equipment.

Before conducting pipeline construction in Cook Inlet, AGDC would conduct detailed geophysical surveys using single and multibeam echosounders and side scan sonar to determine the bathymetry of the seafloor where it would install the Mainline Pipeline. Some of these instruments can generate noise at levels that could affect marine mammals (greater than 200 kilohertz). Typically, single beam echosounders operate at frequencies of 3.5 to 750 kilohertz (which have a range that can affect marine mammals), and multibeam echosounders operate at frequencies of 200 to 400 kilohertz (which are not detectable by marine mammals). Echosounders used for geophysical surveys could produce noise that would reach Level B harassment for humpback whales near the activity.

As described for Cook Inlet beluga whales, anchor handling vessels during Mainline Pipeline pipelay could cause Level B harassment (disturbance) to humpback whales within 1.3 miles. Use of PSOs to monitor when marine mammals enter the Level B harassment zone would not be possible under low light or inclement weather conditions.

Dredging would occur for 4 years at the Marine Terminal MOF in Cook Inlet; both excavator or clamshell mechanical dredge or hydraulic (cutterhead) or mechanical dredgers would be used. Dredging could generate noise levels above thresholds established by NMFS (see table 6.5.2-3 and appendix L-1 of the EIS). Dredging during the open water season would occur in humpback whale habitat, and Level B harassment (disturbance) from dredging would occur within 140 to 450 feet of the dredging activity. As described above for Mainline Pipeline construction, AGDC would use single and multibeam echosounders before, during, and after dredging. Impacts would be the same as described above.

7.7.2.2 Vessel Strikes

Vessels may collide with humpback whales, resulting in injury or death. Whale mortalities are usually caused by blunt force trauma from striking the ship bow, or by lethal wounding from propeller cuts. Vessel speed is the primary factor in the probability of a vessel strike and of the strike being lethal (Vanderlaan and Taggart, 2007). The percent of lethal whale strikes is significantly reduced by vessels traveling at less than 12 knots (13.8 miles per hour) (Vanderlaan and Taggart, 2007).

Vessels travelling through the Gulf of Alaska to Cook Inlet and the Bering, Beaufort, Chukchi, and Bering Seas *en route* to the GTP/West Dock during construction could strike humpback whales. Risks of vessel strikes would be higher in BIAs, where humpback whales concentrate to feed. The total number of vessel trips, vessel types, and typical speeds associated with Project construction and operation is provided in appendix L-2 of the EIS; up to 186 vessel round trips could be made to West Dock during construction over 6 years and about 1,243 vessel round trips would occur during construction to Cook Inlet and up to 10, 921 vessel round trips would occur during operations to Cook Inlet. A variety of vessels would be in use for different phases of construction and operation. Vessel transit speeds vary from less than 10 knots up to 26 knots. A summary of projected vessel strikes is included in table 7.2.2-1 and calculations are described in section 7.4.2.3. Between 1978 and 2011 in Alaskan waters, there were 101 confirmed vessel strikes on humpback whales (Nielson et al., 2012; IWC, 2014). Seventy-nine of these strikes occurred in Glacier Bay, which has a large percentage of tourist/whale watch boat incidents; these incidents have been removed from our calculations. During Project construction and operation, 0.79 and 5.00 humpback whales could be struck by vessels, respectively. Over the life of the project, 5.79 humpback whales would likely be struck, causing injury or death to that individual.

7.7.2.3 Spills

Impacts from spills on humpback whales would be similar to those described for blue whales in section 7.2.2.3.

7.7.2.4 Cumulative Impacts

As provided in appendix X-1 and referenced in section 4.19.3 of the EIS, the following projects would overlap with humpback whale occupied habitat in Cook Inlet, the Gulf of Alaska, the Bering Sea, and the Chukchi Sea:

- the CIGGS Marine Pipeline Conversion;
- the Cook Inlet Area Oil and Gas Development, including;
  - Hilcorp Alaska exploration and development in Cook Inlet;
  - Harvest Alaska exploration and development in Cook Inlet;
- the Kenai LNG Plant; and
- Chukchi Sea oil and gas development.

Activities that may be associated with these projects that could cumulatively increase effects on humpback whales include:

- noise from dredging, exploratory drilling, and other underwater noise generating activities;
- habitat alteration from construction activities in Cook Inlet;
- vessel traffic causing an increased risk of strikes and increases in underwater noise; and
- increases in aircraft overflight disturbances.

Any of the above projects occurring within Cook Inlet could contribute to impacts on humpback whales. Increased noise from vessels, aircraft overflights, and underwater activities could contribute to cumulative impacts on humpback whales. In addition, the Alaska LNG Project would increase vessel traffic in Cook Inlet by up to 74 percent over existing levels, so the additional vessel traffic associated with the above projects, in particular, additional LNG carriers for the Kenai LNG Plant, could lead to increases in vessel strikes on humpback whales.

7.7.3 Determination of Effect

The Project **may affect** humpback whales because:

- construction and operational vessels would transit through humpback whale habitat.

The Project is **likely to adversely affect** humpback whales because:

- there is a high risk of multiple vessel strikes on humpback whales from Project vessel traffic.

7.8 NORTH PACIFIC RIGHT WHALE

7.8.1 Species Description and Potential Presence in the Action Area

The North Pacific right whale was listed as endangered in 1970. Critical habitat for North Pacific right whale has been designated in the southeastern Bering Sea and in the Gulf of Alaska south of Kodiak Island (NMFS, 2017b). PCEs for North Pacific right whales are dense concentrations of prey (NMFS, 2017b). The current population estimate based on photo-identification mark-recapture is 31 whales (coefficient of variation = 0.226; Wade et al., 2011).

North Pacific right whales occur in pelagic and coastal shallow waters and nursery areas are typically in shallow coastal waters (NMFS, 2017b). Females can grow up to 55 feet in length and weigh 220,000 pounds, while males are smaller (ADF&G, 2018). Females give birth starting at 9 to 10 years of age. Calves are born at lower latitudes during winter (NMFS, 2017b). Calves are 13 to 15 feet long, weigh 1 ton, and nurse for 1 year (ADF&G, 2018). North Pacific right whales are baleen whales, feeding primarily on zooplankton (e.g., krill and copepods) by skimming through schools with their mouths open; they generally forage in the spring and fall (ADF&G, 2018). While migration patterns are unclear, they are thought to feed during the summer in high latitudes and move to temperate areas in the winter (ADF&G, 2018). Their movements are largely tied to prey locations (NMFS, 2017b). Their summer range in Alaska includes the southern Bering Sea and Gulf of Alaska (ADF&G, 2018) (see figure 7.8.1-1).

A North Pacific right whale BIA for feeding occurs in the Gulf of Alaska southeast of Kodiak Island. North Pacific right whales use this area for feeding from June through September (NMFS, 2017c). Critical habitat for North Pacific right whales (also a BIA for feeding) occurs in the Bering Sea north of the Alaska Peninsula, as shown on figure 7.8.1-1 (NMFS, 2017c).

Threats to the North Pacific right whale in Alaska include ship strikes and pollutants (Muto et al., 2016). The current North Pacific right whale population trend in Alaska is unknown; the minimum population estimate is 26 (Muto et al., 2016).

North Pacific right whales may occur in vessel traffic routes in the Gulf of Alaska and Bering Sea. Vessels would transit in the Bering Sea near critical habitat.

7.8.2 Effects Analysis

7.8.2.1 Noise

Noise impacts from transiting vessels would be similar for North Pacific right whales as described for the Pacific walrus. Pipeline and materials would be transported to various ports in Alaska. Tug and barge combinations would be used to transport pipeline to the Mainline MOF during the open water period in Upper Cook Inlet; these vessels would transit through a BIA for feeding. Material deliveries to West Dock with vessels would generate noise that could disturb marine mammals along vessel transit routes, which would transit through a BIA for feeding, and while staged at the PBOSA. Vessels are expected to transit during periods of open ice in the summer months. Due to the ephemeral nature of vessels in transit, vessel noise impacts would be expected to be minor from vessels transiting to and from Project facilities in Prudhoe Bay and Cook Inlet during construction and operation.

