ALASKA LNG

DOCKET NO. CP17-___-000
APPLICANT-PREPARED BIOLOGICAL ASSESSMENT

USAI-P2-SRZZZ-00-000008-000

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ACRONYMS AND ABBREVIATIONS

ABBREVIATION	DEFINITION
Abbreviations for Units of Measurement	
dB	decibels
dBA	A-weighted decibels
rms	root mean square
μPa	micropascals
Other Abbreviations	**Other Abbreviations**
ATBA	Areas to be avoided
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
Applicant	Alaska Gasline Development Corporations
ATWS	additional temporary workspace
BA	Biological Assessment
BCP	Beaufort Coastal Plain Ecoregion
BIA	Biologically Important Area
BO	Biological Opinion
C.F.R.	Code of Federal Regulations
CGF	Central Gas Facility
CWT	Coded Wire Tag
CV	coefficient of variation
DPS	Distinct Population Segment
EFH	Essential Fish Habitat
ENP	Eastern North Pacific
EEZ	Exclusive Economic Zone
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FERC	United States Department of Energy, Federal Energy Regulatory Commission
GTP	Gas Treatment Plant
HLV	Heavy Lift Vessel
IHA	Incidental Harassment Authorization
IPHC	International Pacific Halibut Commission
ITR	Incidental Take Regulation
LNGC	liquefied natural gas carrier
MLBV	Mainline block valve
MLLW	Mean Lower Low Water
MMPA	Marine Mammal Protect Act
MOA	Municipality of Anchorage
MOF	material offloading facility
MP	milepost
MTRP	Marine Terminal Redevelopment Project
NMFS	National Oceanic and Atmospheric Administration, National Marine Fisheries Service

ABBREVIATION	DEFINITION
PLF	product loading facility
Project	Alaska LNG Project
PBR	potential biological removal
PBTL	Prudhoe Bay Gas Transmission Line
PBU	Prudhoe Bay Unit
PCE	primary constituent elements
POA	Port of Anchorage
POC	Plan of Cooperation
POP	persistent organic pollutant
PSO	protected species observer
PTT	permanent threshold shift
PTTL	Point Thomson Gas Transmission Line
PTU	Point Thomson Unit
ROW	right-of-way
SBS	Southern Beaufort Sea (stock or subpopulation of polar bears)
SE	Standard Error
SPCC Plan	Spill Prevention, Control, and Countermeasure Plan
STP	seawater treatment plant
TTS	temporary threshold shift
U.S.	United States
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USFWS	United States Department of the Interior, Fish and Wildlife Service
VSM	vertical support member
WNP	Western North Pacific
WPCF	Water Pollution Control Facility
ZID	zone of initial dilution
ZOI	zone of influence

1.0 INTRODUCTION

The following document is an applicant-prepared Biological Assessment (BA) for the Alaska LNG Project (Project) prepared in accordance with Section 7(c) of the Endangered Species Act (ESA). The document has seven main sections. Section 1 provides an overview of the Project, a summary of the consultation process to date, and a summary of the findings. Section 2 is a description of the Project and the action area. Descriptions of the evaluated species and critical habitats are provided in Section 3, and environmental baselines for these resources are presented in Section 4. Potential effects of the Project on the evaluated species are described in Section 5, and preliminary determinations of the effects of the Project on the species and critical habitats are presented in Section 6. Section 7 is a list of cited references. This draft BA is based upon the proposed Project design and will be updated with agency review, comment, and additional information on Project design for the Federal Energy Regulatory Commission (FERC) application.

1.1 OVERVIEW

The Alaska Gasline Development Corporation (Applicant) plans to construct one integrated liquefied natural gas (LNG) Project (Project) with interdependent facilities for the purpose of liquefying supplies of natural gas from Alaska, in particular from the Point Thomson Unit (PTU) and Prudhoe Bay Unit (PBU) production fields on the Alaska North Slope (North Slope), for export in foreign commerce and for in-state deliveries of natural gas.

The Natural Gas Act (NGA), 15 U.S.C. § 717a(11) (2006), and Federal Energy Regulatory Commission (FERC) regulations, 18 C.F.R. § 153.2(d) (2014), define “LNG terminal” to include “all natural gas facilities located onshore or in State waters that are used to receive, unload, load, store, transport, gasify, liquefy, or process natural gas that is ... exported to a foreign country from the United States.” With respect to this Project, the “LNG Terminal” includes the following: a liquefaction facility (Liquefaction Facility) in Southcentral Alaska; an approximately 807-mile gas pipeline (Mainline); a gas treatment plant (GTP) within the PBU on the North Slope; an approximately 63-mile gas transmission line connecting the GTP to the PTU gas production facility (PTU Gas Transmission Line or PTTL); and an approximately 1-mile gas transmission line connecting the GTP to the PBU gas production facility (PBU Gas Transmission Line or PBTL). All of these facilities are essential to export natural gas in foreign commerce and will have a nominal design life of 30 years.

Section 7(a)(2) of the Endangered Species Act (ESA) obligates each federal agency to ensure, through consultation with the Services – the National Marine Fisheries Service (NMFS) and/or the U.S. Fish and Wildlife Service (USFWS) – that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat. The action agency or its representative must prepare a biological assessment (BA) under ESA Section 7, 16 U.S.C. § 1536, for major construction projects that may affect listed species or their critical habitat. FERC, the action agency, has appointed the Applicant as its non-federal representative for purposes of carrying out informal consultation under the ESA. This BA was prepared based on the best scientific and commercial data available, and is consistent with the requirements of 50 C.F.R. § 402.12.

1.2 CONSULTATION HISTORY

Project construction and operation may affect species and habitats protected under the ESA. A summary of public, agency, and stakeholder engagement conducted by the Applicant is provided in Resource Report No. 1, Appendix D. Meetings and correspondence, specific to fish, wildlife, and vegetation from that list are summarized in Resource Report No. 3, Table 3.1.2-1 for federal agencies and Table 3.1.2-2 for state agencies, respectively. The following summarizes the

Applicant's agency correspondence related to protected species potentially occurring within the Project area and preparation of this BA:

- **October 2014, Multiple Agencies:** The Applicant sent initial informal consultation letters to NMFS, USFWS, Bureau of Land Management (BLM), Alaska Department of Fish and Game (ADF&G), and Alaska Natural Heritage Program to request input on listed species and designated critical habitats potentially occurring within the Project area.
- **December 1, 2014, USFWS:** The Applicant received a list of ESA protected species and critical habitat occurring within the study area.
- **January 30, 2015, NMFS:** The Applicant received a list of ESA, essential fish habitat (EFH), and Marine Mammal Protection Act (MMPA) protected species and critical habitat occurring within the action area, including associated shipping activities in shipping corridors in the Beaufort Sea, Cook Inlet, and Gulf of Alaska.
- **April 24, 2015, NMFS:** The Applicant participated in a meeting with NMFS to discuss the outline for the applicant-prepared BA.
- **May 26, 2015, USFWS:** The Applicant participated in a meeting with USFWS to discuss the outline for the applicant-prepared BA.
- **August 17, 2016, NMFS**: The Applicant participated in a meeting with NMFS to discuss the second draft of the BA and EFH Assessment.
- **August 22, 2016, NMFS**: The Applicant participated in a meeting with USFWS to discuss the second draft of the BA and EFH Assessment.

1.3 SPECIES EVALUATED AND FINDINGS

Thirty-one federally-listed species, Distinct Population Segments (DPSs), or Evolutionarily Significant Units (ESUs), one candidate for listing, and two previously listed species were identified by the Services as potentially occurring in the action area (NMFS, 2015a; USFWS, 2014a). These species are listed in Table 1, which also summarizes the results of the effects determinations.

TABLE 1

Summary of Federally Listed and Proposed Threatened, Endangered, and Candidate Species Potentially Occurring in the Project Action Area with Preliminary Findings

Common Name with DPS or ESU	Scientific Name	Federal Status	Detailed Analysis	Preliminary Findings[a] Species/Critical Habitat
MARINE MAMMALS – Whales				
Beluga Whale, Cook Inlet DPS	*Delphinapterus leucas*	Endangered	Yes	LAA /NLAA
Blue Whale	*Balaenoptera musculus*	Endangered	No	NLAA/ND
Bowhead Whale	*Balaena mysticetus*	Endangered	Yes	NLAA/ND
Fin Whale	*Balaenoptera physalus*	Endangered	No	NLAA/ND
Gray Whale, Western North Pacific DPS	*Eschrichtius robustus*	Endangered	No	NLAA/ND
Humpback Whale, Western North Pacific DPS	*Megaptera novaeangliae*	Endangered	No	NLAA/ND
Humpback Whale, Mexico DPS	Megaptera novaeangliae	Threatened	No	NLAA/ND
North Pacific Right Whale	*Eubalaena japonica*	Endangered	No	NLAA/NLA
Sei Whale	*Balaenoptera borealis*	Endangered	No	NLAA/ND

TABLE 1

Summary of Federally Listed and Proposed Threatened, Endangered, and Candidate Species Potentially Occurring in the Project Action Area with Preliminary Findings

Common Name with DPS or ESU	Scientific Name	Federal Status	Detailed Analysis	Preliminary Findings[a] Species/Critical Habitat
Sperm Whale	*Physeter microcephalus*	Endangered	No	NLAA/ND
MARINE MAMMALS – Pinnipeds and Other				
Arctic Ringed Seal	*Phoca hispida*	None[b]	Yes	LAA/ND
Bearded Seal, Beringia DPS	*Erignathus barbatus nauticus*	None[c]	Yes	LAA/ND
Steller Sea Lion, Western DPS	*Eumetopias jubatus*	Endangered	Yes	NLAA/NLAA
Pacific Walrus	*Odobenus rosmarus divergens*	Candidate	Yes	NLAA/ND
Northern Sea Otter, Southwest Alaska DPS	*Enhydra lutris kenyoni*	Threatened	Yes	NLAA/NLAA
Polar Bear	*Ursus maritimus*	Threatened	Yes	LAA/LAA
TERRESTRIAL MAMMALS				
Wood Bison, Nonessential Exp. Population	*Bison athabascae*	Threatened	No	No Effect/ND
BIRDS				
Eskimo Curlew	*Numenius borealis*	Endangered	No	No Effect/ND
Short-tailed Albatross	*Phoebastria albatrus*	Endangered	No	NLAA/ND
Spectacled Eider	*Somateria fischeri*	Threatened	Yes	LAA/NLAA
Steller's Eider, Alaska-breeding Population	*Polysticta stelleri*	Threatened	Yes	NLAA/NLAA
FISH				
Chinook Salmon ESUs	*Oncorhynchus tshawytscha*			
Lower Columbia River Spring[d]		Threatened	No	NLAA/No Effect
Upper Columbia River Spring[d]		Endangered	No	NLAA/No Effect
Puget Sound[d]		Threatened	No	NLAA/No Effect
Snake River Fall[d]		Threatened	No	NLAA/No Effect
Snake River Spring/Summer[d]		Threatened	No	NLAA/No Effect
Upper Willamette River Spring[d]		Threatened	No	NLAA/No Effect
Steelhead Trout DPSs	*Oncorhynchus mykiss*			
Lower Columbia River[d]		Threatened	No	NLAA/No Effect
Middle Columbia River[d]		Threatened	No	NLAA/No Effect
Upper Columbia River[d]		Endangered	No	NLAA/No Effect
Puget Sound[d]		Threatened	No	NLAA/No Effect
Snake River Basin[d]		Threatened	No	NLAA/No Effect
Upper Willamette River[d]		Threatened	No	NLAA/No Effect

Source: NMFS, 2015a; USFWS, 2014a

DPS = Distinct Population Segment, ESU = Evolutionarily Significant Unit

[a] NLAA – May affect, not likely to adversely affect
LAA – May affect, likely to adversely affect.

TABLE 1

Summary of Federally Listed and Proposed Threatened, Endangered, and Candidate Species Potentially Occurring in the Project Action Area with Preliminary Findings

Common Name with DPS or ESU	Scientific Name	Federal Status	Detailed Analysis	Preliminary Findings[a] Species/Critical Habitat

ND – No critical habitat designated

[b] On March 11, 2016, the U.S. District Court for the District of Alaska issued a memorandum decision in a lawsuit challenging the listing of ringed seals under the ESA (Alaska Oil and Gas Association v. National Marine Fisheries Service et al., Case No. 4:14-cv-00029-RPB; North Slope Borough v. Pritzker et al., Case No. 4:15-cv-0000w-RPB; and State of Alaska v. National Marine Fisheries Service et al., Case No. 4:15-cv-00005-RPB). The consolidated decision vacated NMFS's listing of the Arctic ringed seal as a threatened species.

[c] On July 25, 2014, the U.S. District Court for the District of Alaska issued a memorandum decision in a lawsuit challenging the listing of bearded seals under the ESA (Alaska Oil and Gas Association v. Pritzker, Case No. 4:13-cv-00018-RPB). The decision vacated NMFS's listing of the Beringia DPS of bearded seals as a threatened species. NMFS filed an appeal for that decision in May 2015.

[d] These fish stocks spawn on the West Coast outside of Alaska, but may occur in lower Cook Inlet and Gulf of Alaska waters during the marine phase of their life cycle.

1.4 MAGNUSON-STEVENS FISHERY CONSERVATION ACT SUMMARY

Essential Fish Habitat (EFH) consultation is also being conducted for the Project between FERC and NMFS per requirements of the Magnuson-Stevens Fishery Conservation Act. A draft EFH assessment report is included in Resource Report No. 3, Appendix D. The draft assessment report concludes that the potential direct and indirect effects of the Project construction and operation on both marine EFH and EFH species would be minor. This is due to the minor, localized nature of the proposed actions in Cook Inlet and Prudhoe Bay, the temporary nature of effects in each construction season, and implementation of mitigation measures.

Freshwater EFH and EFH species would be encountered most commonly in the southern portion of the Project area. This is an area where ice-rich soils are less common and surface water sources necessary for construction are more available throughout the year. Short-term, localized effects during construction would be likely, but most seasonally sensitive habitats would be avoided through the timing of winter construction. This would include implementation of out-of-sequence stream crossing construction at some sites to ensure construction occurs during the most benign period of the year for fish resources. Perturbation to sensitive fish overwintering and spawning areas could have longer-term effects of increased magnitude. Identification of important spawning and overwintering habitats would be continued through coordination with agency personnel and resource specialists. Once overwintering areas are identified in relation to proposed crossing locations, appropriate mitigation measures can be developed.

2.0 PROJECT DESCRIPTION

A full description of the Project is provided in Resource Report No. 1 and the follow-on sections. This report concerns only activities associated with the construction and operation of the Project that could have direct or indirect effects on listed species. These components are:

- Construction and operation of the Marine Terminal in Cook Inlet;
- Construction and operation of the Mainline onshore, GTP, and GTP associated facilities (including West Dock modifications, , mine/reservoir site, roads, and laydown areas) when within areas used by spectacled eiders, Steller's eiders, and polar bears (MP 0-62);
- Construction and operation of the Mainline across Cook Inlet, including modification and use of an existing dock on the west side of Cook Inlet (or construction of a new MOF);
- Construction and operation of the PTTL;
- Vessel traffic associated with construction and operation of the Project in Cook Inlet, Gulf of Alaska, Bering Sea, Chukchi Sea, and the Beaufort Sea; and
- Non-jurisdictional facilities on the North Slope.

These Project components are depicted in Figures 1 through 4 and described in the following sections.

PROJECT ACTION AREA

FIGURE 1

ALASKA LNG

LEGEND

- Project Facility
- Existing Facility
- Alaska Place Names
- Alaska LNG Rev C2 Route
- Potential Marine Transportation Routes
- Action Area
- Hanna Shoal Walrus Use Area
- Polar Bear Proposed Critical Habitat - USFWS

Spectacled Eider Birds/mi2

- 0 - 0.028
- 0.028 - 0.111
- 0.111 - 0.236
- 0.236 - 0.425
- 0.425 - 1.647

Areas to be Avoided

- ATKA ATBA
- Amchitka ATBA
- East ATBA
- Unalaska ATBA
- West ATBA

Critical Habitat Area

- Northern Sea Otter
- Spectacled Eider
- Steller's Eider
- Steller Sea Lion
- North Pacific Right Whale

0 40 80 160 Miles

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

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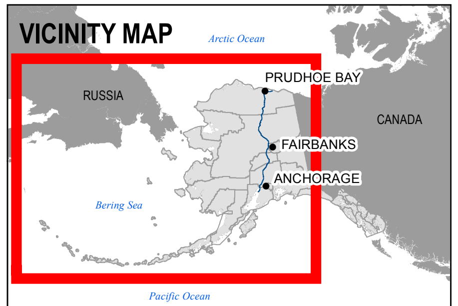
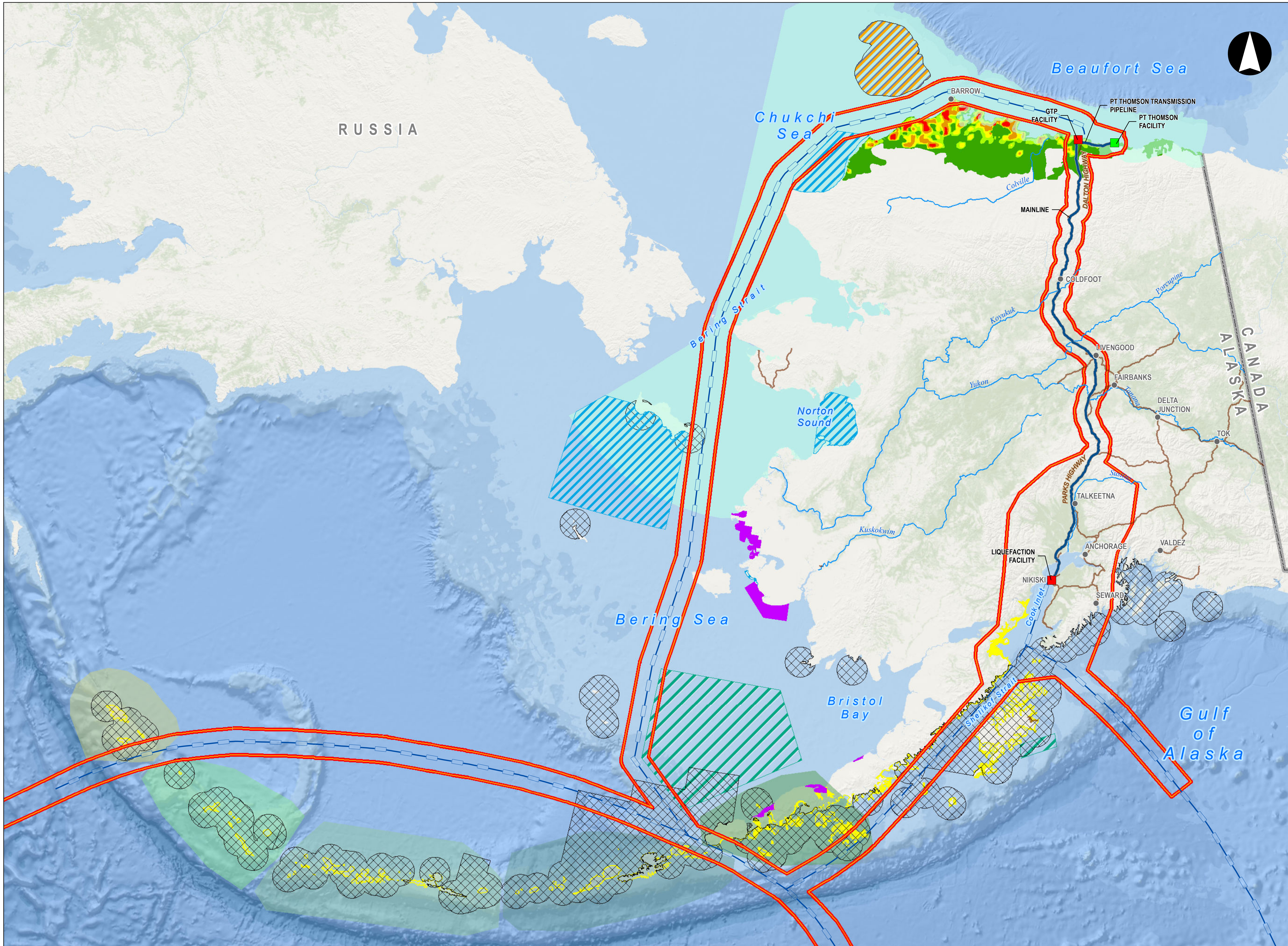
VICINITY MAP





LOCATION OF THE PROPOSED PROJECT MARINE TERMINAL

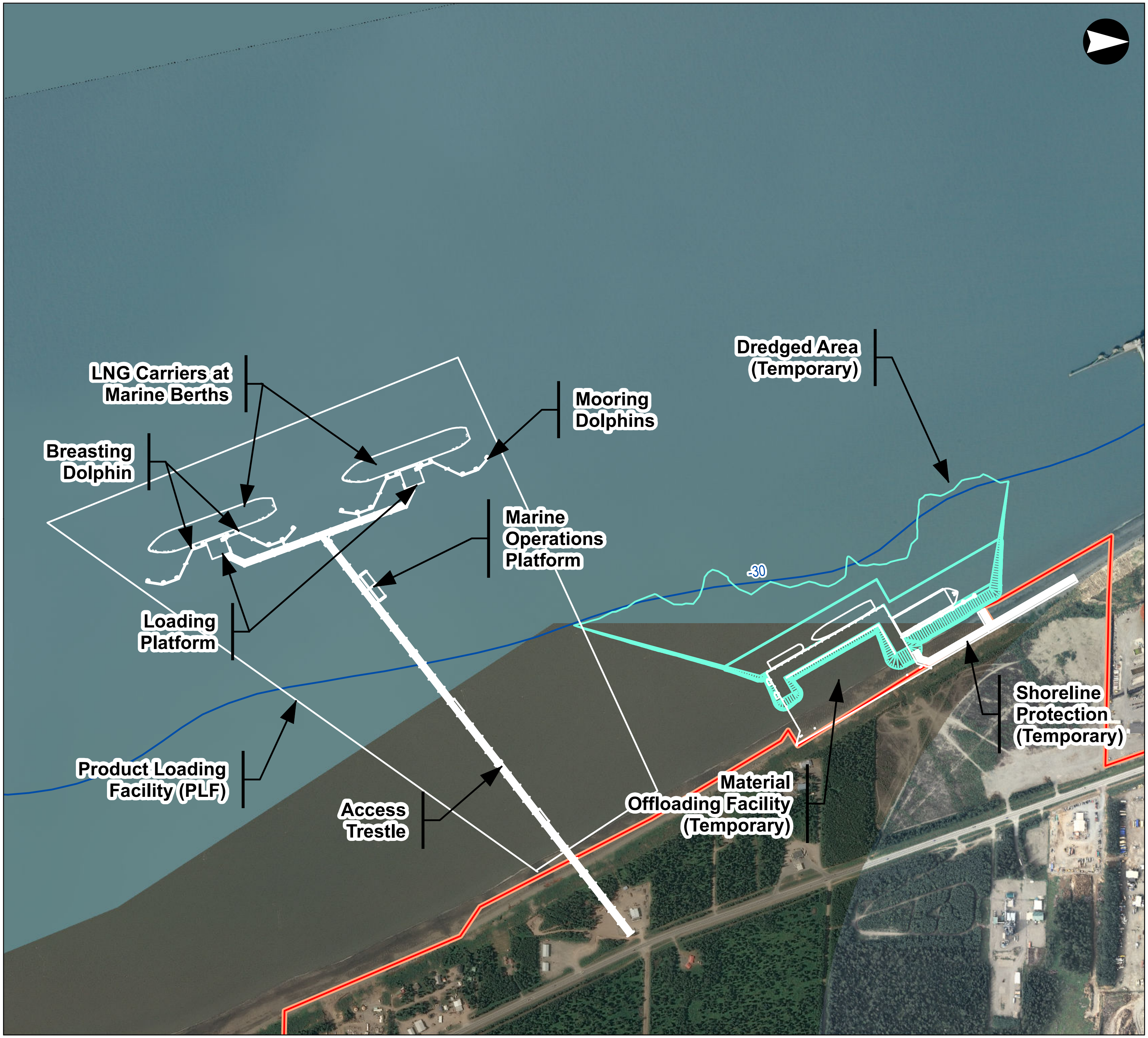
FIGURE 2

ALASKA LNG

LEGEND

- 30 foot Bathymetry Contour from Project Surveys
- LNG Marine Facility
- MOF Dredging Area
- Proposed Plant Boundary

0 250 500 1,000 Feet



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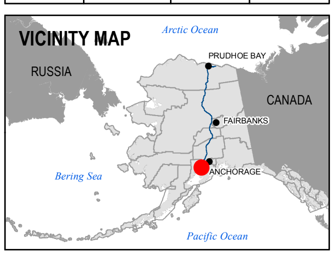
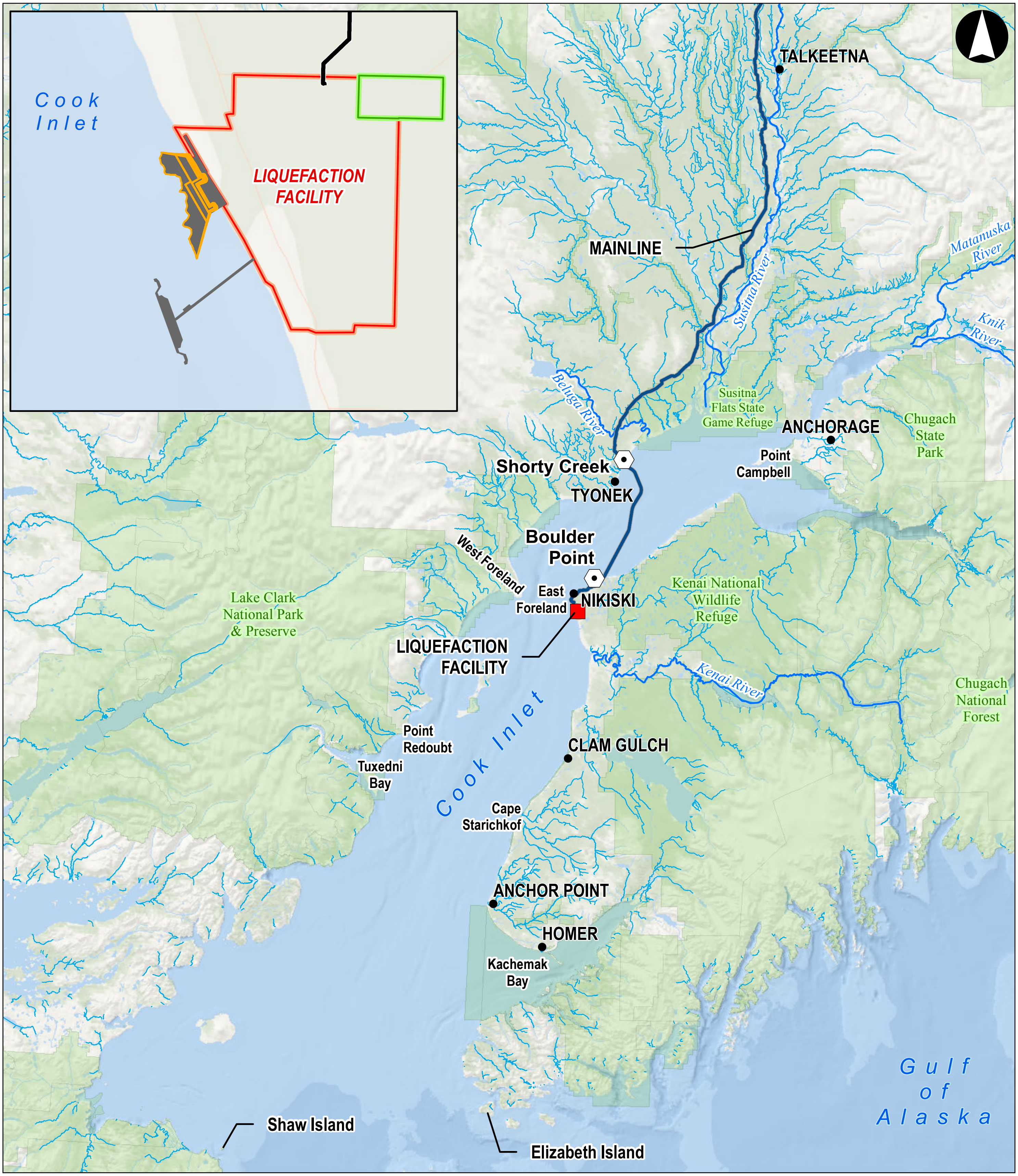
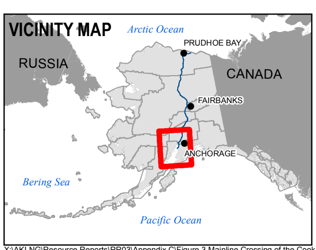


X:\AKLNG\Resource Reports\RR03\Appendix C\Figure 2 Location of the Proposed Project Marine Terminal.mxd





LEGEND

- Alaska Place Names
- Project Facility
- Crossing Point
- Alaska LNG Rev C2 Route
- Anadromous Waters
- Major Rivers
- Dredge
- State and Federal Conservation Lands
- Marine Facility

Liquefaction Facility

- LNG Operations Area
- LNG Construction Camp

0 10 20 40 Miles

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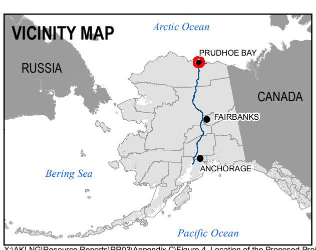
MAINLINE CROSSING OF THE COOK INLET

FIGURE 3

ALASKA LNG

X:\AKLNG\Resource Reports\RR03\Appendix C\Figure 3 Mainline Crossing of the Cook Inlet.mxd

VICINITY MAP



LEGEND

- Mainline Rev C2 Route
- Point Thomson Transmission Pipeline
- Existing Infrastructure

GTP Facility

- Facility
- Study Area

0 0.5 1 2 Miles

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LOCATION OF THE PROPOSED PROJECT WEST DOCK MODIFICATIONS

FIGURE 4

ALASKA LNG

X:\AKLNG\Resource Reports\RR03\Appendix C\Figure 4 Location of the Proposed Project West Dock Modifications.mxd

2.1 MARINE TERMINAL

The Marine Terminal would be constructed adjacent to the LNG Plant in Cook Inlet and would allow LNGCs to dock and load LNG. As shown in Figure 2, marine facilities would include:

- Product loading facility (PLF), which would support the piping that delivers LNG from shore to LNGCs and include all of the equipment to dock LNGCs. No dredging would be required to construct or operate the PLF.
- Material offloading facility (MOF), which would be a dock used during Project construction to enable direct deliveries of modules, materials, equipment, and other cargo to minimize the transport of large and heavy loads over road infrastructure. Dredging would be required to operate the MOF during construction.