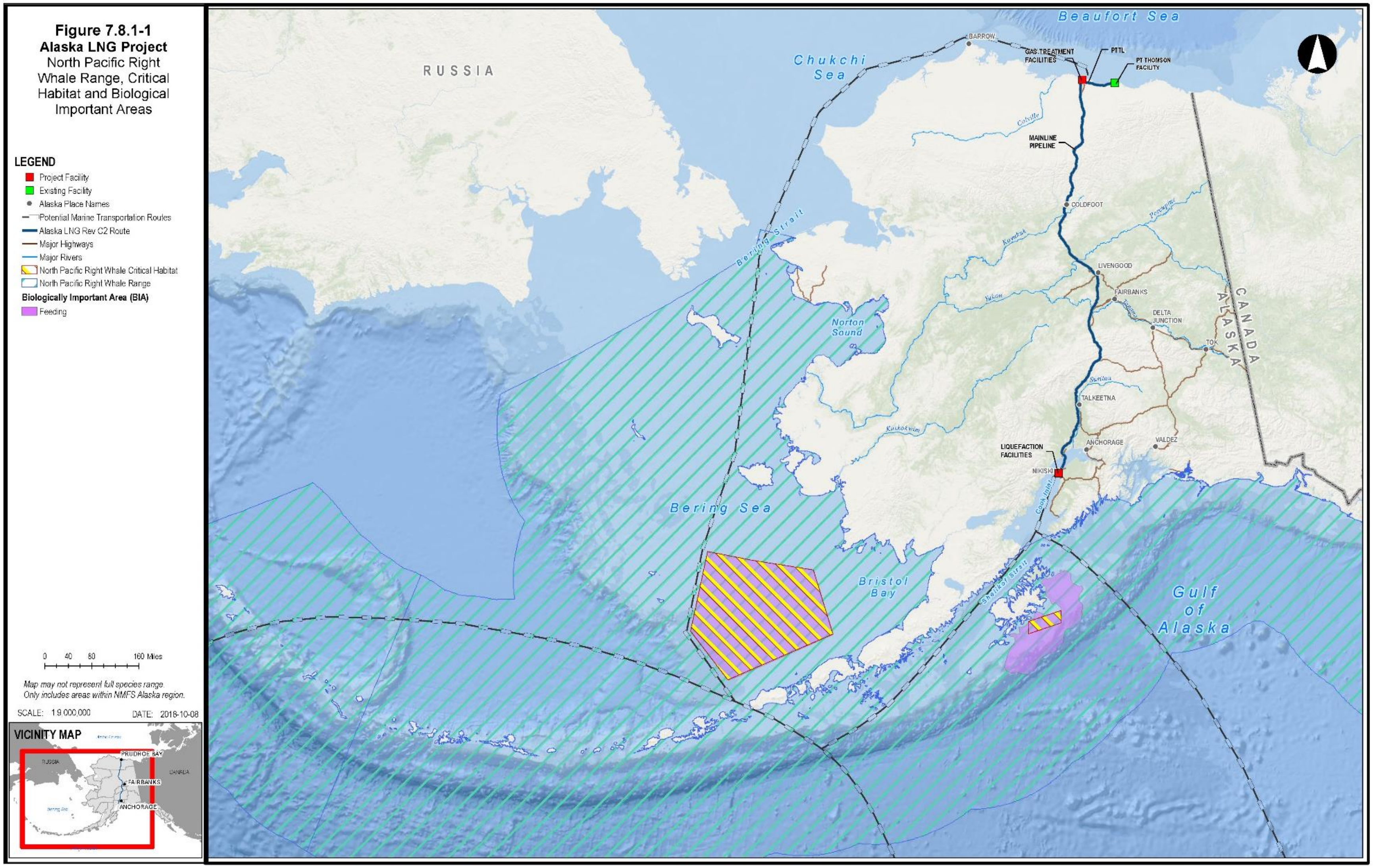


Figure 7.8.1-1
Alaska LNG Project
North Pacific Right Whale Range, Critical Habitat and Biological Important Areas
LEGEND
Project Facility
Existing Facility
Alaska Place Names
Potential Marine Transportation Routes
Alaska LNG Rev C2 Route
Major Highways
Major Rivers
North Pacific Right Whale Critical Habitat
North Pacific Right Whale Range
Biologically Important Area (BIA)
Feeding
0 40 80 160 Miles
Map may not represent full species range.
Only includes areas within NMFS Alaska region.
SCALE: 1:9,000,000
DATE: 2018-10-08
VICINITY MAP
PRUDHOE BAY
FAIRBANKS
ANCHORAGE
RUSSIA
CANADA
Beaufort Sea
Chukchi Sea
BARROW
GAS TREATMENT FACILITIES
PTTL
PT THOMSON FACILITY
MAINLINE PIPELINE
COLDFOOT
LIVENGOOD
FAIRBANKS
DELTA JUNCTION
TOK
TALKEETNA
ANCHORAGE
VALDEZ
LIQUEFACTION FACILITIES
NIKISKI
Bering Strait
Norton Sound
Bering Sea
Bristol Bay
Shelikof Strait
Cook Inlet
Gulf of Alaska
ALASKA
Colville
Yukon
Koyukuk
Porcupine
Tanana
Susitna
Kuskokwim

7.8.2.2 Vessel Strikes

Vessels may collide with North Pacific right whales, resulting in injury or death. Whale mortalities are usually caused by blunt force trauma from striking the ship bow, or by lethal wounding from propeller cuts. Vessel speed is the primary factor in the probability of a vessel strike and of the strike being lethal (Vanderlaan and Taggart, 2007). The percent of lethal whale strikes is significantly reduced by vessels traveling at less than 12 knots (13.8 miles per hour) (Vanderlaan and Taggart, 2007).

Vessels travelling through the Gulf of Alaska to Cook Inlet and the Bering, Beaufort, Chukchi, and Bering Seas *en route* to the GTP/West Dock during construction could strike North Pacific right whales. Risks of vessel strikes would be higher in BIAs, where North Pacific right whales concentrate to feed. The total number of vessel trips, vessel types, and typical speeds associated with Project construction and operation is provided in appendix L-2 of the EIS; up to 186 vessel round trips could be made to West Dock during construction over 6 years and about 1,243 vessel round trips would occur during construction to Cook Inlet and up to 10, 921 vessel round trips would occur during operations to Cook Inlet. A variety of vessels would be in use for different phases of construction and operation. Vessel transit speeds vary from less than 10 knots up to 26 knots. A summary of projected vessel strikes is provided in table 7.2.2-1; calculations for vessel strike estimates are described in section 7.4.2.3. While there are no known records of North Pacific right whale strikes in Alaskan waters, the North Atlantic right whale experiences significant mortality and serious injury from vessel strikes, as nearly one whale per year is struck in the northeastern United States (Muto et al., 2016). With the increase of vessel traffic in North Pacific right whale habitats, vessel strikes are possible, but at this time are unquantifiable due to lack of information; however, the risk of vessel strikes is low due to the low density of North Pacific right whale populations in Alaska.

7.8.2.3 Spills

Impacts from spills on North Pacific right whales would be similar to those described for blue whales and bowhead whales in sections 7.2.2.3 and 7.3.2.3, respectively.

7.8.2.4 Critical Habitat

PCEs for North Pacific right whale critical habitat include dense concentrations of prey. Project vessels transiting near critical habitat in the Bering Sea would have no impact on prey in this area. Vessels could contribute to habitat degradation by introducing noise as they are transiting near critical habitat in the Bering Sea, but would avoid transiting directly through critical habitat.

7.8.3 Determination of Effect

The Project **may affect** North Pacific right whales because:

- construction and operational vessels would transit through North Pacific right whale habitat.

The Project is **not likely to adversely affect** North Pacific right whales because:

- the risk of potential strikes would be minimized with implementation of vessel traffic conservation measures.

The Project **may affect** North Pacific right whale critical habitat because:

- vessels would transit near critical habitat in the Bering Sea.

The Project is **not likely to adversely affect** critical habitat because:

- vessels would not affect PCEs for critical habitat; and
- noise impacts would be reduced because vessels would not transit directly through critical habitat.

7.9 RINGED SEAL

7.9.1 Species Description and Potential Presence in the Action Area

The ringed seal (arctic subspecies/Alaska stock) was listed as threatened (effective February 26, 2013) because ice projection models predict a reduction in sea ice habitat in the latter half of the century and snow prediction models predict a reduction in snow accumulation, which could compromise the ability of the seals to construct subnivean (snow-covered) lairs (77 FR 76706). The reduction of available suitable ice habitat is expected to result in adverse demographic effects. On December 3, 2014, NMFS announced their proposal to designate critical habitat for the ringed seal to include marine waters from the coastline to the U.S. EEZ in the northern Bering, Chukchi, and Beaufort Seas (79 FR 71714). On March 11, 2016, the U.S. District Court for the District of Alaska determined that the NMFS listing decision was arbitrary and capricious. The District Court vacated the listing rule and remanded the rule back to NMFS for reconsideration. A notice of appeal of the District Court decision was filed on May 3, 2016. On February 12, 2018, the U.S. Court of Appeals reversed the 2016 decision that vacated the rule. The ringed seal is currently listed as threatened. Critical habitat has not been designated for the ringed seal.

Ringed seals are circumpolar in distribution, occupying the Bering, Chukchi, and Beaufort Seas in Alaska (see figure 7.9.1-1). Adults breed in heavy shorefast ice and juveniles migrate south to the ice edge for the winter. Ringed seals are an important subsistence resource for Alaska Natives (ADF&G, 2018).

Throughout their range, ringed seals are typically tied to ice-covered waters and are well adapted to occupying both shorefast and pack ice (NMFS, 2017b; Kelly et al., 2010). They remain in contact with ice most of the year, and use it as a platform for pupping and nursing in late winter to early spring, for molting in late spring to early summer, and for resting at other times of the year (Lowry, 2016). Ringed seals give birth in snow-covered ice lairs, called subnivean dens in late spring; these dens are typically on sea ice. Pups are weaned by ice breakup (NMFS, 2018b). Ringed seals are opportunistic predators, eating invertebrates (e.g., shrimp), fish (e.g., cod), and amphipods.

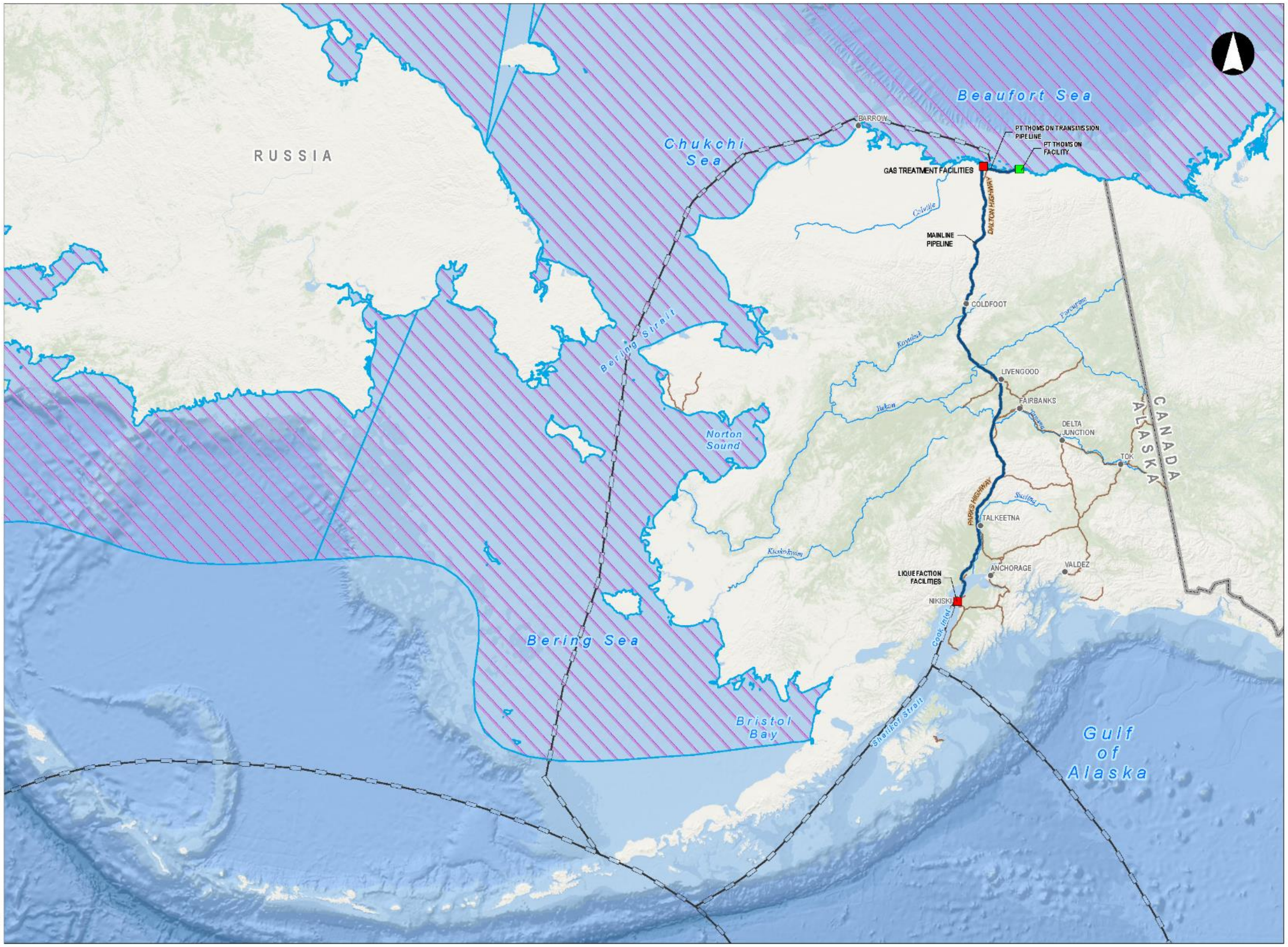
In Alaskan waters, during winter and early spring, ringed seals are abundant in the northern Bering Sea, in the Norton and Kotzebue Sounds, and throughout the Chukchi and Beaufort Seas. Ringed seals occur year-round in the Chukchi Sea (Hannay et al., 2013). Ringed seals in Alaska rarely haul out on land (Lowry, 2016). Ringed seals in Alaskan waters belong to the Alaska stock, which includes the arctic subspecies found in the Bering, Chukchi, and Beaufort Seas (Allen and Angliss, 2014).