The PLF would be a permanent facility for the duration of the LNG export operations. The MOF consists of temporary facilities that would be removed during operations of the LNG Plant

The schedule for Marine Terminal offshore construction activities is based on using ice-free working windows in Cook Inlet from approximately April 1 through October 31. Land required for construction and operation of the Marine Terminal is indicated in Table 2.

TABLE 2

Land Required for Construction and Operation of the Marine Terminal

Facility	Land Affected During Construction (acres) [a]	Land Affected During Operation (acres)
Temporary MOF	11.32 [a]	0.00
Temporary MOF Dredging Area	50.70 [a]	0.00
Dredge Disposal Area	1,200	0.00
Shoreline Protection	1.54	0.00
PLF	18.67	18.67
Marine Terminal Total	1,282.23	20.21

[a] Construction acreages include operational areas
[b] The temporary MOF footprint totals 28.3 acres; however, 16.98 acres is included within the MOF dredging footprint.

2.1.1 Product Loading Facility (PLF)

2.1.1.1 Use of the PLF

The purpose of the PLF would be to load LNGCs for export from Nikiski. Based on a nominal 176,000-cubic-meter LNGC design vessel, approximately 21 vessel visits per month would be required to export the produced LNG. The LNGCs would range in size between 125,000 cubic meters (approximately 30 vessel visits per month) and 216,000 cubic meters (approximately 17 vessel visits per month).

2.1.1.2 Ballast and Cooling Water Discharges

LNGCs calling at the Marine Terminal would be carrying ballast water (sea water) upon arrival to Cook Inlet. The ballast water would have been exchanged in international waters according to regulatory requirements. As LNG would be loaded onto the LNGCs at the Marine Terminal, the LNGCs would release the ballast water, thereby replacing the sea water with LNG product as ballast to maintain stability of the LNGC during transit. Approximately 2.9–3.2 billion gallons of ballast water would be discharged per year from LNGCs during LNG loading operations at the Marine Terminal, with the range in annual discharge volume due to varying LNGC sizes and number of voyages which may call at the Marine Terminal (204 to 360 LNGCs per year). The water discharged would be approximately 0-25 degrees Fahrenheit warmer than ambient water temperature in Cook Inlet. Ballast water discharged in Cook Inlet would be treated according to US regulations.

Approximately 1.6-2.4 billion gallons of sea water per year may be taken in and discharged by LNGCs as cooling water while at the Marine Terminal (204 to 360 LNGCs per year). The water would undergo minimal filtration upon intake and support a non-contact heat exchange process to provide cool water needed for the LNGC integrated cooling systems for equipment onboard, such as main engines and diesel generators. The range in intake/discharge volumes account for the varying LNGC sizes and estimates of the number of LNGC calls at the Marine Terminal. The water discharged could be approximately 5 degrees Fahrenheit warmer than ambient water temperature in Cook Inlet.

2.1.2 Material Offloading Facility

2.1.2.1 Description of the MOF

The MOF would facilitate the marine transport of bulk materials, equipment, and modules during construction. The MOF would be a temporary facility and would be removed approximately 10 years after completion of its construction.

The MOF area would be approximately 1,050 feet by 525 feet with a deck elevation +32 feet MLLW, which would provide sufficient space for cargo discharge operations, and up to three sealift seasons of module shipments. MOF construction would be land-based work. The MOF would consist of a combi-wall of pilings and sheets backfilled with granular materials and tied back to a sheet pile anchor wall.

All vessels brought into the State of Alaska or federal waters are subject to U.S. Coast Guard (USCG) 33 C.F.R. 151 regulations, which are intended to reduce the transfer of aquatic invasive organisms. Management of ballast water discharge is regulated by federal regulations (33 C.F.R. 151.2025) that prohibit discharge of untreated ballast water into the waters of the United States unless the ballast water has been subject to a mid-ocean ballast water exchange (at least 200 nautical miles offshore). Vessel operators are also required to remove “fouling organisms from hull, piping, and tanks on a regular basis and dispose of any removed substances in accordance with local, state, and federal regulations” (33 C.F.R. 151.2035(a)(6). Adherence to the USCG 33 C.F.R. 151 regulations would reduce the likelihood of Project-related vessel traffic introducing aquatic invasive species.

2.1.2.2 Dredging for the MOF

The approach and berths at the MOF would need to be dredged to the depths of -30 feet and -32 feet mean lower low water (MLLW), respectively, while an additional allowance of no more than -2 feet may be required for over dredge. Several disposal and/or reuse options are under consideration. Given the total volume of dredging planned at the site and the potential for multi-year maintenance dredging, an offshore unconfined aquatic disposal site would be the preferred option for disposal of the dredged material. The proposed dredge disposal area is located approximately 3-5 miles west of the dredge area in relatively deep water (-60 feet to -100 feet MLLW) with strong northerly currents (over 6.5 knots peak flood and over 5.5 knots peak ebb), which are expected to disperse the dredge sediment, but not carry the material back towards shore. The deep water and strong currents are expected to disperse the material with no effects on water depth (navigation).

The dredged material is anticipated to be a heterogeneous mix of sandy silt and sand with hard packed clay. The estimated volume of material that would be dredged for the Marine Terminal totals approximately 800,000 cubic yards. Additionally, 140,000 cubic yards (approximately) of maintenance dredging is expected to be necessary at the MOF berths and approach during the later construction seasons.

Dredging at the MOF during the first season of marine construction may be conducted with either an excavator or clamshell (both mechanical dredges). Dredging at the MOF during the second season of marine construction at Nikiski may be conducted with either a hydraulic (cutterhead) dredger or a mechanical dredger.

2.2 MAINLINE

The Mainline would be a 42-inch-diameter natural gas pipeline, approximately 806 miles in length, extending from the GTP on the Arctic Coastal Plain to the Liquefaction Facility on the shore of Cook Inlet near Nikiski, including an offshore pipeline section crossing Cook Inlet. The pipeline would be a buried pipeline with the exception of four planned aerial water crossings, aboveground crossings of active faults, and the offshore pipeline.

2.2.1 Onshore Mainline

Construction/installation of the pipeline itself would occur over a period of approximately two years with additional time on either end for site preparation and facility construction. Various ROW construction modes would be used to support the construction: ice work pad; winter frost packed; granular work pad; graded cross slopes; and mountain graded cut. A total of 514 waterbodies would be crossed by the Mainline (Resource Report No. 2, Table 2.3.11-3). These streams would be crossed using one of the following methods, depending on the conditions at the waterbody crossing and engineering requirements: open cut, frozen cut, buried trenchless, and aerial.

The proposed design would include eight compressor stations, one standalone heater station, two meter stations, multiple pig launching/receiving stations as part of one system (associated with meter stations, GTP, Liquefaction Facility and/or Mainline block valve [MLBV]), multiple MLBVs, and a minimum of five gas interconnection points. Facilities would be built on granular pads with the thickness of the granular pads varying depending on site conditions, including the presence and type of permafrost.

2.2.1.1 Associated Facilities and Infrastructure

Access roads would be required during construction of the pipelines and aboveground facilities to transport equipment, material, pipe, and personnel to the ROW, compressor stations, material sites, and other locations. These access roads include existing public roads, existing non-public roads, newly built access roads, and shoo-flies. If existing roads are not readily available, or do not provide adequate access, new temporary or permanent access roads using available native material, imported granular material, or temporary use of snow/ice, depending on the intended traffic load, duration, and timing of use, would be required. Construction of some new permanent roads to access compressor stations and the heater station would be needed. Permanent or temporary bridges would be constructed, if needed, to cross waterbodies, depending on water levels.

2.2.1.2 Material Sites

Various materials (e.g., sand, granular material, and stone) would be required for construction of the Project, including base material for work pads, aboveground facility sites, temporary construction facilities, access roads, and other uses. The material required for these facilities would be obtained from material sites that are either existing or would be developed for the Project. A preliminary list of potential sources for these various materials is included in Appendix F of Resource Report No. 6. Approximately 32 million cubic yards of granular fill would be required for construction of the Project, 20 million of which is for Mainline construction. This granular fill would be sourced from multiple locations over the seven-year construction period. Access to these material sites would be by winter road, all-weather road, Project footprint (e.g., pipeline ROW) or some combination of these. At the conclusion of construction activities, material sites would likely either be used for other projects by the landowner (such as for road construction administered by the Alaska Department of Transportation and Public Facilities) or closed and restored as per land use agreements and regulatory requirements.

2.2.1.3 Hydrostatic Testing

After backfilling, the pipeline would be pressure tested. The proposed hydrostatic test approach, including pipeline cleaning, gauging plate pig run, pressure testing, caliper pig run, and pipeline dehydration is based on testing up to 20-mile long sections during the summer or fall. Potential water sources for pipeline hydrostatic testing include streams crossed by the pipeline ROW and nearby lakes and parallel streams. Anticipated volumes and potential sources of test water are provided in the *Water Use Plan*, located in Resource Report No. 2, Appendix K. Once final water sources are identified, pressure test plans for each construction spread would list all permitted water sources, the associated pipeline milepost, and the permitted water volume and conditions for water withdrawals and discharge received from the regulatory authorities.

Hydrostatic testing is planned for the summer and fall; however, some testing may also be carried out during the winter. If testing is done during summer or fall, no additives, including antifreeze chemicals, biocides, corrosion inhibitors, oxygen scavengers, or leak detection tracers would be added to the test water. If winter testing becomes necessary, the pressure test plans would list which additives are proposed for use.

2.2.2 Cook Inlet Crossing

2.2.2.1 Description of the Cook Inlet Crossing

The proposed Cook Inlet crossing route for the Mainline is an approximate 28-mile stretch between Shorty Creek near the Village of Beluga on the western shore of upper Cook Inlet near Boulder Point on the eastern side of the inlet. Figure 3 provides an overview of Cook Inlet Mainline crossing. Land requirements for construction and operation of the Mainline are provided in Table 3. These numbers do not represent expected effects; they are based on ROW widths. The construction ROW encompasses an area 1.25 mile on either side of the centerline to include all areas where anchors may be set. The expected footprint of the 12 plus anchors within the 2.5-mile-wide construction ROW is expected to be less than 1 acre each time the anchors are picked up and moved. The number of times the anchors are reset would be dictated by weather and current conditions and the rate of pipelay progress, but of the construction ROW required, less than 1 percent of the area would be directly affected by anchors.

TABLE 3

Land Requirements for Construction and Operation of the Mainline Cook Inlet Crossing

Facility	ROW Required During Construction (acres)	Land Affected During Operation (acres)
Mainline	38,131.76	330.11

2.2.2.2 Construction of the Cook Inlet Crossing

The pipeline crossing would be installed over two years, with the working window for construction in Cook Inlet being mid-April to mid-October. The expected pipelay vessel progress would be between 2,000 and 5,000 feet per 24-hour day, depending on currents and weather. The shoreline crossings would be constructed the first year, and the main pipelay operation would occur the second year.

The pipe would be laid using a pipelay vessel, which moves by pulling on its anchors or through the assistance of its dedicated support vessels. Certain pipelay vessels may also have integral thrusters to provide propulsion. The specific vessel that would be used will be finalized during procurement of the installation contractor. Several anchor handling tugs (AHTs) would be used to reposition the anchors after pipe is welded and lowered over the back of the pipelay vessel. Primary underwater sound sources would be from the AHTs during the anchor-handling and thrusters from the pipelay vessel (if equipped).

2.2.2.3 Shoreline Crossings

The pipeline would be installed at the shoreline crossings on both sides of Cook Inlet using the open cut method. In Cook Inlet, the pipeline would be installed in a trench and buried from the shoreline out to a water depth of 35 to 45 feet, which represents a distance of approximately 8,300 to 8,800 feet on the northern shore and 6,400 to 6,600 feet on the southern shore. Seaward of these locations, the pipeline would be installed on the seafloor. Construction methods would differ between the nearshore and offshore portions of these trenched sections.

The trench for each shoreline is expected to be constructed using amphibious or barge-based excavators to trench to a transition water depth where a dredge vessel can be employed. A backhoe dredge could also be required to work in the nearshore region. Backfill would take place following pipeline installation.

In the event the pipeline would be required to be buried beyond water depths accessible by amphibious excavators, a trailing suction hopper dredger would be used in advance to provide the necessary trench for the pipeline. Alternative burial techniques, such as plowing, backhoe dredging, or clamshell dredging, would be considered if conditions become problematic for the dredger. After installation of the nearshore pipelines, a jetsled or mechanical burial sled could be used to achieve post dredge burial depths.

2.2.2.4 Hydrostatic Testing

Seawater would be used to hydrostatically test the integrity of the pipeline after welding. Water is pumped into the pipeline behind a fill plug, pressurized above intended operating pressures, and then discharged after the required test holding period (usually 48 hours). The necessity of additives (e.g. corrosion inhibitor, biocide) will be evaluated as well as freshwater alternatives. The seawater discharge would be performed in compliance with regulatory requirements.

2.2.3 Mainline MOF

A Mainline MOF may be required on the west side of Cook Inlet in close proximity to the offshore pipeline shore crossing to support onshore and offshore pipeline and facilities construction activities, including the Cook Inlet shoreline crossing as well as onshore construction between the Beluga Landing area shoreline crossing and the Yentna River. All of the supporting equipment, materials, and supplies need to be delivered by water or by air as the Beluga area is not connected by road to any other area of the state. The purpose of the MOF would be to provide a marine offloading and backhaul loading point for construction equipment and consumables, fuel, personnel accommodation units, personnel, line pipe, and other construction materials.

A precise location for the Mainline MOF has not been selected; however, it would be located close to, but at a reasonable distance from, the current Beluga barge landing facility such that the MOF construction and operation would not interfere with the current operations. The MOF would consist of berths and space for tugs including:

- Lo-Lo Berth for unloading pipes and construction materials;
- Ro-Ro Berth and ramp dedicated to Ro-Ro operations

The planned overall dimensions of the MOF are 600 ft. long x 400 ft. wide, including an adjacent Ro-Ro ramp. Two proposed 30-foot wide access roads would lead from the MOF to a planned material lay down area that connects to the local road system. These new access roads would cut the existing bluff. All surfacing on the quay and access roads would be expected to be graded crushed rock

Due to the shallow water at the MOF site, it is assumed that the barges delivering cargo will be grounded at the berths at low tide. The exception to this is that Ro-Ro barges or vessels will be restricted to the tidal window in which they can operate. No dredging is proposed to enhance barge docking capabilities, however adequate fill from onshore would be added at the facility to enable the barge to ground itself and provide offloading capability.

The permanent Mainline MOF is anticipated to consist of:

- Two 30-foot-wide access roads cut through the existing bluff and leading to a quay;
- A quay constructed as a gravity structure formed by an anchored sheet pile wall;
- A Ro-Ro ramp consisting of anchored sheet pile construction that abuts the quay; and

Surfacing on the quay and access roads consisting of graded crushed rock.

2.3 GTP AND ASSOCIATED RESERVOIR

The GTP water systems would provide water to various users in the GTP and operations camp, including process makeup requirements, firewater, and potable water. Water supply to the GTP and associated camps would originate from the Putuligayuk River. Due to the low flow in the winter and fish use of the river, year round withdrawal of sufficiently large quantities is unlikely. To ensure year round water supply, water from the river would be used to fill a reservoir during spring break-up (over more than one year) when there is sufficient water runoff. An integrated granular material/water use system where material excavated for development of the reservoir would be used for Project infrastructure, such as granular pads and roads, is proposed.

The exact location and layout of the reservoir site has not been finalized, but it is planned to be located within the study area identified on Figure 4. The preliminary reservoir design includes a footprint of approximately 35 acres with a depth in range of 35 to 60 feet. The preliminary estimate for available capacity is 250 million gallons that would support process and potable water demands. The water intake structure would be located on the Putuligayuk River and draw water during spring break up at acceptable flow rates through protective fish screens. The proposed Putuligayuk River pipeline (approximately one mile of 14-inch pipe) would deliver water from the Putuligayuk River to the reservoir; and the proposed supply water pipeline (approximately five miles of 6-inch pipe) would transport raw water from the reservoir to the GTP and GTP operations camp.

2.4 WEST DOCK MODIFICATIONS

The West Dock Causeway, which runs approximately 2.5 miles from the shoreline to the west end of Prudhoe Bay, is a solid fill granular material structure that was constructed in three segments between 1974 and 1981. Construction of the GTP at Prudhoe Bay would require barge delivery of modules to West Dock over 4 sealift seasons. Modifications of the existing West Dock facilities would be necessary to facilitate offloading a large number of barges within a short ice-free work window. Land requirements for the construction and operation of Project facilities at West Dock are identified in Table 4.

TABLE 4

Land Required for Construction and Operation of the West Dock Facilities

Facility	Land Affected During Construction (acres)	Land Affected During Operation [1] (acres)
Barge Bridge	2.58	0.00
Dock Modifications	31.05	0.00
Berthing Basin	13.70	0.00
Total	47.33	0.00

[1] This is acreage used for the Project during operations, the structure and impact to resources may remain.

2.4.1 Dock Head 4 (DH 4)

A new Dock Head (DH 4) would be built at the seawater treatment plant (STP) and five berths would be constructed. The West Dock DH 4 addition would include installing sheet piling and fill material behind the sheet piling, and installing mooring dolphins. Most of the piles would be placed with an impact hammer during the winter. A barge bridge would be required to facilitate construction. The dock face would be approximately 1,000 feet wide and elevated approximately 8 feet. The five or more new berths would be dedicated to Project activities. The new dock would provide a working area of approximately 31 acres.

2.4.2 Barge Bridge

An existing bridge within the West Dock causeway spans 650-foot channel/breach located between DH 2 and DH 3. The bridge limits the roadway to a single-lane, to light vehicle traffic at a width of 20 feet, and to an approximate load limit of 100 tons. A bridge with capacity to support the modules would be required for a successful sealift. Therefore, a temporary barge bridge, consisting of two barges ballasted to the sea floor, would be used to span the gap. The barges would be placed at the beginning of the open-water season prior to each sealift.

The barge bridge will provide up to three areas for fish passage, if required during the proposed time of use (e.g. between the barges and between each barge and the adjacent bulkhead). Pre-work would be performed a year before the first sealift to prepare the seafloor and install a minimum of four breasting-dolphins for the barge bridge support. No dredging is planned at this time for barge bridge preparation or emplacement.

The barges would be removed at the end of each sealift and the surface would need to be prepared again prior to each sealift year. As additional data is acquired and further guidance received on fish passage requirements, the barge bridge surface, structures, and mooring systems will be re-analyzed and may require updates.

2.4.3 Use of DH 4

Major components of the GTP would be built as modules offsite and delivered to Dock Head 4 in a series of sealifts. Four consecutive summer sealift seasons and corresponding construction periods are planned. The expected frequencies of large vessel traffic into Dock Head 4 for construction of GTP are indicated in Section 2.7.1.4.

Due to the size of the modules required for the GTP, large oceangoing vessels would be used. All cargo barges would be grounded for the modules offloaded at DH 4. The grounding pad for the barges would be prepared in advance of each sealift. In total, construction for the GTP facility would last 8 years.

2.5 POINT THOMSON GAS TRANSMISSION LINE

2.5.1 Description of the PTTL

The GTP and associated facilities, located in the Prudhoe Bay area, would receive natural gas from the PTU by way of the PTTL. As proposed, the PTTL would be an approximately 62.5-mile, 32-inch-diameter aboveground pipeline. The PTTL would be installed on vertical support members (VSMs). The PTTL would be constructed primarily during the winter season from ice roads and ice pads. Surface water would be the source of water required to make the work pads.

2.5.2 Waterbody Crossings of PTTL

The PTTL would cross several named waterbodies. Three crossings (i.e., Shaviovik River, Kadleroshilik River, and Sagavanirktok River Main Channel) would be buried with conventional open-cut methods in the winter. Designs of these buried crossings will be provided in the FERC application. The remaining three crossings, the West Channel of the Sagavanirktok, an unnamed tributary to Putuligayuk River, and the Putuligayuk River would be installed with aboveground pipeline crossings. The West Channel of the Sagavanirktok would be crossed by adding structural extensions to an existing pipeline bridge, while the Putuligayuk and its unnamed tributary would be crossed using standard VSMs.

2.6 PRUDHOE BAY GAS TRANSMISSION LINE

The GTP and associated facilities, located in the PBU, would receive natural gas from the PBU by way of the PBTL. The PBTL would be an approximately 1-mile, 60-inch-diameter aboveground pipeline to transport natural gas from the PBU Central Gas Facility (CGF) to the GTP. The PBTL would be installed on horizontal support members connected to a steel pile or vertical support members (VSMs) and would cross public lands managed by the State of Alaska.

A typical VSM is illustrated in Appendix E of Resource Report No. 1. The VSM would be embedded and slurried at a specified depth in the ground. Design of the supports would be in accordance with appropriate codes and standards. The pipeline would maintain a minimum of 7 feet from the tundra to the bottom of the pipe.

2.6.1 Associated Facilities and Infrastructure

The construction of the PBTL would use the camps for the GTP as well as laydown areas on the GTP site and possibly on the PBU CGF pad. No access roads are required for the PBTL since it would be accessed through the GTP and PBU CGF.

2.6.2 Construction and Schedule

A 120-foot-wide nominal construction ROW would be required for the PBTL. The PBTL would be installed on typical VSMs connected to a horizontal support member. A nominal 120-foot-wide ice road would be constructed along the construction ROW. In locations where additional laydown areas are needed, a wider construction ROW may be required. The VSM installation, pipeline assembly, and erection would be accomplished from the ice road. The PBTL would be located on State of Alaska land and following construction, a 100-foot-wide ROW would be acquired. The

PBTL would be constructed concurrent with the GTP construction and take approximately one year to complete.

2.6.3 Hydrostatic Testing

Once constructed, the PBTL would be hydrostatically tested in the summer. Anticipated test water volumes and potential sources are provided in the Water Use Plan, located in Resource Report No. 2, Appendix K. Once final water sources are identified, pressure test plans would list all permitted water sources, the associated pipeline MP, and the permitted water volume and conditions for water withdrawals and discharge received from the regulatory authorities. No additives, including antifreeze chemicals, biocides, corrosion inhibitors, oxygen scavengers, or leak detection tracers would be added to the test water.

2.7 VESSEL TRAFFIC

Marine vessel traffic associated with the Project would occur during construction and operation. In addition to the mobilization of vessels for marine construction, vessels would be required to bring in facility modules, pipe, equipment, and supplies. The primary ports that would be used are the Port of Anchorage, the MOF in Cook Inlet, Seward, and West Dock in Prudhoe Bay. During facilities operations LNGCs would deliver natural gas to foreign markets. Vessel routes are unknown at this time; however, likely corridors are indicated in Figure 1.

2.7.1 Vessel Traffic during Construction

Anticipated numbers and types of vessels needed to support construction are listed in Table 5.

TABLE 5

Typical Vessel Types that would be used during Project Construction

Facility	Activity	Vessel	Anticipated Number of Vessels
Marine Terminal	Dredging	Hydraulic Dredge	1
		Dredging Barge (barge-mounted crane, clamshell)	1
		Deck Barge/Material Barges	TBD
		Scow/Hopper Barges	TBD
		Tug Boats	TBD
		Work/Crew Boats	TBD
		Survey Vessel	1
	Marine Construction Spreads	Derrick Barge	TBD
		Material Barge	TBD
		Tug	TBD
		Work/Crew Boats	TBD
	Materials Transport	Geared Heavy Lift Vessel	TBD
		Heavy Transport Vessel	TBD
		Ocean Tug and Barge	TBD
Pipeline	Pipeline Shipments	Ocean Tug and Barges	TBD
	Marine Construction Spreads	Pipelay Vessel	1
		Pull Barge	1
		Anchor Handling Tugs	3

TABLE 5

Typical Vessel Types that would be used during Project Construction

Facility	Activity	Vessel	Anticipated Number of Vessels
		Supply/Pipe-Haul Vessels	2
		Work/Crew Boats	1
		Survey Vessel	1
		Nearshore Trenching/Backfilling Spreads	TBD

[1] Each tug and barge would consist of one ocean going tug and one barge; they would be supported by up to 2 primary and 4 secondary assist tugs.

2.7.1.1 Construction Vessel Traffic at the MOF

It is estimated that approximately 60 module shipments would be made directly to the MOF from fabrication yards during the three years of active Liquefaction Facility construction. The Pioneer MOF is also expected to receive approximately 20 shipments of small modules for construction of the Marine Terminal during the third year of construction. It is anticipated that approximately 10 barges would be circulating from the ports of Anchorage and Seward to the Project's on-site MOF on a weekly basis for three years.

Modules would be fabricated outside of Alaska and transported directly to the Nikiski Liquefaction Facility site. Modules weighing up to 770 U.S. tons would be transported by lift-on/lift-off (Lo/Lo) self-propelled Geared Heavy Lift Ships. Modules weighing more than 770 U.S. tons would be loaded and discharged by roll-on/roll-off (Ro/Ro) methods using a self-propelled modular transporter. Typical vessels for dredging, marine construction spreads, material transport, and heavy lift are summarized in Table 5.

2.7.1.2 Construction Vessel Traffic for Cook Inlet Crossing Pipelay

Platform Supply Vessels (PSVs) would be used to support the trenching and pipelay activities during construction of the Mainline crossing of Cook Inlet. Typical vessels for dredging, marine construction spreads, material transport, and heavy lift are summarized in Table 6. Approximately 100 trips between the pipelay/trenching spread and a shore base (assumed to be Port Mackenzie) would be required to supply and support these activities over the course of the construction window. Barge-based vessels that would be used for logistics or pipelay have a typical transit speed of 5 knots while towed. PSV or Anchor Handling Tug Supply Vessels (AHTSs) transit speed is generally in the range of 10-12 knots. Pipelay (HLV) vessels transit at speeds in the range of 8-15 knots.

2.7.1.3 Construction Vessel Traffic Associated with Pipe Delivery

The pipe for the Mainline and PTTL would be shipped to the Port of Anchorage or Seward in Handymax class vessels from outside of Alaska. The pipe would be delivered to Anchorage or Seward in 15,000 to 18,000-ton ships over several construction seasons. An estimated 47 vessel trips would transport the pipe over a 34-month shipping schedule (approximately 0.7 trips per month or one every 22 days) in the 2.5 years prior to the start of pipeline construction.

The ships would be Handymax class vessels or similar and would transit at speeds of 10 to 14 knots in the open ocean. From Anchorage or Seward, pipe would be distributed to onshore pipe storage yards by rail or by barge to multiple locations, including to the MOF on the west side of Cook Inlet.

2.7.1.4 Construction Vessel Traffic at West Dock

Approximately 51 modules would be delivered to West Dock during GTP construction as part of four planned sea lifts. The number of barge and tugs that would be required for each sealift are indicated in Table 6. Sea lifts would be delivered at DH 4 each of the four years during the ice-free period.