Threats to the ringed seal in Alaska include reduction of sea ice and snow cover (climate change), prey availability, disturbance from vessel traffic, human-caused underwater noise, pollutants, entanglement with commercial fisheries, and disease. The current ringed seal minimum population estimate and population trend in Alaska are unknown (Muto et al., 2016).

Ringed seals may occur along vessel transit routes through the Bering, Chukchi, and Beaufort Seas and at the PBOSA. Ringed seals are expected to occur near the West Dock Causeway year-round.

Figure 7.9.1.1
Alaska LNG Project

Summer and Winter
Ringed Seal Distribution



LEGEND

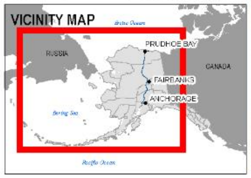
- Project Facility
- Existing Facility
- Alaska Place Names Alaska LNG
- Rev C2 Route Major Highways
- Major Rivers
- Potential Marine Transportation Route
- Ringed Seal Range in U.S. Waters off Alaska

0 50 100 200 Miles

Map may not represent full species range.
Only includes areas within NMFS Alaska region.

PREPARED BY:	AGDC		
SCALE:	1:9,000,000		
DATE:	2017-03-21	SHEET:	1 of 1

VICINITY MAP



7.9.2 Effects Analysis

7.9.2.1 Habitat Loss or Degradation

Project-related activities could cause permanent habitat loss or alteration from installation of in-water structures, and temporary foraging loss due to screeding activities. Ringed seals may occasionally occur on land but more likely would occur on sea ice in the Project area in Prudhoe Bay coastal areas. Ringed seals may be disturbed by construction activity and noise and avoid the area; construction activities could make the habitat temporarily unsuitable during active construction periods. Placement of West Dock structures would affect the availability of sea ice in the area. Winter activities at the GTP (prepping the seabed for the barge bridge) when ice is present, could injure or kill adults and pups in dens (lairs).

Sealifts to West Dock would be conducted when surface ice coverage is equal to or less than 30 percent or less (the average ice-free period is 61 days, with the earliest opening on July 15 and the latest closing on November 4). If ice is present, ringed seals may be present; however, activities would occur outside their more vulnerable period (during whelping, mating, and molting from mid-March through June) minimizing the risk of vessels striking or disturbing seals resting on ice (Boveng et al., 2008, 2009).

Construction of West Dock at Dock Head 4 would result in the loss and alteration of about 166 acres of benthic marine substrates. The seabed would be disturbed prior to each sealift, and barges would be grounded during module deliveries. At West Dock, the seabed would be graded/screeded in the summer before each sealift. Ringed seals may be displaced by these screeding activities. This area of marine and benthic habitat used for foraging by ringed seals would be lost during these activities. Once barge deliveries are complete, the benthic community would be anticipated to recolonize the area rapidly following seafloor disturbance since it is adapted to annual seafloor disturbance (e.g., ice scour).

7.9.2.2 Noise

Complete noise analysis calculation results using the NMFS Technical Guidance and airborne noise guidance are included in appendix L-1 of the EIS. Summaries of Level A and B harassment areas are included in tables 6.5.2-2 and 6.5.2-3.

Underwater Noise

Underwater noise impacts on ringed seals would be similar to those described for bearded seals (see section 7.1.2.2). Material deliveries to West Dock with vessels would generate noise that could disturb ringed seals along transit routes and while vessels are staged at the PBOSA. Vessels are expected to transit during periods of open ice in the summer months. Ringed seals would occur in vessel transit routes during the summer months. Vessel use for deliveries to West Dock could generate noise at levels that would disturb ringed seals.

Dock Head 4 construction would require installing piles (sheet piling), most of which would be placed using an impact hammer in summer, and installing four dolphins required for affixing the temporary barge bridge across the West Dock Causeway (see appendix L-1 of the EIS). Dock Head 4 piles and sheet piles would be installed between June and August. Ringed seals could occur near West Dock during pile driving activities and be affected by pile driving noise. Ringed seals would be exposed to Level A harassment (injury) within 0.1 square mile of pile driving and Level B harassment (disturbance) within 0.1 to 6.2 square miles (see tables 6.5.2-2 and 6.5.2-3).

Screeding would occur at West Dock during summer months to accommodate vessels. Noise generated by screeding vessels and their activities could generate noise levels above thresholds established by NMFS (see table 6.5.2-3). Ringed seals within 330 feet of screeding activities would be exposed to Level B harassment (disturbance). Use of PSOs to monitor and shut down activities when marine mammals enter the Level B harassment zone would not be possible under low light conditions; therefore, if activities occur during low lighting or inclement weather, some ringed seals may be exposed to Level B harassment (disturbance) from screeding due to lack of visibility and the inability of the PSOs to implement shutdown procedures.

Airborne Noise

Airborne noise impacts on ringed seals would be similar to those described for bearded seals (see section 7.1.2.2). Table 6.5.2-4 summarizes airborne noise impacts on marine mammals. Airborne sounds over water may affect ringed seals at the surface or when hauled out. These noises could cause startle reactions, or cause ringed seals to avoid or move away from the areas where the noise is generated.

Noise generated by the GTP during operation would not be expected to reach harassment levels for ringed seals. Airborne noise generated during pile driving would be unlikely to rise to disturbance levels for ringed seals unless the animal is immediately adjacent to the activity. Ringed seals would be anticipated to avoid pile driving activities and thereby not be exposed to Level B disturbance. Airborne noise generated during general construction activities on land or over water would reach Level B harassment (disturbance) for ringed seals near West Dock within 0.2 mile. No blasting is planned near the Beaufort Sea coast for the Mainline Pipeline or Gas Treatment Facilities; therefore, no blasting impacts on ringed seals would be expected.

Ringed seals may occur in Prudhoe Bay either on ice or potentially on land where flights could be seen and/or heard by individuals. Effects on ringed seals from aircraft noise and disturbance would be similar as described for bearded seals.

7.9.2.3 Turbidity/Prey Impacts

Benthic invertebrates and fish are important prey sources for ringed seals. Prey habitat loss and alteration could occur from disturbance related to screeding in Prudhoe Bay; construction (e.g., benthic construction and noise from construction equipment) at West Dock facilities; and barge bridge grounding at West Dock. Some individuals may be injured or killed if they occur near pile driving activities, but generally, fish are expected to avoid habitats around Project construction activities. Benthic communities would be temporarily lost during screeding and barge bridge placement activities at West Dock. Temporary loss of benthic food sources is not expected to be significant since the area around West Dock is often subject to disturbance from seasonal ice scour.

In-water activities, such as pile driving and screeding, would increase turbidity in the surrounding water column. Increased turbidity could make it harder for ringed seals to find food. Effects on ringed seals' ability to find prey resources from increased turbidity during construction would be temporary and similar to turbidity generated during spring ice breakup or summer/fall storms.

7.9.2.4 Vessel Strikes

Available data are limited for how often ringed seals are struck by vessels; however, increased vessel activity is a concern for this species (NMFS, 2018b). The total number of vessel trips, vessel types, and typical speeds associated with Project construction and operation is provided in appendix L-2 of the EIS; up to 186 vessel round trips could be made to West Dock during construction over 6 years. The risk of a vessel striking an adult resting seal is low due to their alertness and mobility. Ringed seals would have pups on pack ice when vessels are in transit to West Dock during spring months, and adults would be on the ice during their molting period in summer. Ice breaking vessels have been reported to negatively affect ice-breeding seals, such as ringed seals, by directly striking seals on ice or by separating mothers and pups (Hauser et al., 2018).

7.9.2.5 Spills

Impacts from spills on ringed seals, would be similar to those described for bearded seals in section 7.1.2.5. Spills could affect ringed seals and their prey if present around West Dock or the Beaufort and Chukchi Seas at the time of the spill. Spills and leaks of oil or wastewater from Project activities that reach marine waters could directly affect the health of exposed seals. If contaminants spill into the ocean, the material would travel with the currents. Individual ringed seals exposed to contaminants could show acute irritation or damage to their eyes and skin and respiratory distress from the inhalation of vapors (NMFS, 2017a). Ingestion of contaminants could cause acute irritation to the digestive tract, including vomiting and aspiration into the lungs, which could result in pneumonia or death (NMFS, 2017a). A spill during winter could be particularly harmful to ringed seals that use leads and polynyas for breathing or feeding (Smith, 2010).

7.9.2.6 Cumulative Impacts

As provided in appendix X-1 and referenced in section 4.19.3 of the EIS, the following projects would overlap with ringed seal habitat:

- Alliance Exploration;
- PTU Expansion Project; and
- PBU MGS Expansion Project.

Activities that may be associated with these projects that could cumulatively increase effects on ringed seals include:

- noise from dredging and exploratory drilling;
- habitat loss or alteration;
- vessel traffic disturbances; and
- aircraft overflight disturbances.

The above activities could directly or indirectly affect ringed seals and their habitats by making it unavailable for use during feeding, breeding, and denning due to increased noise and vessel traffic. Due to the transitory nature of ringed seal habitat and denning areas (i.e., seasonally available sea ice habitat) and the non-concurrent timing of most of these activities, we do not expect cumulative impacts to be significant on ringed seals.

7.9.3 Determination of Effect

The Project **may affect** ringed seals because:

- ringed seals would occur within the Project area during construction and operation of the Project;

- the Project would temporarily affect ringed seal habitat; and

- there is potential for disturbance and spills from Project-related vessel traffic through occupied habitat.

The Project is **likely to adversely affect** ringed seals because:

- the Project would cause Level A and Level B harassment to ringed seals from underwater noise; and
- vessel traffic could cause injury to denning seals.

7.10 SEI WHALE

7.10.1 Species Description and Potential Presence in the Action Area

The sei whale was listed as endangered in 1970. Critical habitat has not been designated for the sei whale. The Eastern North Pacific stock occurs in Alaskan waters. Sei whales are typically found near the continental shelf edge and slope over deeper waters in groups of two to five animals (NMFS, 2017b). Adults can reach lengths of 40 to 60 feet (12 to 18 meters). Sei whales are baleen whales primarily feeding on plankton, small schooling fish, and squid (NMFS, 2017b).

Sei whales are found in the Gulf of Alaska and south of the Aleutian Islands in the summer where they feed (typically June through August); they migrate south out of Alaskan waters to lower latitudes for winters where they give birth (NMFS, 2011).