TABLE 6

Typical Vessel Types that would be used during Project Operation

Sea Lift Year	Number of Barges (400x105 to 400x135)	Ocean going tugs (120 ton)	Primary Assist Tugs (42.5 ton)	Secondary Assist Tugs (15 ton)
Sea Lift 1	12	12	2	4
Sea Lift 2	12	12	2	4
Sea Lift 3	10	10	2	4
Sea Lift 4	9	9	2	4

2.7.2 Vessel Traffic during Operations

Operational traffic would include LNGCs traveling to and from the Liquefaction Facility to foreign markets. Sizes of LNGC vessels have not been determined at this time, but are expected to range in length from 306.2 to 344.5 yards with capacities of between 125,000 and 216,000 cubic meters. Depending on the size, an LNGC would arrive at the Marine Terminal 17 to 30 times per month. Additional vessels to be used during operations would include a pilot boat and one or more Azimuth Stern Drive tugs to support carrier approach and docking. LNGCs would transit open ocean waters at speeds of 19 knots or less.

2.8 NON-JURISDICTIONAL FACILITIES

2.8.1 PBU MGS Project

Approximately 75 percent of the natural gas that would supply the Project would be sourced from the Prudhoe Bay field. The PBU has been a large oil producing and gas cycling operation since 1977. The purpose of the PBU MGS project is to allow the natural gas currently being produced, compressed, and injected within PBU to be transported to the GTP for processing to remove Byproduct and compressing of the hydrocarbon gas to enter the Mainline for transport to the LNG Plant. PBU MGS project components include:

- Addition of an approximately 5-acre pad expansion at the CGF.
- Addition of three new pipelines (approximately 48 inch) from the PBU CGF low temperature separation system, which would enter a new valve module on the PBU CGF Pad. Upon exiting the new valve module, the new pipelines would combine into a single larger pipeline to deliver gas to a new metering module on the PBU CGF pad.
- Potential addition of a gas pipeline from the Lisburne Production Center to PBU CGF (5 miles long), following commissioning.
- Addition of four new pipelines would be constructed to deliver GTP Byproduct to Well Pad W (W Pad), Well Pad Z (Z Pad), the AGI Pad, Drill Site 9, Drill Site 16 and two Point McIntyre drill sites (PM1 and PM2). The pipelines include:

  - A new pipeline and tie-ins to W and Z Pads would be constructed from the GTP byproduct receiving module at PBU CGF to the Eileen West End junction, then onto connections at W-Pad and Z-Pad. This pipeline would be approximately 25 miles in total length.
  - A new pipeline from the GTP byproduct receiving module to the AGI would be approximately 3 miles in length.
  - A new pipeline from the GTP byproduct receiving module to FS2 and Drill Sites 9 and 16 would be approximately eight miles in length.
  - A new pipeline from the GTP byproduct receiving module to PM1/2 would be approximately 8 miles in length.

2.8.2 PTU Expansion Project

Approximately 25 percent of the natural gas that would supply the GTP would be sourced from the Thomson Sand gas condensate field located on the eastern Arctic Coastal Plain, approximately 60 miles east of the Prudhoe Bay fields. The PTU operator is currently developing the PTU Expansion project. The proposed PTU Expansion project would integrate with the existing facilities, drilling, and infrastructure to produce the natural gas instead of reinjecting it back into the reservoir. Full field production of natural gas and condensate from the Thomson Sand reservoir would be supported. The PTU Expansion project facilities would be designed, permitted, constructed, and operated by the PTU operator. The timing of construction would coincide with the Project to support commercial delivery of natural gas to the first gas conditioning train at the GTP.

The scope of new development for the PTU Expansion project would include:

- Pad Expansion
  - Incremental expansion of the granular footprint of the Central Pad by approximately 26 acres;
  - Construction of the East Pad and East Pad Road (previously permitted by IPS project, determined not to be required for IPS start-up) (approximately 38 acres).
- Pipelines
  - Installation of the previously permitted 14-inch diameter East Gathering Line on VSMs between East Pad and Central Pad; and
- Granular Mine Development and Rehabilitation
  - Development and rehabilitation of a new granular material mine site (approximately 43 acres) to produce approximately 1-2 million cubic yards of granular material.
- Facilities and Support Infrastructure
  - Off-site fabrication of process facility modules delivered to Point Thomson by sealift and trucks;
  - Installation of a new high integrity pressure protective system to accompany the existing high-pressure/low-pressure combination flare;
  - Minor expansion of the sectional bridge and installation of additional mooring dolphins (previously permitted) to enable module delivery at the marine facilities; and

2.8.3 Kenai Spur Highway Relocation Project

The planned Liquefaction Facility location would require that an approximately 1.33-mile segment of the existing Kenai Spur Highway be relocated to the east to enhance public safety and avoid potential conflicts with the proposed Liquefaction Facility. It is anticipated that the relocation would be completed prior to the start of Project construction. Project representatives are working with the Alaska Department of Transportation and Public Facilities and Kenai Peninsula Borough on the highway relocation planning, including routing discussions, public engagement, and permitting and construction. A summary of preliminary options under consideration is provided in Resource Report No. 1. None of the options would affect listed species.

2.9 PROJECT SCHEDULE

2.9.1 Marine Terminal Construction

While site access and preparation activities would begin in 2019, actual construction of the PLF and MOF would begin in 2020 and be completed in 2021. The construction of the PLF trestle would begin in 2022 and finish in 2024. Berth construction and module offload would occur in 2022-2023.

2.9.2 Mainline Construction

Pipeline construction across Cook Inlet would occur during the open water seasons of 2021 and 2022. Onshore off-ROW pipeline construction would begin in 2019, on-ROW in 2021, and pipelay would begin in 2022.

2.9.3 West Dock Modifications

Construction of infrastructure at West Dock is proposed to begin in 2019 and be completed by 2020. Following site preparation and infrastructure activities sealift modules would be delivered. Because of the limited seasonal window (approximately 45 days) when Prudhoe Bay is ice-free, it is expected that it would take four seasons (2023-2026) to complete the barge trips necessary to deliver the modules and materials.

2.10 CONSERVATION MEASURES

The following conservation measures would be implemented.

2.10.1 Routing

To the greatest extent practicable, the Mainline has been routed outside of Critical Habitat Area 1 to minimize potential effects on Cook Inlet beluga whales and critical habitat.

2.10.2 Protected Species Observers

- Protected Species Observers (PSOs) would be used during open-water construction activities at West Dock to identify any marine mammals that may come into proximity of these activities.
- PSOs would be used to monitor construction activities in Cook Inlet that have potential for acoustic harassment to ensure that beluga whales would not be exposed to sound in excess of NMFS thresholds.
- PSOs would be given the authority to immediately stop construction, dredging (in Cook Inlet), and/or lower noise levels (to NMFS thresholds) when marine mammals are visible within exclusion zones.

- PSOs would establish exclusion zones for cetaceans and pinnipeds of 180 and 190 dB re 1 µPa (rms), respectively, when impact pile-driving activities would occur.
- Impact pile-driving activities would be shut down if marine mammals enter the applicable exclusion zones.

2.10.3 Marine Construction

- The Applicant would ensure that all Contractors comply with the Project's *Spill Prevention, Control, and Countermeasure (SPCC) Plan* (Resource Report No. 2, Appendix M).
- Dock Head 4 piles and sheet piles would be installed in winter or outside of the bowhead fall migration period.

2.10.4 Land Construction

- Bear monitors would watch for polar bears and deter polar bears from project activities, as necessary, using deterrent methods as described in the *Wildlife Avoidance and Interaction Plan*.
- Procedures and communications protocols would be implemented for polar bear encounters and the *Wildlife Avoidance and Interaction Plan* would be updated as necessary to ensure current contacts and procedures are incorporated.
- Ensure Project personnel attend training programs established with USFWS, which cover polar bear and wildlife awareness.
- Current polar bear issues would be communicated to workers through bulletins, posters, and safety meetings.
- Forward-Looking Infrared Radar (FLIR) surveys would be conducted over the area within 1.0 mile or more of all planned work areas in polar bear critical habitat prior to winter construction to identify potential maternal polar bear dens. A 1-mile buffer from any active den identified via FLIR would be established. Planned ice roads would be relocated to avoid buffer if possible to do so; if not, a monitoring plan would be implemented in consultation with USFWS during the time of den emergence (mid-March to mid-April).
- If a polar bear den is located during construction or operations, activity would be shut down and an exclusion zone would be established near the den. 24-hour monitoring of the den site would be implemented to limit human-bear encounters and allow the female bear to naturally emerge from and leave the den site.
- If an active polar bear den would be discovered within 1 mile of the ice road route after construction, consultations with USFWS would be held.
- Spill prevention and response programs would be implemented.
- Vegetation would be cleared (where applicable) prior to construction, outside the migratory bird nesting windows as established through consultation with USFWS.
- Potential disturbance to nesting spectacled or Steller's eiders would be reduced by completing most construction activities during winter. Should site preparation and/or construction activities occur on the tundra between June 1 and July 31 the appropriate USFWS Field Office would be contacted for instructions on how to avoid or minimize the potential loss of the active nest.
- All Contractors would be required to comply with the Project's *Spill Prevention, Control, and Countermeasure (SPCC) Plan* (Resource Report No. 2, Appendix M).

2.10.5 Vehicles and Aircraft

- Reduce disturbance to birds by controlling vehicle speeds and aircraft altitude and flight routes. Aircraft would fly at 1,500 feet above ground level and follow a route inland of the coast to avoid the most likely breeding areas except when required for operational or safety reasons.
- Conduct ice road closure drills to practice the ice road closure protocols.

2.10.6 Facility Design and Maintenance

- Develop project design and operational features to avoid or discourage wildlife encounters and to protect wildlife and human safety (e.g., building walkways, doors, lighting, snow management, and traffic control).
- Project facilities would be designed to minimize potential for bird strikes including:
- ○ Design facility lighting (e.g., light hoods to reduce outward radiating light) that minimizes the potential for disorienting migrating birds.
- ○ Design buildings, towers, and flares heights to be as low as practicable without impeding operational efficiency of the equipment.
- ○ Design flares to be free standing (no guy wires).
- ○ Design communications towers to be freestanding and light according to Federal Aviation Administration requirements (Appendix E of Resource Report No. 3).
- ○ Design power lines and fiber optic cables to be buried or placed on the pipeline Vertical Support Members (VSMs).
- Implement operational controls to minimize nesting opportunities for predatory birds and denning opportunities for predatory mammals including:
- ○ Block off access to potential nest sites on structures at facility sites with fabric/netting or other bird nest deterrents.
- ○ Use scare devices to deter birds when they land in places likely to be nesting sites.
- ○ Remove nest material before birds lay eggs.
- ○ Deter foxes from denning by elimination of open containers, culverts, pipes, and other potential shelters at ground level.
- ○ Minimize overall vegetation and habitat loss by use of existing granular pads, minimal footprint size, and roadless connection between PTU and PBU.
- ○ Limit removal of water from freshwater lakes during the summer, to minimize reductions in amount or quality of nesting and brood-rearing habitat through diminished water levels.

2.10.7 Waste Management

- Implement measures detailed in the *Project Waste Management Plan* provided in Resource Report No. 8, Appendix J, which describes:
- ○ Proper handling and disposal of any food wastes including use of bear-proof dumpsters at project locations.
- ○ Proper handling, removal, and disposal of any animal carcasses.
- ○ Management procedures for the control and containment of waste containers and food.
- Minimize attraction of predatory birds and mammals to food and wastes at facilities.

2.10.8 Permits

- Apply for an LOA for the incidental take of polar bears and implement measures in the *Wildlife Avoidance and Interaction Plan* which includes the *Polar Bear and Pacific Walrus Avoidance and Interaction Plan* provided in Resource Report No. 3, Appendix J.
- Apply for an Incidental Harassment Authorization (IHA) and/or LOA for the incidental take of Cook Inlet beluga whales and implement a Draft *Marine Mammal Mitigation and Monitoring Plan* provided in Resource Report No. 3, Appendix N, for noise and activity associated with Marine Terminal and Mainline construction and marine dredging activities.

2.10.9 Native Agreements

- Engage in the Conflict Avoidance Agreement process with the Alaska Eskimo Whaling Commission to develop and implement applicable protective measures.
- Develop and implement applicable protective measures for a Plan of Cooperation (POC) provided in Resource Report No. 3, Appendix O, with subsistence users.

2.10.10 Vessels

- Use minimal speed that does not sacrifice vessel safety or steerage but minimizes noise and maneuverability to avoid collisions with marine mammals.
- Ensure that all Project-related vessels comply with USCG 33 C.F.R. 151 for ballast water discharge.
- Plan sealift barging to be completed prior to the main fall bowhead whale migration and subsistence whaling.
- Route HLV and LNGC traffic well offshore of the Aleutian Islands whenever possible in compliance with the Aleutian ATBAs (Figure 1; NCSR, 2014).
- Implement oil spill response plans for vessel groundings or other accidental releases of oil.
- Construct the West Dock modifications to reduce the total number of barge trips.

2.10.11 Vessel Strikes

A Ship Strike Avoidance Measures Package would be provided to 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. Some of the suggested measures include those listed below.

- Provide training 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.
- Provide a copy of the NMFS CD-ROM–based training program entitled *A Prudent Mariner's Guide to Right Whale Protection* (NMFS, 2009b) as part of a ship-strike avoidance measures package to all vessels calling on the terminal. While this training program is specific to right whales, NMFS has stated that the guidance and avoidance measures are also applicable to fin, humpback, and sperm whales.

Vessel masters would be requested to provide reports of sightings of marine mammals while in the EEZ and to provide the report to the Project 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.

2.11 ACTION AREA

An action area is defined by regulation as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 C.F.R. § 402.02). The Project's action area spans the state of Alaska from Nikiski on the Kenai Peninsula to Prudhoe Bay on the North Slope, including marine areas crossed by LNGC routes from Cook Inlet through Shelikof Strait or the Gulf of Alaska, and through the Aleutian Islands and southern Bering Sea and by HLV routes through the Bering, Chukchi, and Beaufort Seas, as well as through the Gulf of Alaska and Cook Inlet (Figure 1). The transit routes of construction and operational support vessels and LNG carriers are analyzed from the Liquefaction Facility or West Dock through Cook Inlet or Prudhoe Bay out to the U.S. Economic Exclusion Zone (EEZ).

The geographic extent of the action area that is focused on within this assessment includes those areas in which the Project activities coincide with and have a potential to directly, indirectly, or cumulatively affect threatened, endangered, or candidate species and their critical habitats, including the following:

- Nearshore Beaufort Sea waters (approximately 2,078 square miles, Figure 5);
  - Near West Dock where in-water construction is proposed (Figure 4, Figure 5);
- Onshore areas on the North Slope (approximately 1,523 square miles, Figure 5);
  - Tundra habitats surrounding the Mainline from Milepost 0 to about Milepost 62;
  - Tundra habitats surrounding the GTP and associated facilities;
  - Tundra habitats surrounding the PTTL and associated facilities;
  - Tundra habitats surrounding the PBTL and associated facilities.
- Nearshore (approximately 15,121 square miles) and onshore coastal habitats (approximately 41,162 square miles) in the Cook Inlet Basin (Figure 6);
  - Nearshore and coastal habitats crossed by the proposed Mainline;
  - Nearshore and coastal habitats near the proposed Liquefaction Facility Marine Terminal;
  - Anadromous stream crossings for the proposed Mainline within the Cook Inlet Basin.
- Nearshore and marine habitats traversed by vessels associated with the Project (approximately 146,837 square miles, Figure 1);
  - Marine habitats along potential LNGC routes within the EEZ off Alaska;
  - Marine habitats along likely HLV routes from the Gulf of Alaska into Cook Inlet within the EEZ off Alaska; and
  - Marine habitats along likely HLV routes from the Gulf of Alaska to Prudhoe Bay within the EEZ off Alaska.

Action area is also indicated along the Mainline (approximately 21,926 square miles) between the Cook Inlet Basin and the North Slope (Figure 1) was consider, but not evaluated in detail because of the limited potential for presence of listed species. Additional areas that may be affected by work completed in support of this Project would be identified as the logistic execution plans are developed with the third parties who would complete the work (e.g., module construction). Effects from the expansion work anticipated at the PBU and PTU as a result of this Project would occur within similar timeframes and would be located within the Project's action area.

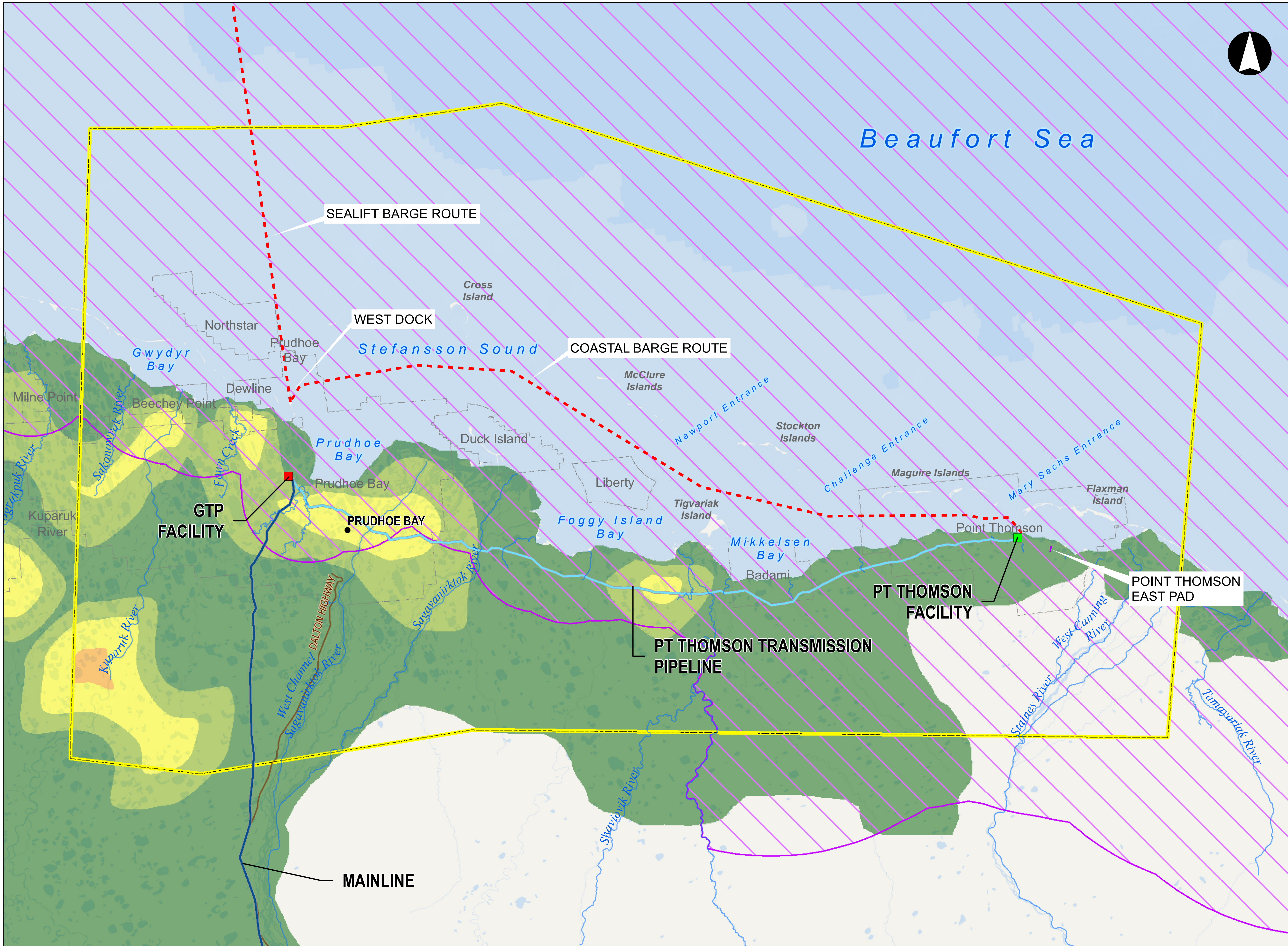
There would be other interconnected actions associated with the Project that occur outside of Alaska, such as the manufacturing of pipe, facility modules, and other materials. Effects on listed species from these connected actions are not reasonably foreseeable at this time, thus these areas are not included within the action area. Sections of the BA will be revised when more details on these activities are known.

Information from the recent USFWS and NMFS Biological Opinions (BOs) for the U.S. Coast Guard's (USCG) and EPA's Alaska Federal/State Preparedness Plan for Response to Oil and Hazardous Substance Discharges/Releases (NMFS, 2015c; USFWS, 2015a) is incorporated by reference in the environmental baseline and cumulative effects discussions in this BA. The intent of this BA is to present brief summaries of the current species' status, species occurrence within the action area, and brief descriptions of potential effects from Project-related activities and mitigation (conservation) measures relevant for the effect on each species and critical habitat. The conservation measures are based on measures that have recently been applied to similar projects and activities for the Point Thomson Project Biological Opinion/Concurrence (USFWS, 2012b; NMFS, 2012c), the Port of Anchorage Expansion Project (NMFS, 2011), and seismic surveys in upper Cook Inlet (NMFS, 2013b).

PROJECT ACTION AREA PRUDHOE BAY

FIGURE 5

ALASKA LNG



LEGEND

- Project Facility
- Existing Facility
- Alaska Place Names
- Shipping Routes
- Anadromous Streams
- Alaska LNG Rev C2 Route
- Major Highways
- Polar Bear Proposed Critical Habitat - USFWS
- PTTL AG
- Oil & Gas Units
- Action Area

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
- 0.426 - 1.647

0 2 4 8 Miles

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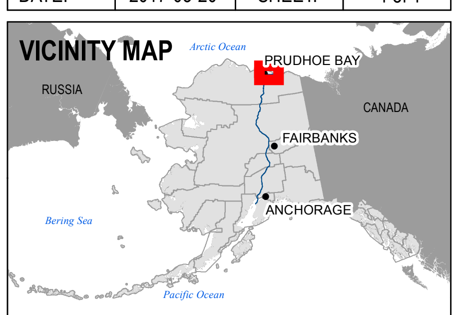
VICINITY MAP



X:\AKLNG\Resource Reports\RR03\Appendix C\Figure 5 Project Action Area - Prudhoe Bay.mxd

PROJECT ACTION AREA COOK INLET

FIGURE 6

ALASKA LNG

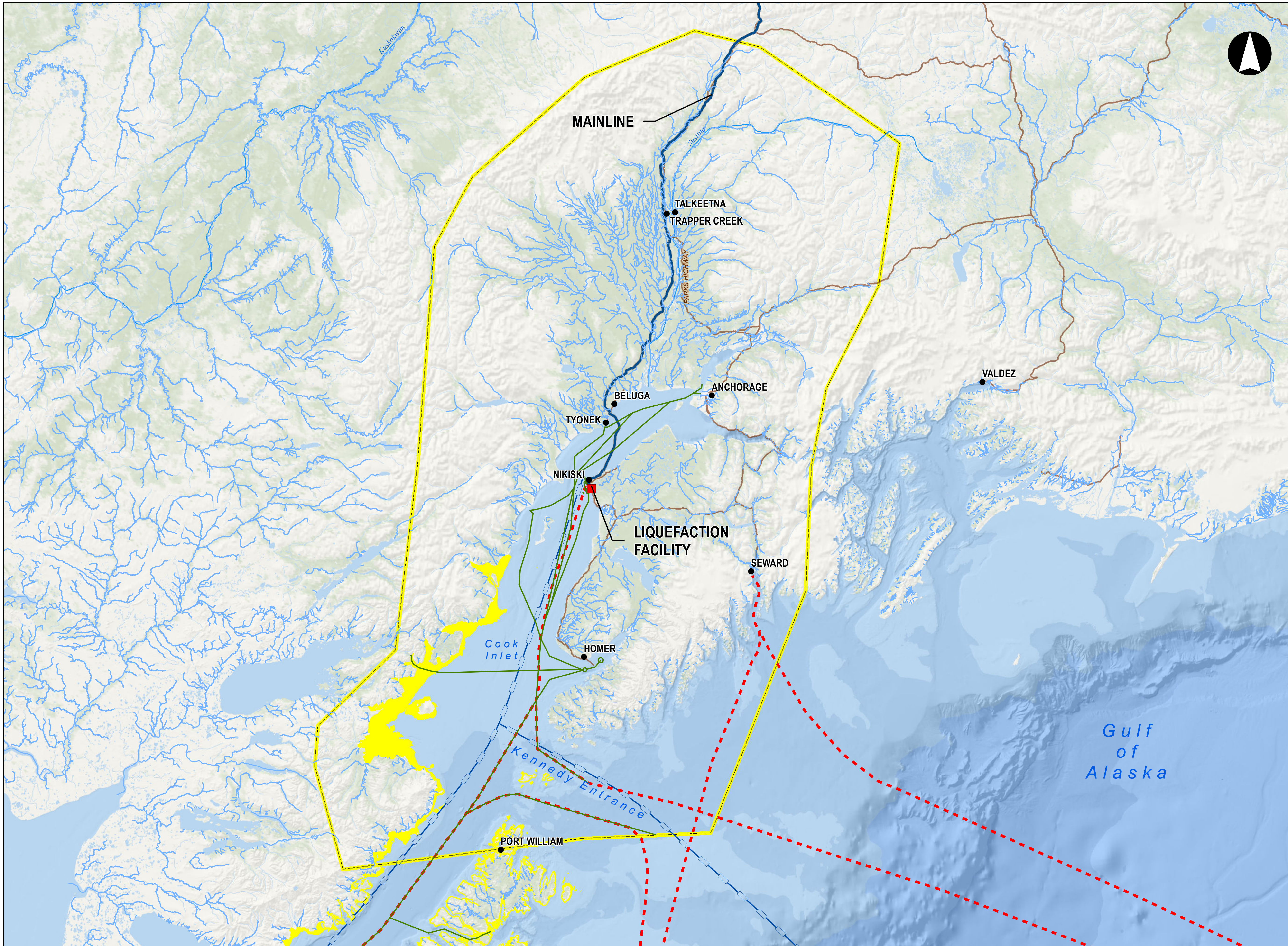
LEGEND

- Project Facility
- Alaska Place Names
- Alaska LNG Rev C2 Route
- Vessel Traffic
- Shipping Routes
- Potential Marine Transportation Route
- Anadramous Streams
- Action Area

Critical Habitat Areas

- Northern Sea Otter

0 10 20 40 Miles



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

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VICINITY MAP

X:\AKLNG\Resource Reports\RR03\Appendix C\Figure 6 Project Action Area - Cook Inlet.mxd

3.0 DESCRIPTION OF SPECIES AND CRITICAL HABITAT

Thirty federally-listed species, Distinct Population Segments (DPSs), or Evolutionarily Significant Units (ESUs), one candidate for listing, and two proposed (previously listed) species were identified (Table 1) by the Services as potentially occurring in the action area (NMFS, 2015a; USFWS, 2014a). The status, range, and presence in the action area, as well as the designated critical habitats, of each of these species are described in the following sections.

3.1 BELUGA WHALE, COOK INLET DISTINCT POPULATION SEGMENT (DPS)

The Cook Inlet DPS or Cook Inlet beluga whale was listed as endangered in October 2008 (73 FR 62919) due to population declines caused by overharvest during the mid-1990s. Unregulated overharvest was believed to be primarily responsible for the rapid decline in the Cook Inlet beluga population. The population was expected to increase at a rate of 2 to 6 percent a year after cooperative efforts reduced subsistence hunts in 1999 (NMFS, 2015b). It is NMFS's position that the beluga population has continued to decline since 1999, based on a 10-year analysis from 2004 to 2014 (Shelden et al., 2015). The most recent annual abundance estimates based on aerial surveys of Cook Inlet from 2014 was 340 (CV = 0.08, 95 percent CI = 291 to 398) belugas (Shelden et al., 2015).

The proposed draft recovery plan identifies 10 potential threats to Cook Inlet beluga whales scaled from high to low relative concern: high – catastrophic events (natural disasters, spills, mass strandings), cumulative and synergistic effects of multiple stressors, and noise; medium – disease agents (pathogens, parasites, harmful algal blooms), habitat loss or degradation, reduction in prey, unauthorized take; and low – subsistence hunting, pollution, and predation (NMFS, 2015b).

A total of eight Biologically Important Areas (BIAs) have been identified for belugas, one of these, a small resident population BIA consisting of most of Cook Inlet, was identified for the Cook Inlet beluga whale (Ferguson et al., 2015a, b).

3.1.1 Species Description – Cook Inlet Beluga

The beluga whale is a circumpolar northern hemisphere species, ranging primarily over the Arctic Ocean and some adjoining seas, where they inhabit fjords, estuaries, and shallow water in Arctic and Subarctic oceans. Five distinct stocks of beluga whales are currently recognized in Alaska: Beaufort Sea, eastern Chukchi Sea, eastern Bering Sea, Bristol Bay, and Cook Inlet. The Cook Inlet population is numerically the smallest of these, and is the only one of the five Alaskan stocks that is listed under the ESA.