Threats to sei whales in Alaska include ship strikes and human-caused underwater noise (Muto et al., 2016). The current minimum population estimate for Eastern North Pacific sei whales is 374 (Muto et al., 2016). The current sei whale population trend in Alaska is unknown (Muto et al., 2016). Sei whales may occur along vessel transit routes in the Gulf of Alaska and Cook Inlet (see figure 7.10.1-1).

7.10.2 Effects Analysis

7.10.2.1 Noise

Noise impacts from transiting vessels would be similar for sei whales as described above for the Pacific walrus in section 6.6. Pipeline and materials would be transported to various ports in Alaska. Tug and barge combinations would be used to transport pipeline to the Mainline MOF during the open water period in Upper Cook Inlet. Vessels are expected to transit during periods of open ice in the summer months. Due to the ephemeral nature of vessels in transit, vessel noise impacts are expected to be minor from vessels transiting to and from Project facilities in Cook Inlet during construction and operation.

7.10.2.2 Vessel Strikes

Vessels may collide with sei whales, resulting in injury or death. Whale mortalities are usually caused by blunt force trauma from striking the ship bow, or by lethal wounding from propeller cuts. Vessel speed is the primary factor in the probability of a vessel strike and of the strike being lethal (Vanderlaan and Taggart, 2007). The percent of lethal whale strikes is significantly reduced by vessels traveling at less than 12 knots (13.8 miles per hour) (Vanderlaan and Taggart, 2007).

Vessels travelling through the Gulf of Alaska to Cook Inlet could strike sei whales. The total number of vessel trips, vessel types, and typical speeds associated with Project construction and operation is provided in appendix L-2 of the EIS; about 1,243 vessel round trips would occur during construction to Cook Inlet and up to 10, 921 vessel round trips would occur during operations to Cook Inlet. A variety of vessels would be in use for different phases of construction and operation. Vessel transit speeds vary from less than 10 knots up to 26 knots. A summary of projected vessel strikes is included in table 7.2.2-1.

While there are no known records of sei whale strikes in Alaskan waters, one vessel strike was reported in Washington in 2003 (Muto et al., 2016). With the increase of vessel traffic in sei whale habitats, vessel strikes are possible, but at this time they are unquantifiable due to lack of information.

Figure 7.10.1-1
Alaska LNG Project
Sei Whale Range

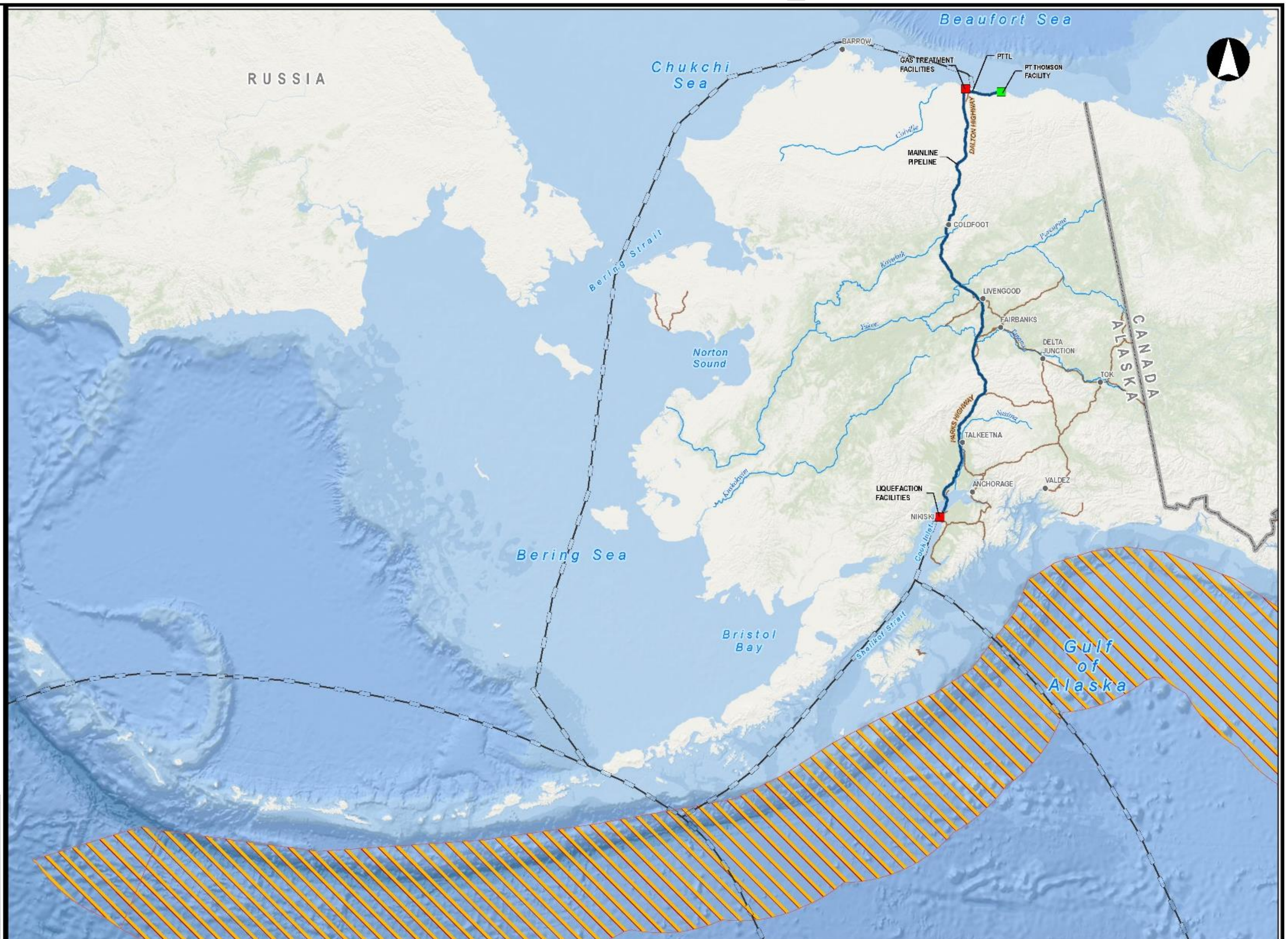
LEGEND

- Project Facility
- Existing Facility
- Alaska Place Names
- Alaska LNG Rev C2 Route
- Potential Marine Transportation Routes
- Major Highways
- Major Rivers
- Sei Whale Range in U.S. Waters off Alaska

0 50 100 200 Miles

Map may not represent full species range. Only includes areas within NMFS Alaska region.

SCALE: 1:9,100,000 DATE: 2017-03-21



7.10.2.3 Spills

Impacts from spills on sei whales would be similar to those described for blue whales in section 7.2.2.3.

7.10.3 Determination of Effect

The Project **may affect** sei whales because:

- construction and operational vessels would transit through sei whale habitat.

The Project is **not likely to adversely affect** sei whales because:

- the risk of potential strikes would be minimized with implementation of the vessel traffic conservation measures.

7.11 SPERM WHALE

7.11.1 Species Description and Potential Presence in the Action Area

The sperm whale was listed as endangered in 1970. Critical habitat has not been designated for the sperm whale. The North Pacific stock occurs in Alaskan waters. Sperm whales are typically found offshore in waters deeper than 655 feet (200 meters) (ADF&G, 2018). Sperm whales can reach up to 45 tons for males, and 15 tons for females. They feed on large squid, sharks, skates, and fish (NMFS, 2017b).

In Alaska, male sperm whales can be found in the summer in the Gulf of Alaska, Bering Sea, and the Aleutian Islands where they come to feed (ADF&G, 2018). Females and young typically stay further south in temperate and tropical waters. Males will rejoin the females and young in winter in more temperate and tropical waters (ADF&G, 2018).

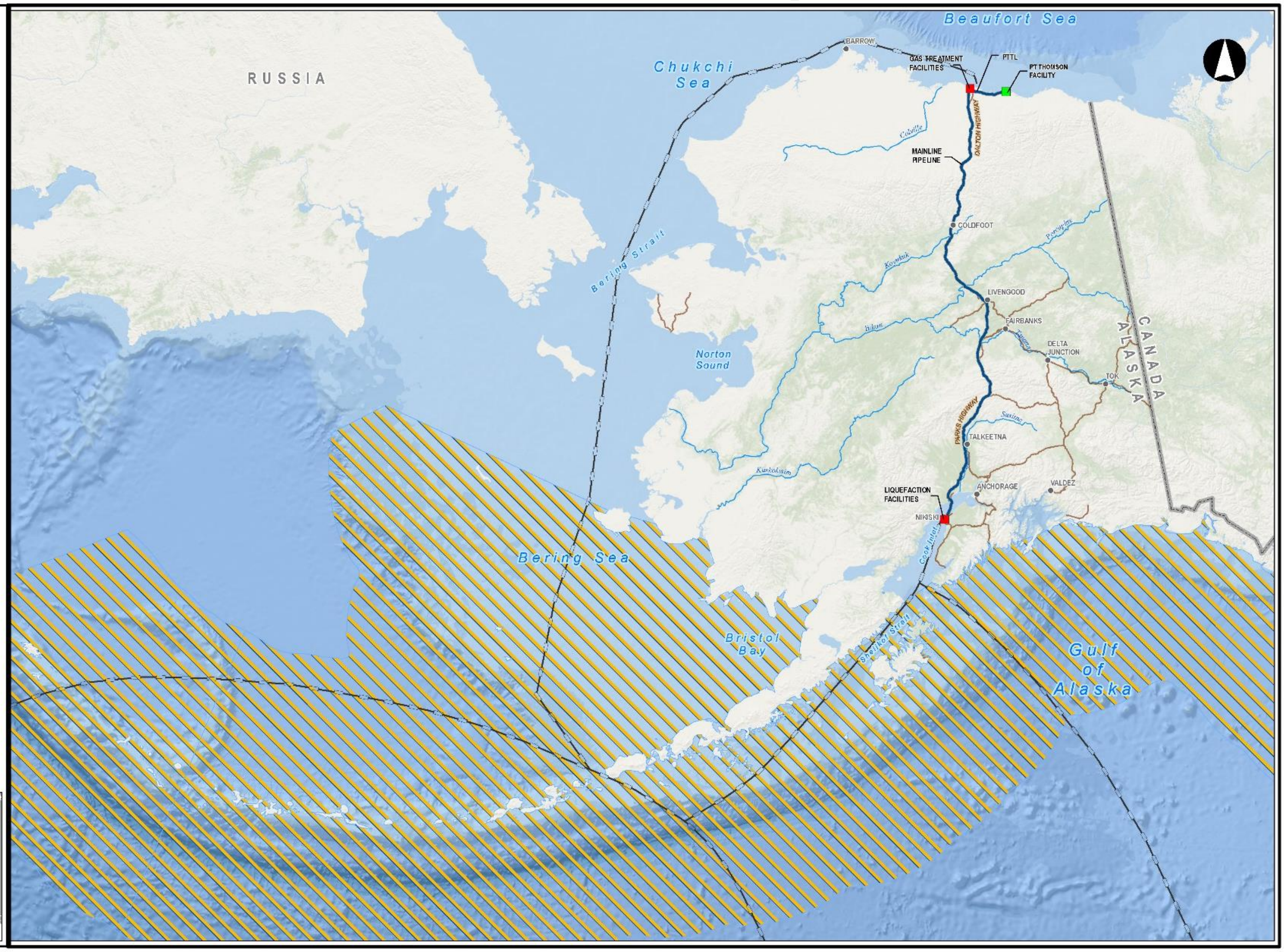
Threats to sperm whales in Alaska include ship strikes, human-caused underwater noise, prey reduction due to climate change, and entanglement in commercial fisheries (Muto et al., 2016). The current sperm whale minimum population estimate and population trend in Alaska are unknown (Muto et al., 2016, 2017). Male sperm whales may occur along vessel transit routes in the Gulf of Alaska, Bering Sea, and through the Aleutian Islands (see figure 7.11.1-1).