Beluga whale adults are white, toothed, and have a large melon (i.e., bulbous structure on their forehead) (ADF&G, 2015e). They have a ridge down their back rather than a dorsal fin, are approximately 11 to 15 feet long, and can weigh 1,000 to 3,300 pounds. Females are smaller than males (ADF&G, 2015e). Beluga whales may live 60 to 70 years, reach sexual maturity at around 8 to 14 years, and change colors as they mature from gray to white at around 6 to 7 years (NMFS, 2015b). Mating is believed to occur between late winter and early spring. Females calve from mid-May to mid-July at about 3 year intervals, and nurse their calves for 2 years (NMFS, 2015b).

The life history of the Cook Inlet beluga whale as described in the draft recovery plan (NMFS, 2015b) is summarized in the following section. Beluga whales are social and typically migrate, hunt, and interact in dynamic groups of four to 250 individuals during the ice-free season in Cook Inlet. They forage on prey that concentrates, such as shrimp and schooling fish. In Cook Inlet, belugas 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 belugas forage more on benthic fish and invertebrates at that time of year. Beluga whales may live 60 to 70 years, reach sexual maturity at around 8 to 14 years, and change colors as they mature from gray to white at around 6 to 7 years. Mating is believed to occur between late winter and early spring. Females calve from mid-May to mid-July at about 3 year intervals, and nurse their calves for 2 years. 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, Turnagain Arm), as well as the lower Kenai River and delta.

3.1.2 Presence of Cook Inlet Belugas in the Action Area

Aerial surveys for beluga whales in Cook Inlet have been conducted by the NMFS each year since 1993. Over that period, beluga whale estimates have declined from 653 whales in 1994 to 347 whales in 1998 (NMFS, 2015b). It is NMFS's position that the beluga population has continued to decline since 1999, based on a 10-year analysis from 2004 to 2014 (Shelden et al., 2015). The most recent annual abundance estimates based on aerial surveys of Cook Inlet from 2014 was 340 (CV = 0.08, 95 percent CI = 291 to 398) belugas (Shelden et al., 2015).

Cook Inlet belugas reside in Cook Inlet year-round (Figure 7). Traditional Ecological Knowledge of Alaska Natives and systematic aerial survey data document a contraction of the summer range of Cook Inlet belugas from 1978 to 1979, 1993 to 1997, and 1998 to 2008 (Figure 8; Rugh et al., 2010). While belugas were once abundant and frequently sighted in lower Cook Inlet during summer, they are now primarily found concentrated in upper Cook Inlet (Figure 8). This range contraction is likely a function of the reduced population seeking the highest quality habitat with the most abundant prey, most favorable feeding topography, preferred calving areas, and the best protection from predation (NMFS, 2015b).

Although belugas 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, 2015b). Data from satellite-tagged beluga whales document fidelity to habitats within upper Cook Inlet and a preference for shallow inshore waters throughout the year, although sea ice may prevent access to coastal areas during December-May when belugas spend more time offshore between East and West Forelands and Fire Island (Goetz et al., 2012b). Belugas spend the most of their time year round in the coastal areas of Knik Arm, Turnagain Arm, Susitna Delta, Chickaloon Bay, and Trading Bay (Goetz et al., 2012b). During the summer, Cook Inlet beluga whales typically concentrate in habitats near river mouths (Figure 9, Goetz et al., 2012a). Belugas show variation in movement and dive patterns by season and within different regions in Cook Inlet, but consistently made shorter shallower dives and traveled slower from June through November than from December through May, consistent with increased foraging activity in summer and fall (Goetz et al., 2012b). Dive statistics and tracking data identify coastal areas near the Susitna Delta, Chickaloon Bay, Knik Arm, Turnagain Arm, and Trading Bay as potential foraging areas in summer, and north Kalgin Island in winter (Goetz et al., 2012b). During the summer, Cook Inlet beluga whales typically concentrate in habitats near river mouths (Figure 9, Goetz et al., 2012a).

Based on these above studies, beluga whales are most likely to occur near the Marine Terminal in moderate densities during the period when sea ice is typically present in Cook Inlet north of the Forelands (December through May; Goetz et al., 2012b). During this period, belugas would likely be transiting through the area at an average rate of about 2.1 mph, average depth of 33 feet, and average duration of 3.9 minutes (Figure 10; Goetz et al., 2012b). A few belugas may occur in the vicinity of the Marine Terminal during the ice-free period (June through November), although their transit rate may be slower (averaging 1.4 mph), their dive depth may be shallower (averaging 6 feet), and they are likely to spending less time underwater with an (average dive duration 1.3 minutes) (Figure 10; Goetz et al., 2012b). Belugas would not be expected to focus their foraging (dive) efforts near the proposed Marine Terminal location. If belugas do forage near the Marine

Terminal, their foraging dives are more likely to be long and deep during the sea-ice season (December through May; Goetz et al., 2012b).

Beluga whales are expected to occur along the entire portion of the Mainline route within upper Cook Inlet year-round, but as discussed previously, beluga distribution is concentrated in shallow coastal waters near Knik Arm, Chickaloon Bay, and Trading Bay during the ice-free season (June through November); and in deeper waters of the Susitna Delta, and offshore between East and West Forelands, and around Fire Island during the sea-ice season (December through May; Figure 10; Goetz et al., 2012b). Belugas may remain in the vicinity of the Mainline during the winter (December-May); although their transit rate may be faster averaging 1.7 mph, their depth may be deeper averaging 32 feet, and they are likely to spend more time with an average duration of 7.1 minutes (Figure 10; Goetz et al., 2012b).

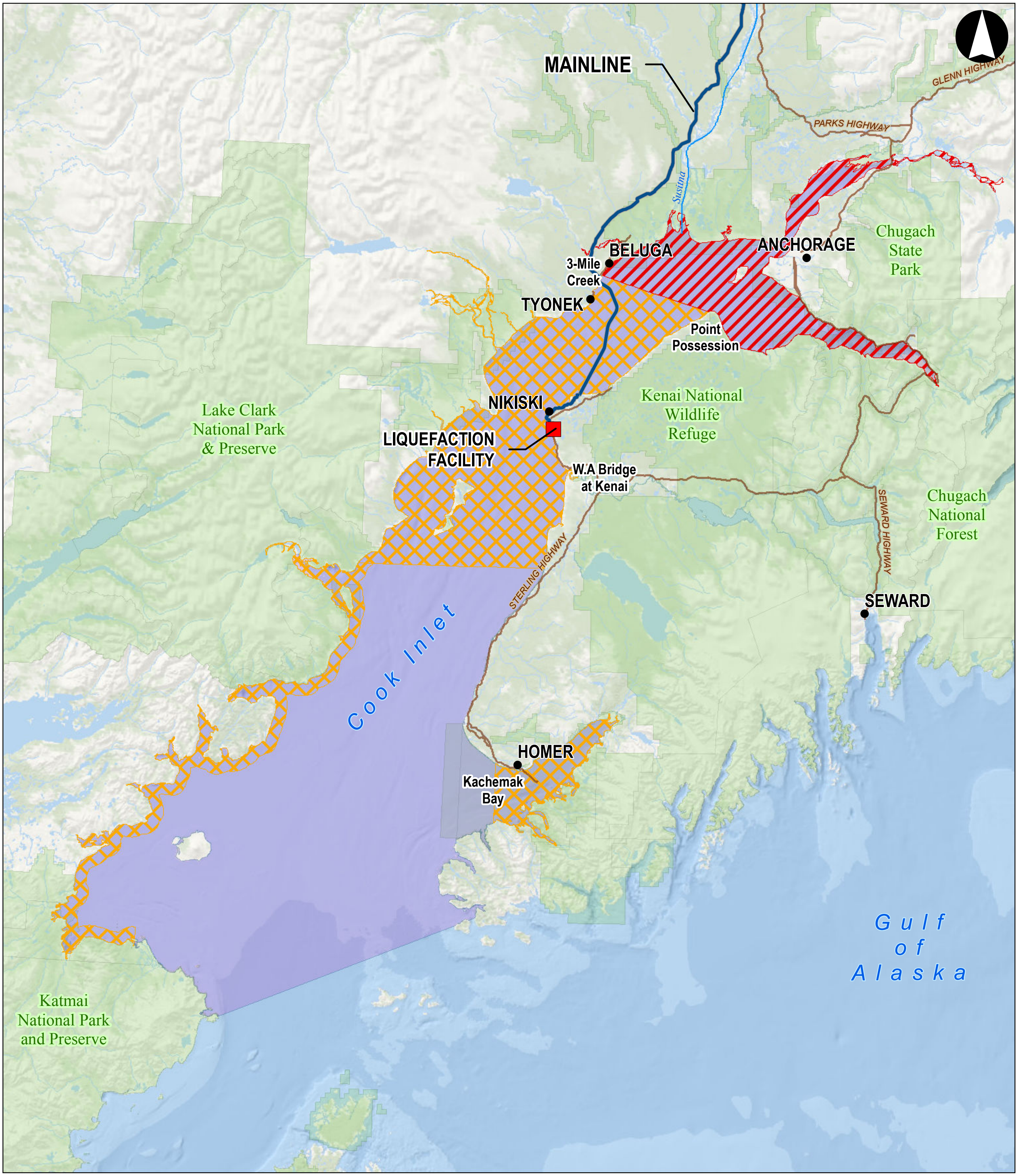
Belugas forage in the Trading Bay area from June to through November, and would likely be transiting through the Trading Bay area at an average rate of about 1.2 mph, average depth of 11 feet, and average duration of 1.9 minutes (Figure 10; Goetz et al., 2012b). Belugas may remain in the vicinity of the Mainline during the winter (December through May); although their transit rate may be faster (averaging 1.7 mph), their depth may be deeper (averaging 32 feet), and longer dive times (average duration of 7.1 minutes) (Figure 10; Goetz et al., 2012b). Belugas would be expected to focus their foraging (dive) efforts near the Trading Bay area during June to November, south of where the proposed Mainline would enter Cook Inlet. Foraging dive behavior, primarily pelagic dives, is expected to occur along the Mainline route in the North Foreland region during the open-water season (June-November; Goetz et al., 2012b). When belugas are diving, they spend more time at depth in mid-Inlet water in the North Foreland and Lower Cook Inlet regions; while they spend less time at depth in Trading Bay and the Susitna Delta (Goetz et al., 2012b).

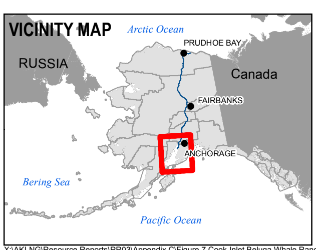
3.1.3 Cook Inlet Beluga Critical Habitat

In April 2011, NMFS designated critical habitat for Cook Inlet beluga whales (76 FR 20180) in two areas of Cook Inlet:

- **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 (MHW) 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 (Figure 7).

The waters of Joint Base Elmendorf-Richardson and the Port of Anchorage were excluded from the designation under the provision of Section 4(b)(2) of the ESA.





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

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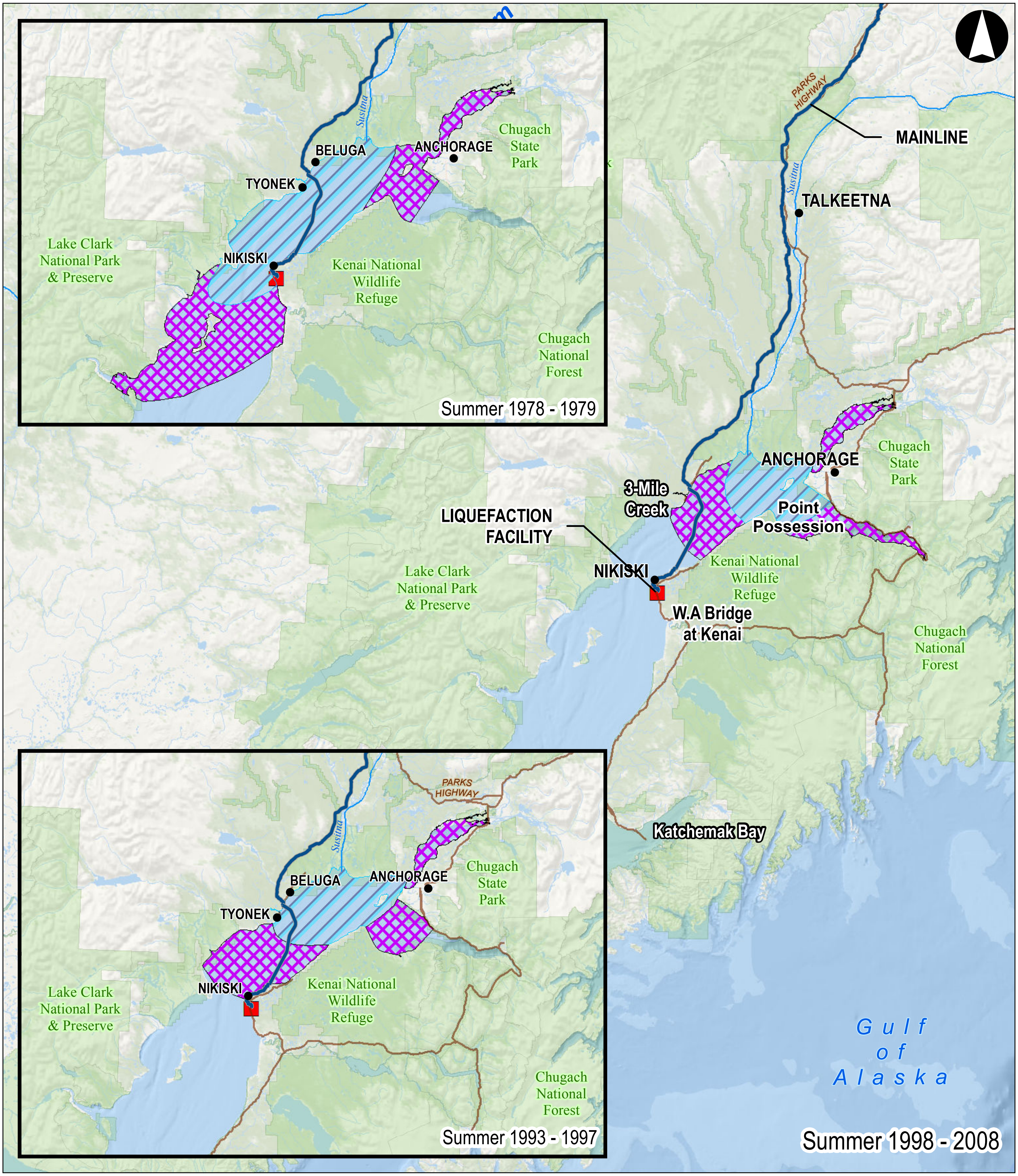
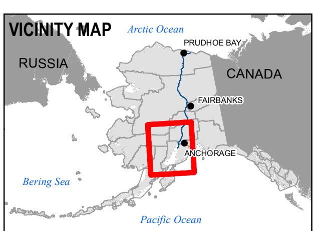
COOK INLET BELUGA WHALE RANGE AND CRITICAL HABITAT