7.11.2 Effects Analysis

7.11.2.1 Noise

Noise impacts from transiting vessels would be similar for sperm whales as described for the Pacific walrus. Pipeline and materials would be transported to various ports in Alaska. Tug and barge combinations would be used to transport pipeline to the Mainline MOF during the open water period in Upper Cook Inlet. Material deliveries to West Dock with vessels would generate noise that could disturb marine mammals along vessel transit routes and while staged at the PBOSA. Vessels are expected to transit during periods of open ice in the summer months. Due to the ephemeral nature of vessels in transit, vessel noise impacts would be expected to be minor from vessels transiting to and from Project facilities in Prudhoe Bay and Cook Inlet during construction and operation.

Figure 7.11.1-1
Alaska LNG Project
Sperm Whale Range



LEGEND

- Project Facility
- Existing Facility
- Alaska Place
- Alaska LNG Rev C2
- Potential Marine Transportation Routes
- Major Highways
- Major Rivers
- Sperm Whale Range in U.S. Waters off Alaska

0 50 100 200 Miles

Map may not represent full species range. Only includes areas within NMFS Alaska region.

SCALE: 1:9,000,000 DATE: 2017-03-21

VICINITY MAP

7.11.2.2 Vessel Strikes

Vessels may collide with sperm whales, resulting in injury or death. Whale mortalities are usually caused by blunt force trauma from striking the ship bow, or by lethal wounding from propeller cuts. Vessel speed is the primary factor in the probability of a vessel strike and of the strike being lethal (Vanderlaan and Taggart, 2007). The percent of lethal whale strikes is significantly reduced by vessels traveling at less than 12 knots (13.8 miles per hour) (Vanderlaan and Taggart, 2007).

Vessels travelling through the Gulf of Alaska to Cook Inlet and the Bering, Beaufort, Chukchi, and Bering Seas *en route* to the GTP/West Dock during construction could strike sperm whales. The total number of vessel trips, vessel types, and typical speeds associated with Project construction and operation is provided in appendix L-2 of the EIS; up to 186 vessel round trips could be made to West Dock during construction over 6 years and about 1,243 vessel round trips would occur during construction to Cook Inlet and up to 10, 921 vessel round trips would occur during operations to Cook Inlet. A variety of vessels would be in use for different phases of construction and operation. Vessel transit speeds vary from less than 10 knots up to 26 knots. A summary of projected vessel strikes is included in table 7.2.2-1, and calculations are described in section 7.4.2.3. In Alaskan waters, there were 3 confirmed vessel strikes on sperm whales in 1997 (Nielson et al., 2012; IWC, 2014). During construction and operation, 0.11 and 0.68 sperm whale could be struck by vessels, respectively. Over the life of the project, 0.79 sperm whale would likely be struck, causing injury or death to that individual.

7.11.2.3 Spills

Impacts from spills on sperm whales would be similar to those described for blue whales and bowhead whales in sections 7.2.2.3 and 7.3.2.3, respectively.

7.11.3 Determination of Effect

The Project **may affect** sperm whales because:

- construction and operational vessels would transit through sperm whale habitat.

The Project is **not likely to adversely affect** sperm whales because:

- the risk of potential strikes would be minimized with implementation of vessel traffic conservation measures.

7.12 STELLER SEA LION, WESTERN DISTINCT POPULATION SEGMENT

7.12.1 Species Description and Potential Presence in the Action Area

The Western DPS Steller sea lion was listed as endangered in 1997. Critical habitat for the Steller sea lion is defined by NMFS in western south-central Alaska as “a 20-nautical-mile aquatic buffer around all major haulouts and rookeries, as well as associated terrestrial, air, and aquatic zones, and three large offshore foraging areas.” The critical habitat is shown on figures 7.12.1-1 and 7.12.1-2 (NMFS, 2017b). In addition, NMFS also “designated no-entry zones around rookeries [and] a complex suite of fishery management measures designed to minimize competition between fishing and the endangered population of Steller sea lions in critical habitat areas” (NMFS, 2017b). Critical habitat also includes “… a terrestrial zone that extends 3,000 feet (0.9 kilometer) landward from the baseline or base point of each major rookery and major haulout in Alaska. Critical habitat includes an air zone that extends 3,000 feet (0.9 kilometer) above the terrestrial zone of each major rookery and major haulout in Alaska, measured vertically from sea level.” Shelikof Strait is also identified as a critical habitat foraging zone.

Figure 7.12.1-1
Alaska LNG Project
Stellar Sea Lion Range and Critical Habitat

LEGEND

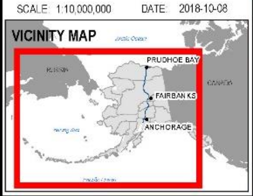
- Project Facility
- Existing Facility
- Alaska Place Names
- Steller Sea Lion Rookery Site
- Alaska LNG Rev C2 Route
- Major Highways
- Major Rivers
- Potential Marine Transportation Route
- Western Steller Sea Lion DPS
- Eastern Steller Sea Lion DPS
- Steller Sea Lion Critical Habitat Area

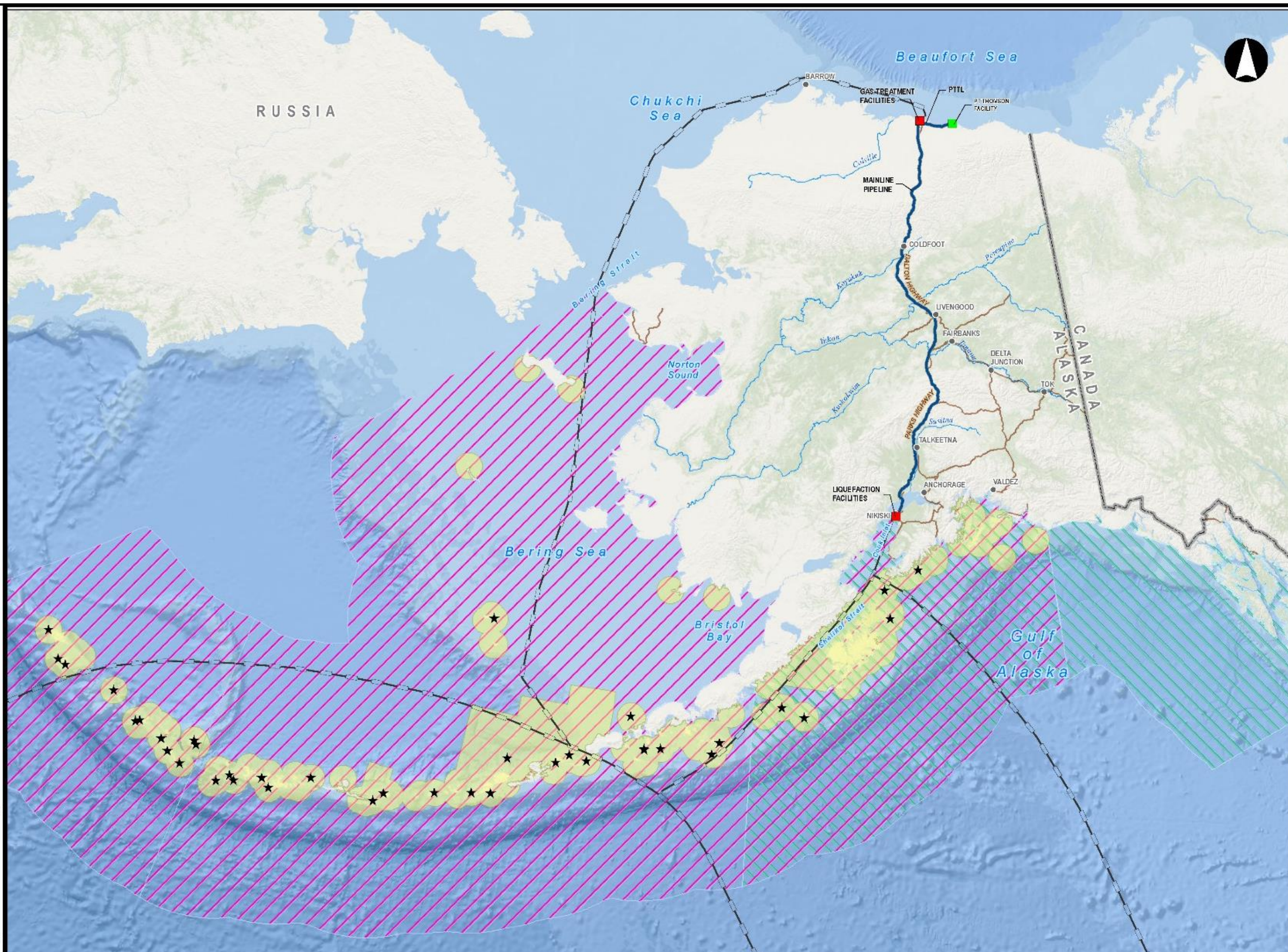
0 45 90 180 Miles

Map may not represent full species range.
Only includes areas within NMFS Alaska region.

SCALE 1:10,000,000 DATE 2018-10-08

VICINITY MAP





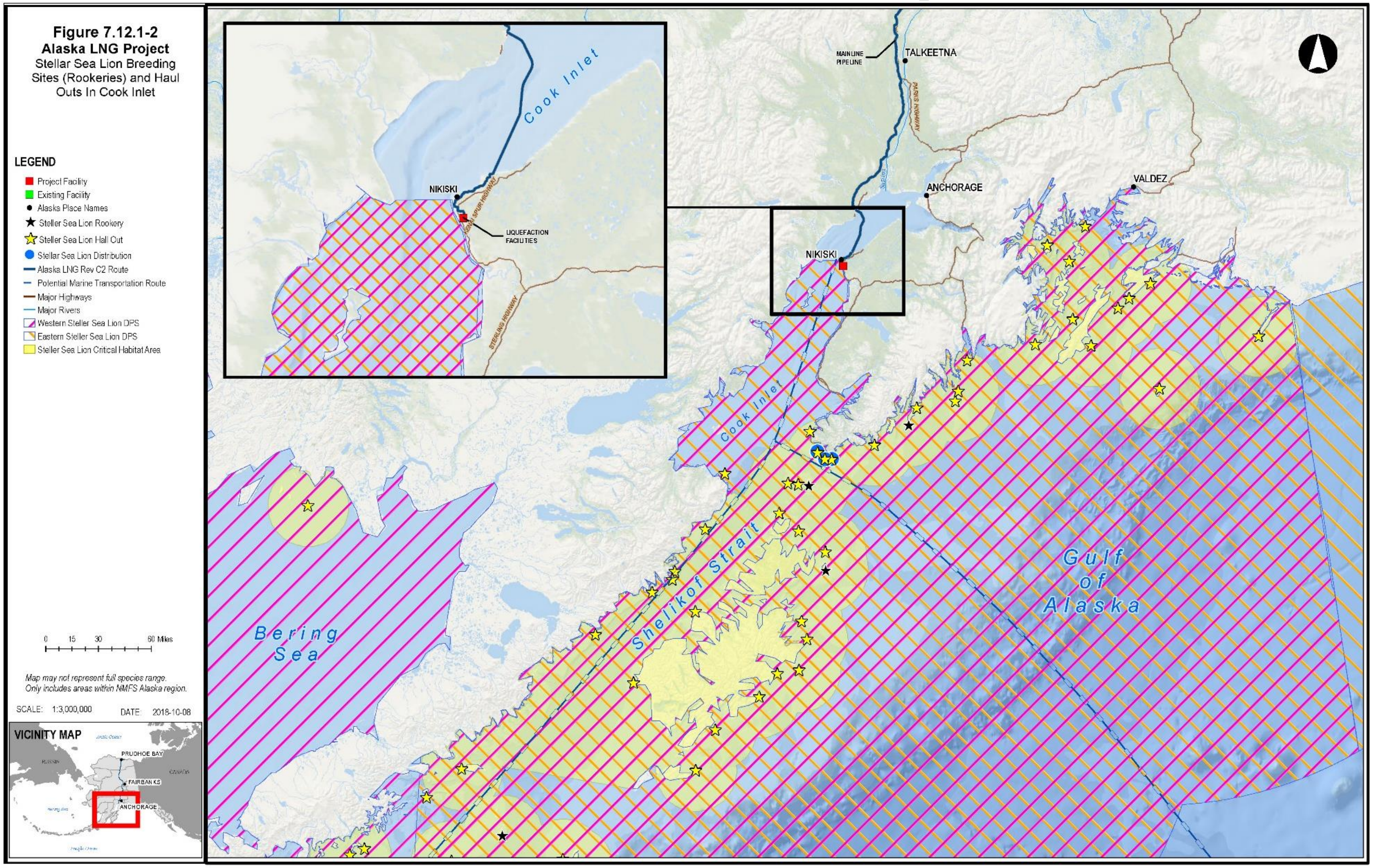


Figure 7.12.1-2
Alaska LNG Project
Stellar Sea Lion Breeding Sites (Rookeries) and Haul Outs In Cook Inlet
LEGEND
Project Facility
Existing Facility
Alaska Place Names
Steller Sea Lion Rookery
Steller Sea Lion Hall Out
Stellar Sea Lion Distribution
Alaska LNG Rev C2 Route
Potential Marine Transportation Route
Major Highways
Major Rivers
Western Steller Sea Lion DPS
Eastern Steller Sea Lion DPS
Steller Sea Lion Critical Habitat Area
0 15 30 60 Miles
Map may not represent full species range.
Only includes areas within NMFS Alaska region.
SCALE: 1:3,000,000
DATE: 2018-10-08
VICINITY MAP
PRUDHOE BAY
FAIRBANKS
ANCHORAGE
Cook Inlet
NIKISKI
LIQUEFACTION FACILITIES
MAINLINE PIPELINE
TALKEETNA
ANCHORAGE
VALDEZ
Shelikof Strait
Gulf of Alaska
Bering Sea

Males weigh over 1,200 pounds and females average 580 pounds (ADF&G, 2018). Steller sea lions feed primarily on fish and cephalopods. Single pups are typically born in June and suckle for 1 to 3 years (ADF&G, 2018). Steller sea lion haulouts and rookeries are found on beaches, ledges, and reefs for resting and breeding (NMFS, 2017b). Offshore rookeries are used for breeding during summer months, and haulouts used in winter are typically in more protected areas (ADF&G, 2018).

Threats to Steller sea lions in Alaska include environmental change, disease, pollutants, killer whale predation, disturbance from vessels, illegal take, disease, and entanglement in commercial fisheries and marine debris. The minimum population estimate in Alaska is about 53,000 (Muto et al, 2017). Population trends for Steller sea lions in Alaska vary by location; some regions are increasing in number and some are declining (Muto et al., 2016).

Steller sea lions would be found in vessel transit routes in the Gulf of Alaska, the entrance to Cook Inlet, and through the Aleutian Islands, and individuals may be found near the Marine Terminal. Vessels would pass through critical habitat surrounding haulout or rookery locations at the entrance to Cook Inlet and through the Aleutian Islands.

7.12.2 Effects Analysis

7.12.2.1 Habitat Loss or Degradation

Project-related activities could cause permanent habitat loss or alteration from installation of in-water structures, and temporary foraging loss due to dredging activities.

No known haulouts or rookeries occur near the Marine Terminal, Mainline Pipeline crossing on the eastern side of Cook Inlet, or Kachemak Bay staging area; however, Steller sea lions may occur on land, in the water, or on sea ice in the Project area in Cook Inlet. Steller sea lions may be disturbed by construction activity and noise and avoid these areas.

The Marine Terminal PLF and MOF would cause the permanent loss of about 20 acres of foraging habitat, and the Marine Terminal MOF and dredging would cause the temporary loss of about 81 acres of foraging habitat in Cook Inlet. Steller sea lions could avoid the area immediately around the Marine Terminal Facilities due to the additional disturbance from pile driving, dredging, vessel traffic, and human presence during construction and operation. These habitats could become unsuitable for Steller sea lions due to habitat loss and human activity and would be unavailable for feeding, resting, or transiting.

7.12.2.2 Noise

Complete noise analysis calculation results using the NMFS Technical Guidance and airborne noise guidance are included in appendix L-1 of the EIS. Summaries of Level A and B harassment areas are provided in tables 6.5.2-2 and 6.5.2-3.

Underwater Noise

Noise impacts from transiting vessels would be similar for Steller sea lions as described for the Pacific walrus. Steller sea lions disturbed on haulout or rookery sites will often stampede and rush to the water; calves, sick, and other individuals are often injured or killed (NMFS, 2018b). Cook Inlet has a naturally noisy acoustic environment with anthropogenic noise sources such as vessels, oil platform activities, and aircraft overflights, as well as natural noise sources such as bottom substrate transport by high currents from large tidal fluxes (Blackwell and Greene, 2003). Construction vessel activity would occur in the ice-free summer months. LNG carriers are expected to visit the Marine Terminal year-round.

Some vessels may generate noise that has potential to cause Level B harassment (disturbance) of marine mammals. Vessel noise could cause Steller sea lions to avoid the area near the transiting vessel. No known rookeries or haulouts are near the Kachemak Bay staging area or Marine Terminal; disturbance from vessels for pipelay, anchor handling, or positioning is not expected; however, individual sea lions may occur near the Marine Terminal. Vessel noise could cause Steller sea lions to avoid the area near the transiting vessel. Due to the ephemeral nature of vessels in transit, vessel noise impacts would likely be minor from vessels transiting to and from Project facilities in Cook Inlet during construction and operation.

LNG carriers are expected to visit the Marine Terminal year-round. Some vessels could generate noise that has potential to cause Level B harassment (disturbance) of Steller sea lions. Noise generated by vessels includes propeller cavitation, thrusters, engines, and depth sounders. Of these sources, SPLs associated with LNG carrier docking at the PLF could exceed threshold values for injury or harassment of Steller sea lions. The onset of thruster noise is generally sudden and can cause a startle reaction in nearby marine mammals. Vessel use during Liquefaction Facilities construction and at the Marine Terminal MOF could generate noise at levels that would disturb Steller sea lions.

Impact pile driving would occur for Marine Terminal MOF and PLF construction; removal of the Marine Terminal MOF piles would occur with a vibratory hammer (see appendix L-1 of the EIS). Pile driving, for installation, would occur between April and August. Pile driving at the Marine Terminal MOF and PLF would occur in the ice-free window over a 3-year period; both impact and continuous vibratory pile drivers are planned for use. Steller sea lions would occur in Cook Inlet during the ice-free summer season during pile driving for the Marine Terminal MOF and PLF. Pile driving would cause Level A harassment (injury) to Steller sea lions that are at the source of the noise and up to 486 feet away (see table 6.5.2-2). Pile driving would cause Level B harassment (disturbance) to Steller sea lions between 0.6 mile and 13.4 miles from the activity, depending on the pile type (see table 6.5.2-3).

Shoreline trenches for the Mainline Pipeline in Cook Inlet would be dug by amphibious or barge-based excavators to a depth where a dredge vessel would then be used to complete the trenching. A backhoe dredge or trailing suction hopper dredge could also be used depending on conditions. These vessels would generate continuous and intermittent noise levels. If alternative dredging or burial techniques (such as plowing or jetting) are determined necessary after geotechnical investigations, AGDC would conduct a noise analysis for these methods. Excavation for the Mainline Pipeline would cause Level B harassment (disturbance) from 140 feet to 1.9 miles from the activity (depending on equipment used) for Steller sea lions (see table 6.5.2-3). If DMT should be used in place of trenching at the shoreline, these activities would generate Level B harassment (disturbance) 183 feet from the equipment.

Before conducting pipeline construction in Cook Inlet, AGDC would conduct detailed geophysical surveys using single and multibeam echosounders and side scan sonar to determine the bathymetry of the seafloor where it would install the Mainline Pipeline. Some of these instruments can generate noise at levels that could affect marine mammals (greater than 200 kilohertz). Typically, single beam echosounders operate at frequencies of 3.5 to 750 kilohertz (which have a range that can affect marine mammals), and multibeam echosounders operate at frequencies of 200 to 400 kilohertz (which are not detectable by marine mammals). Echosounders used for geophysical surveys could produce noise that would reach Level B harassment (disturbance) for Steller sea lions near the activity.

Dredging would occur for 4 years at the Marine Terminal MOF in Cook Inlet; both excavator or clamshell mechanical dredge or hydraulic (cutterhead) or mechanical dredgers would be used. Dredging during the open water season would occur in Steller sea lion habitat, and Level B harassment (disturbance) would occur within 140 to 450 feet of the dredging activity (see table 6.5.2-3). As described above for pipeline construction, AGDC would use single and multibeam echosounders before, during, and after dredging. Impacts would be the same as described above.

Airborne Noise

Sources that could cause airborne noise levels above disturbance thresholds for Steller sea lions include pile driving, onshore vehicles, some construction equipment, and aircraft overflights. Table 6.5.2-4 summarizes airborne noise impacts on marine mammals. Airborne sounds over water may affect Steller sea lions when swimming at the surface or when hauled out. These noises could cause startle reactions or stampeding, or cause Steller sea lions to avoid or move away from the areas where the noise is generated.

Airborne noise generated during pile driving would be unlikely to rise to disturbance levels for Steller sea lions unless the animal is immediately adjacent to the activity. Steller sea lions would be anticipated to avoid pile driving activities and would thereby be outside of disturbance thresholds.

Airborne noise generated during general construction activities on land would reach NMFS disturbance levels within 0.2 mile of the activity. No blasting is planned near the Cook Inlet coast for the Mainline Pipeline or Liquefaction Facilities; therefore, no blasting impacts on Steller sea lions would be expected.

Sounds from compressor or heater stations for the Mainline Pipeline would not affect Steller sea lions: the closest facility is Theodore River Heater Station, which is about 8 miles from the Cook Inlet shoreline. Noise from operation of the Liquefaction Facilities would not be expected to reach harmful levels for Steller sea lions; however, individuals may avoid the area immediately around the Marine Terminal Facilities due to the increase in ambient noise.

Most air traffic to support Liquefaction Facilities construction would be for transporting Project personnel to the Kenai Municipal Airport and Ted Stevens Anchorage International Airport. Helicopters would be used for a limited time during construction of a portion of the LNG tank roofs at the Liquefaction Facilities. While small airplanes and helicopters used for the Project may not generate noise levels that reach NMFS disturbance levels, research has shown that marine mammals are affected by aircraft overflights. Effects on Steller sea lions from aircraft noise and disturbance would be similar to those described for bearded seals. Steller sea lions occupying haulouts exhibit variable reactions to aircraft (Calkins, 1979). Approaching aircraft usually frighten some or all animals into the water. Immature sea lions and pregnant females are more likely to enter the water than are territorial males and females with small pups. Over 1,000 animals stampeded off a beach in response to a helicopter greater than 1 mile away (Richardson et al., 1995). Sea lions on haulouts are less responsive to boats, and rarely react unless a boat approaches within 300 to 600 feet (Richardson et al., 1995).

Project-related air traffic would use airstrips in Kenai. Additional aircraft traffic would likely occur due to Project-related activities over Cook Inlet, and would cause additional disturbance to Steller sea lions in Cook Inlet. Pipeline inspections during operation would typically be conducted by aircraft, which could also disturb Steller sea lions in Cook Inlet. Pipeline surveillance overflights for routine pipeline inspections are estimated at 26 flights (helicopter or fixed wing) per year, but would maintain a minimum flight altitude of 1,500 feet over Cook Inlet. At that altitude, received sound levels at the water surface would be below the NMFS threshold value of 120 dB (Nowacek et al., 2007) for continuous sound sources and would result in a minor disturbance of Steller sea lions. Aircraft would generate noise that would cause disturbance to Steller sea lions within about 80 feet (see table 6.5.2-4).

Helipads would be installed for use at construction camps during Mainline Pipeline construction. Kenai Peninsula helipads may have helicopter traffic for construction and operation that could disturb Steller sea lions if in the vicinity during flights. Helipads are planned at Mainline Pipeline MLVs 27, 28, and 29 and at the LNG Plant on the Kenai Peninsula, which would be about 700, 1,500, 800, and 5,000 feet, respectively, from the Cook Inlet shoreline. These helipads would be installed during construction and used during operation to support Mainline Pipeline operation and maintenance.

7.12.2.3 Vessel Strikes

Available data are limited for how often Steller sea lions are struck by vessels; however, vessel strikes leading to injury or death are possible (NMFS, 2018b). Vessel strikes are most likely near rookeries where large numbers of animals are congregating and transiting between habitats (NMFS, 2018b). The total number of vessel trips, vessel types, and typical speeds associated with Project construction and operation is provided in appendix L-2 of the EIS; about 1,243 vessel round trips would occur during construction to Cook Inlet and up to 10, 921 vessel round trips would occur during operations to Cook Inlet. Vessels would transit past two rookeries and ten haulouts at the entrance to Cook Inlet, seven haulouts in Shelikof Strait, and numerous rookeries and haulouts along the Aleutian Islands (see figure 7.12.1-2). Vessels would not transit through shallow waters near the coast where rookeries and haulouts are located, minimizing the risk of vessel strikes.

7.12.2.4 Turbidity/Prey Impacts

Pile driving at the Marine Terminal and Mainline MOF would result in a temporary increase in turbidity. Construction activities for the Liquefaction Facilities' Marine Terminal and the Marine Terminal MOF in Cook Inlet would result in permanent and temporary alteration and destruction of prey habitat from placement of structures on the bottom of Cook Inlet, dredging and dredged material disposal, and shading from permanent structures. Direct impacts from construction excavation in Cook Inlet would include temporary and permanent loss of benthic prey habitat. There would be about 356 acres of prey habitat permanently lost under the Mainline Pipeline, Marine Terminal and Mainline MOFs, the PLF, and shoreline protection; and about 100 acres of prey habitat temporarily affected from anchor drop scars across the Cook Inlet seafloor and dredging.

Construction and removal of the Marine Terminal MOF would disturb benthic habitats and cause a temporary increase in turbidity near the site. Upon removal of the Marine Terminal MOF, the disturbed shoreline could erode due to the active nature of Cook Inlet and the large tidal range and vessel wake activity, causing a loss of fish habitat.

Construction in anadromous fish streams that connect to Cook Inlet could have effects on Steller sea lion prey species and their habitats. In-stream activities could cause increased sedimentation and turbidity, alteration or removal of aquatic habitat cover, streambank erosion, impingement or entrainment of fish and other biota associated with the use of water pumps, downstream scouring, and the potential for spills that could reduce prey availability for Steller sea lions.

7.12.2.5 Spills

Construction and operation of the Mainline Pipeline and Liquefaction Facilities would require fuel transport. Pipeline and materials would be transported to and from various ports in Alaska, and to the Marine Terminal and Mainline MOFs through Steller sea lion habitat. As described for northern sea otter, LNG carriers would call at the Liquefaction Facilities 204 to 360 times per year (see section 6.5.2.3). Potential fuel spills in Steller sea lion habitats could occur from an increase in vessel traffic.

If contaminants spill into the ocean, the material would travel with the currents. Individual Steller sea lions exposed to contaminants could show acute irritation or damage to their eyes, nose, and skin, and respiratory distress from the inhalation of vapors (NMFS, 2017a). Ingestion of contaminants could cause acute irritation to the digestive tract, including vomiting and aspiration into the lungs, which could result in pneumonia or death (NMFS, 2017a).

7.12.2.6 Critical Habitat

Vessels would transit through critical habitat at the entrance to Cook Inlet, Shelikof Strait, and the Aleutian Islands, as described above. Project-related aircraft are not expected to fly over these critical habitat areas. Impacts on critical habitat include vessel noise, disturbance, and potential strikes as described above. Effects on critical habitat would be temporary as vessels transit through these areas, and the risk of a strike would be low. NMFS established and enforces a 3-mile no-transit zone around rookeries (NMFS, 2008b), which would reduce the risk of vessel strikes and interactions with Steller sea lions in these critical habitat zones.

7.12.3 Determination of Effect

The Project **may affect** Steller sea lions because:

- Project activities would occur within Steller sea lion habitat;
- the Project would permanently and temporarily affect Steller sea lion habitat; and
- there is potential for disturbance and spills from Project-related vessel traffic through occupied habitat.

The Project is **not likely to adversely affect** Steller sea lions because:

- use of PSOs would minimize exposures of Steller sea lions to noise disturbances; and
- the risk of potential strikes would be minimized with implementation of vessel traffic conservation measures.

The Project **may affect** Steller sea lion critical habitat because:

- vessels would transit through critical habitat.

The Project is **not likely to adversely affect** critical habitat because:

- vessels would not transit close to shore where rookeries and haulouts are located.

7.13 CHINOOK SALMON

7.13.1 Species Description and Potential Presence in the Action Area

Six Chinook salmon ESUs spawn on the West Coast outside Alaska, but occur in the Project area during the marine phase of their life cycle: Lower Columbia River Spring, Upper Columbia River, Puget Sound, Snake River Fall, Snake River Spring/Fall, and Upper Willamette River. These ESUs are listed as either threatened or endangered (see table 5-1). Critical habitat for Chinook salmon does not occur in Alaska; therefore, it would not be affected by Project-related activities.

Chinook salmon are anadromous fish (migrating from a marine environment to freshwater streams and rivers to spawn); once they mate in freshwater, they die (NMFS, 2017b). Chinook salmon runs can vary depending on the stream or river to which they migrate; they can migrate in spring, summer, fall, late-fall, or winter to freshwater spawning areas (NMFS, 2017b). While in marine environments, they feed on other fish, and while in freshwater or estuarine environments, they feed on terrestrial and aquatic insects and crustaceans (NMFS, 2017b). Chinook salmon from any of the ESUs may be found in vessel transit routes in the Gulf of Alaska, Cook Inlet, the Aleutian Islands, and the Bering Sea and near Project facilities in Cook Inlet during any time of year.

7.13.2 Effects Analysis

7.13.2.1 Noise

Noise effects on fish include behavioral responses, masking, physiological stress responses, hearing loss, injury, and mortality. In addition, percussive effects from activities such as pile driving can damage fish swim bladders and cause temporary or permanent injury. There is evidence that pile driving causes increased acute stress responses and repeated exposure reduces overall fitness of exposed fish (Debusschere et al., 2016).

Direct impacts would include potential mortality/injury to migrating juvenile and adult fish near noise-generating activities. The impacts of sound on marine fish species can be pathological, physiological, and/or behavioral. Pathological effects include physical damage to fish, physiological effects include stress responses, and behavioral effects include changes in fish behavior. Underwater noise effects criteria have been established for fish by the Fisheries Hydroacoustic Working Group (see table 7.13.2-1). The Working Group is a coalition of NMFS; the USFWS; the Federal Highway Administration; Department of Transportation offices from California, Oregon and Washington; and national experts on sound propagation.

TABLE 7.13.2-1

Fish Injury and Disturbance Thresholds for Underwater Sound

Fish Size	Behavior Effects Threshold	Injury Effects Threshold
Fish ≥ 2 grams	150 dB_{rms}	187 dB Cumulative SEL
Fish < 2 grams	150 dB_{rms}	183 dB Cumulative SEL
Fish all sizes	150 dB_{rms}	Peak 206 dB

Source: Fisheries Hydroacoustic Working Group, 2008; California Department of Transportation, 2009
dB_{rms} = decibels root mean square; SEL = sound exposure level

The onset of physical injury is determined by peak pressure and SEL. Adverse behavioral effects are measured using the root mean square threshold. For pile driving, root mean square is the square root of the mean square of a single pile driving impulse pressure event. For the purposes of this report, the underwater area of effect is defined as those areas exposed to underwater noise where behavioral modifications to species may be expected. Underwater sound from pile driving would be expected to extend to the point where the sound intersects a land mass or where it is reduced to background levels.

Pile-driving techniques have been shown to cause serious injury to nearby fish, damaging swim bladders and causing barotrauma and temporary hearing loss (Wenger et al., 2017; Popper and Hastings, 2009; Halvorsen et al., 2012). Adult Chinook salmon could experience injury from underwater activities at the source of the activity (e.g., vibratory pile driving, dredging, and vessel traffic), and up to 242 feet from impact pile driving (see appendix L-1 of the EIS). Fish are most likely to experience behavioral effects, such as moving away from the source of the noise, and reduced ability to find prey or avoid predators due to masking of natural sounds (Dickerson et al., 2001). Behavioral effects could occur from underwater activities for adult fish at the source of the activity (e.g., dredging) and up to 13.4 miles from impact pile driving (see appendix L-1 of the EIS). Installing each pile is estimated to take 1 to 2 hours; 478 piles and over 6,600 feet of sheet piling would be installed (see appendix L-1 of the EIS). The long duration of noise impacts from these activities in the same area over multiple years could make the habitat unsuitable for fish use during construction.

Sound generated by vessels could also have negative impacts on fish. The total number of vessel trips associated with Project construction and operation is provided in appendix L-2 of the EIS. Fish have been shown to react when engine and propeller sounds exceed a certain level (Ona and Godø, 1990). Avoidance reactions have been observed in fish such as cod and herring when vessel sound levels were 110 to 130 dB (Ona and Godø, 1990). Others have found that fish may be attracted to stationary vessels (silent, engines running, and in dynamic-positioning) and vessels underway (Røstad et al., 2006). Any avoidance reactions would last minutes longer than the vessel is at a location, and would be limited to a relatively small area (Mitson and Knudsen, 2003; Ona et al., 2007). Sound from bow thruster operation, dredging, and anchor handling during Mainline Pipeline pipelay across Cook Inlet could potentially affect fish. When activated, in-hull bow thrusters produce large bursts of cavitation sound.

Sound levels associated with vessel activity are included in appendix L-1 of the EIS. Fish exposed to unnatural sounds are expected to avoid the area of active pipelay. This is not expected to cause a significant impact on fish in Cook Inlet since the area is mostly a transition zone to other river locations and similar to the sounds now taking place in Cook Inlet. Cook Inlet is a relatively industrialized area in Alaska, subject to routine sound-generating activities such as dredging, gas and oil drilling, marine seismic surveys, pile driving, and vessels (as reviewed in Norman, 2011). Ambient sound levels measured away from industrial areas in Cook Inlet averaged 95 dB re 1 μPa, but reached as high as 124 dB re 1 μPa. Measurements as high as 149 dB re 1 μPa have been measured within Knik Arm (Blackwell and Greene, 2003).

Sound from routine Marine Terminal operation would be associated with LNG carrier operations, including hoteling, maneuvering, and tug vessels when moored to the Marine Terminal. Sound generated by LNG carriers could have negative impacts on fish; calculated and modeled sound levels for these activities are between 170 and 185 dB at the source (McKenna et al., 2012; McCrodan and Hannay, 2013). Due to the noise generated by the LNG carriers and supporting tugs visiting the Marine Terminal, behavioral noise effects on fish would be expected to occur within about 328 feet around the Marine Terminal, making this habitat less preferable for Chinook salmon for the life of the Project (McCrodan and Hannay, 2013). The greatest effect on fish resources would be noise from vessels during migratory periods. No blasting is planned within or near Cook Inlet; therefore, noise impacts from blasting on Chinook salmon would not occur.

7.13.2.2 Spills

Spills could occur during construction and operation Project-wide. A spill could potentially reach marine fisheries during operation from a fuel leak from an LNG carrier, a leak from the fuel line at the Mainline MOF, or a leak from fuel and chemical storage facilities at the Liquefaction Facilities. The increase in vessel traffic would result in an increased risk of spills in marine fish habitats. Vessels associated with Liquefaction Facilities operations would include LNG carriers and four to five assist tugs used for docking and undocking, vessel escorts, ice management, and firefighting.

The chemicals released during spills could have acute fish impacts, such as altered behavior, changes in physiological processes, or changes in food sources. Fish also could experience greater mortality if a large volume of hazardous liquid is spilled into a waterbody. Minor releases of hydrocarbons (e.g., diesel fuel, lubricants) could result in short-term, minor, direct adverse impacts on juvenile and adult fish, including death or chronic effects.

Spills would be expected to have acute effects on fish proximate to the spill location and could lead to fish avoidance of the area. Spills that move from the spill location would have a higher potential to affect more fish and more habitat over a longer distance.

All waste generated from construction would be handled in accordance with the Project Waste Management Plan. All hazardous waste and contaminated soils would be stored at collection sites until they could be transported to the Lower 48 for disposal. To prevent and mitigate against inadvertent contamination from waste, AGDC would properly contain all waste in upland areas until disposal.

7.13.3 Determination of Effect

The Project **may affect** Chinook salmon ESUs because:

- Project activities would occur within Chinook salmon habitat; and
- there is potential for disturbance and spills from Project-related vessel traffic.

The Project is **not likely to adversely affect** Chinook salmon ESUs because:

- noise impacts on suitable habitat would occur in a small area compared to the available habitat within Cook Inlet; and
- implementation of the Project SPCC Plan would minimize the risk of a spill reaching occupied habitat.

7.14 STEELHEAD TROUT

7.14.1 Species Description and Potential Presence in the Action Area

Six steelhead trout DPSs spawn on the West Coast outside Alaska, but occur in the Project area during the marine phase of their life cycle: Lower Columbia River, Middle Columbia River, Upper Columbia River, Puget Sound, Snake River Basin, and Upper Willamette River. These DPSs are listed as either threatened or endangered (see table 5-1). Critical habitat for steelhead trout does not occur in Alaska; therefore, it would not be affected by Project-related activities.

Steelhead trout are anadromous fish (migrating from a marine environment to freshwater streams and rivers to spawn); unlike Chinook salmon, steelhead trout can mate more than once (NMFS, 2017b). Steelhead trout can mature in the ocean or in freshwater rivers (NMFS, 2017b). Young fish feed on zooplankton, and adults feed on aquatic and terrestrial invertebrates, mollusks, crustaceans, fish eggs, and other fish (NMFS, 2017b). Steelhead trout runs occur in either winter or summer, depending on the DPS. Steelhead trout from any of the DPSs may be found in vessel transit routes in the Gulf of Alaska and Cook Inlet and near Project facilities in Cook Inlet during any time of year.

7.14.2 Effects Analysis

7.14.2.1 Noise

Noise effects on steelhead trout would be similar as described above for Chinook salmon. Adult steelhead trout could experience injury from underwater activities at the source of the activity (e.g., vibratory pile driving, dredging, and vessel traffic), and up to 242 feet from impact pile driving (see appendix L-1 of the EIS). Fish are most likely to experience behavioral effects, such as moving away from the source of the noise, and a reduced ability to find prey or avoid predators due to masking of natural sounds (Dickerson et al., 2001). Behavioral effects could occur from underwater activities for adult fish at the source of the activity (e.g., dredging) and up to 13.4 miles from impact pile driving (see appendix L-1 of the EIS).

7.14.2.2 Spills

Impacts from spills on steelhead trout would be similar to those described for Chinook salmon in section 7.13.2.2.

7.14.3 Determination of Effect

The Project **may affect** steelhead trout DPSs because:

- there is potential for disturbance and spills from Project-related vessel traffic in steelhead trout habitat.

The Project is **not likely to adversely affect** steelhead trout DPSs because:

- noise impacts on suitable habitat would occur in a small area compared to the available habitat within Cook Inlet; and
- implementation of the Project SPCC Plan would minimize the risk of a spill reaching occupied habitat.

8.0 CONCLUSION

Thirty-one federally listed species, DPSs, or ESUs, and one candidate for listing that potentially occur in the Project action area could be affected by construction and operation. Table 8-1 summarizes the determinations of effect for each of the species. Six species could be adversely affected (spectacled eider, polar bear, Cook Inlet beluga whale, humpback whale, bearded seal, and ringed seal). The Project action area crosses designated critical habitat for seven species and could affect designated critical habitat for two species. Based on the current Project design and avoidance, minimization, and mitigation measures, we conclude that the Project is compliant with the requirements of the ESA and is not likely to jeopardize the continued existence of a listed species or result in adverse modification of designated critical habitat.

TABLE 8-1

Summary of the Determinations of Effect Associated with the Project

Species	Federal Status, Designated Critical Habitat (DCH)	Determination of Effect (species/critical habitat)
U.S. Fish and Wildlife Species		
Birds		
Alaska-breeding Steller's eider	Threatened, DCH	NLAA/NLAA
Eskimo curlew [a]	Endangered	No effect
Short-tailed albatross	Endangered	NLAA
Spectacled eider	Threatened, DCH	LAA/NLAA
Mammals		
Northern sea otter, Southwest Alaska DPS	Threatened, DCH	NLAA/NLAA
Pacific walrus	Previous Candidate	N/A
Polar bear	Threatened, DCH	LAA/LAA
Wood bison	Threatened; Experimental	No effect
National Marine Fisheries Service Species		
Mammals		
Bearded seal	Threatened	LAA
Blue whale	Endangered	NLAA
Bowhead whale	Endangered	NLAA
Cook Inlet beluga whale	Endangered, DCH	LAA/LAA
Fin whale	Endangered	NLAA
Gray whale, Western North Pacific DPS	Endangered	NLAA
Humpback whale, Western North Pacific DPS [a]	Endangered	LAA
North Pacific right whale	Endangered, DCH	NLAA/NLAA
Ringed seal	Threatened	LAA
Sei whale	Endangered	NLAA
Sperm whale	Endangered	NLAA
Steller sea lion (western DPS)	Endangered, DCH	NLAA/NLAA
Fish		
Chinook salmon ESUs [c]		
Lower Columbia River Spring	Threatened	NLAA
Upper Columbia River	Endangered	NLAA
Puget Sound	Threatened	NLAA
Snake River Fall	Threatened	NLAA
Snake River Spring/Fall	Threatened	NLAA
Upper Willamette River	Threatened	NLAA

TABLE 8-1

Summary of the Determinations of Effect Associated with the Project

Species	Federal Status, Designated Critical Habitat (DCH)	Determination of Effect (species/critical habitat)
Steelhead Trout DPSs [b]		
Lower Columbia River	Threatened	NLAA
Middle Columbia River	Threatened	NLAA
Upper Columbia River	Endangered	NLAA
Puget Sound	Threatened	NLAA
Snake River Basin	Threatened	NLAA
Upper Willamette River	Threatened	NLAA

Sources: NMFS, 2017b, 2018b; USFWS, 2018a

N/A = Not applicable; NLAA = Not Likely to Adversely Affect; LAA = Likely to Adversely Affect

[a] Considered extirpated.

[b] Fish/stocks (ESU/DPS) spawn on the West Coast outside Alaska, but could occur in Lower Cook Inlet, Gulf of Alaska, Aleutian Island, and Bering Sea waters during the marine phase of their life cycle.

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