FIGURE 7

ALASKA LNG

X:\AKLNG\Resource Reports\RR03\Appendix C\Figure 7 Cook Inlet Beluga Whale Range and Critical Habitat.mxd





LEGEND

- Project Facility
- Alaska Place Names
- Alaska LNG Rev C2 Route
- Major Highways
- Major Rivers
- 68% of Beluga Whales
- 95% of Beluga Whales
- State and Federal Conservation Lands

0 15 30 60 Miles

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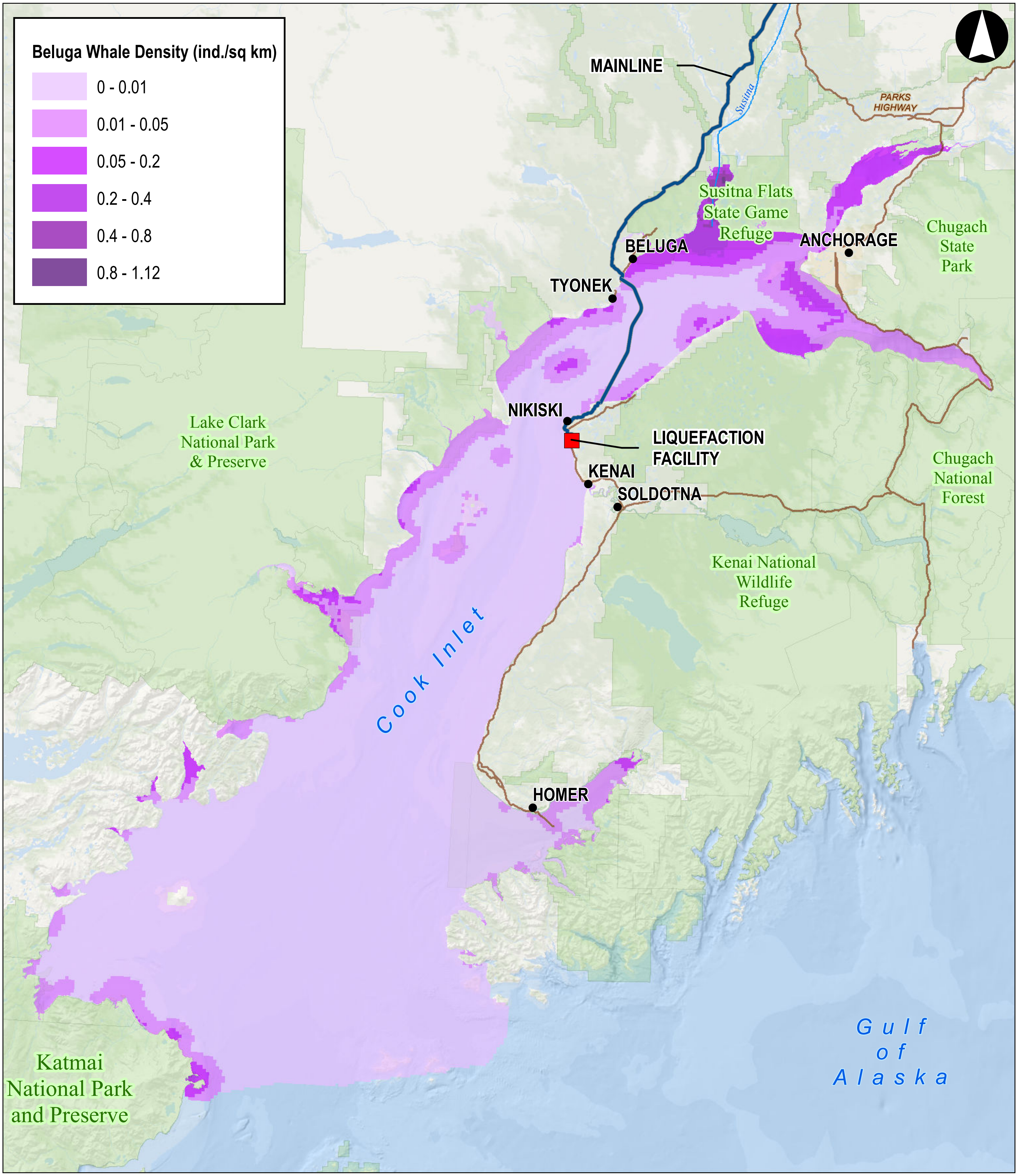
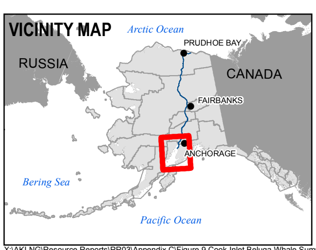
COOK INLET BELUGA WHALE SUMMER RANGE CONTRACTION, 1978 TO 2008

FIGURE 8

ALASKA LNG

X:\AKLNG\Resource Reports\RR03\Appendix C\Figure 8 Cook Inlet Beluga Whale Summer Range Contraction 1978 to 2008.mxd





LEGEND

- Project Facility
- Alaska Place Names
- Alaska LNG Rev C2 Route
- Major Highways
- Major Rivers
- State and Federal Conservation Lands

0 10 20 40 Miles

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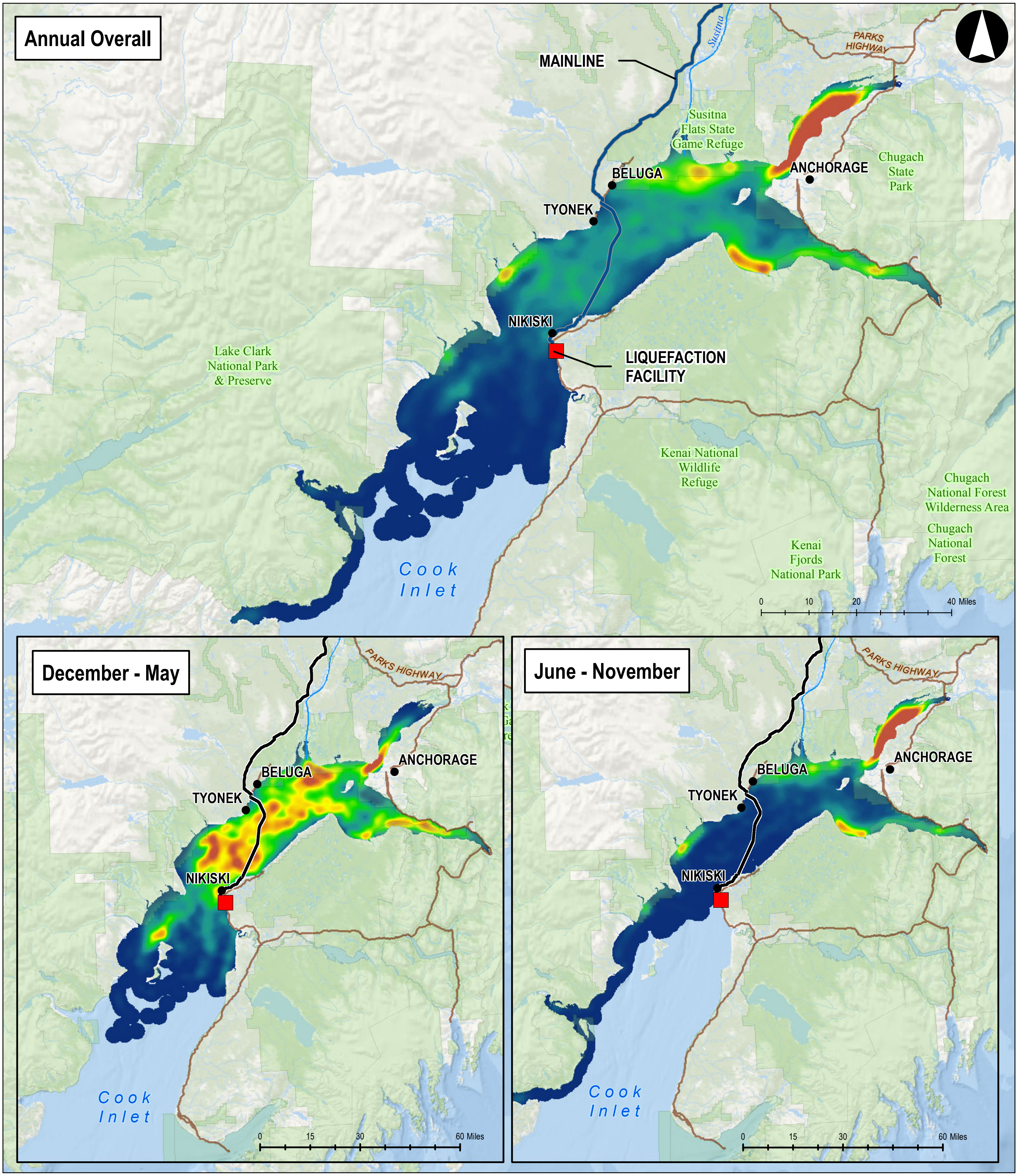
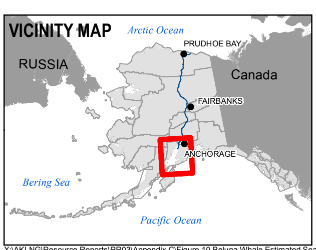
BELUGA WHALE PREDICTED SUMMER DENSITY IN COOK INLET

FIGURE 9

ALASKA LNG

X:\AKLNG\Resource Reports\RR03\Appendix C\Figure 9 Cook Inlet Beluga Whale Summer Density in Cook Inlet.mxd





LEGEND

- Project Facility
- Alaska Place Names
- Alaska LNG Rev C2 Route
- Major Highways
- Major Rivers
- State and Federal Conservation Lands

Beluga Density (ind./sq km)
High
Low

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BELUGA WHALE ESTIMATED SEASONAL RANGE IN COOK INLET (GOETZ ET AL., 2012)

FIGURE 10

ALASKA LNG

X:\AKLNG\Resource Reports\RR03\Appendix C\Figure 10 Beluga Whale Estimated Seasonal Range in Cook Inlet.mxd

Primary constituent elements (PCE) of these critical habitats essential for conservation of Cook Inlet beluga whales are:

1. Intertidal and subtidal waters of Cook Inlet with depths <30 feet Mean Lower Low Water (MLLW) and within 5 miles of high and medium flow anadromous fish streams.
2. Primary prey consisting of four Pacific salmon (Chinook, sockeye, chum, and coho), Pacific eulachon, Pacific cod, walleye Pollock, saffron cod, and yellowfin sole.
3. Waters free of toxins or other agents of a type and amount harmful to Cook Inlet beluga whales.
4. Unrestricted passage within or between the critical habitat areas.
5. Waters with in-water noise below levels resulting in the abandonment of critical habitat areas by Cook Inlet beluga whales (76 FR 20180).

3.2 BLUE WHALE

Blue whales were listed as endangered in 1970 under the Endangered Species Conservation Act (predecessor act to the ESA of 1973) primarily due to overexploitation in commercial fisheries (35 FR 8491). Its listing covers the entire species throughout its entire range; however, NMFS has identified two stocks of blue whales within the North Pacific Ocean. The Eastern North Pacific stock includes animals found in the eastern North Pacific Ocean from the northern Gulf of Alaska to the eastern tropical Pacific. The Western North Pacific stock appears to feed in summer southwest of Kamchatka, south of the Aleutians, and in the Gulf of Alaska (NMFS, 1998; Stafford et al., 2001). In winter, the Western stock migrates to lower latitudes in the western Pacific and, less frequently, to the central Pacific, including Hawaii (Stafford et al., 2001). The best estimate of blue whale abundance for the Eastern North Pacific stock is 1,647 whales with a Coefficient of Variation (CV) of 0.07, which was taken from the Chao model results of Calambokidis (2013) for the period 2008 to 2011. The International Whaling Commission reports a North Pacific Basin population estimate of approximately 2,500 whales (IWC, 2007).

3.2.1 Species Description – Blue Whale

Blue whales average 85 feet in length, and may travel alone or in pairs in pelagic waters, but may also occur near the ice edge while migrating. They are baleen whales and filter feed primarily on euphausids (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 Bering Sea, are used as summer feeding grounds.

Risk factors for blue whales include ship strikes and degradation of their acoustic habitat. Monnahan et al. (2014) investigated the effects of ship strikes on blue whales using a population modeling approach. They estimated the population likely never dropped below 460 individuals, and is at 97 percent of carrying capacity (95 percent confidence interval [CI] 62 to 99). These results suggest that density dependence, not ship strikes, is the key reason for the observed lack of increase in the population and that future strikes will likely have a minimal effect (Monnahan et al., 2014).

3.2.2 Blue Whale Presence in the Action Area

Although blue whales are found in coastal waters, they are thought to occur offshore more commonly than other whales in Alaskan waters. In Alaska, Moore et al. (2002a) found an association between whale distribution and the Emperor Seamounts, the steep continental slope off Kamchatka Peninsula, and the Aleutian Island chain.

While there is a potential for ship strikes in Project LNGC and HLV traffic routes through the Aleutian Islands, southern Bering Sea, and Gulf of Alaska (see Section 2.1), the risk of strikes is considered low. Therefore, a detailed analysis was not conducted for the fin whale.

3.2.3 Blue Whale Critical Habitat

Critical habitat has not been designated for blue whales.

3.3 BOWHEAD WHALE

The bowhead whale is an important subsistence resource for Alaska Native communities. It was listed as endangered in 1970 under the Endangered Species Conservation Act (predecessor act to the ESA of 1973) due to concern over population declines caused by commercial whaling (35 FR 8491). Increasing vessel traffic associated with reduction in Arctic sea ice, and exploration for and development of offshore oil and gas resources in the Beaufort and Chukchi seas are factors that may affect the bowhead population by increasing the number of vessel collisions with bowhead whales (Allen and Angliss, 2015).

Bowhead whales are circumpolar in distribution. Bowhead whales in Alaska waters belong to the Western Arctic stock (also called the Bering-Chukchi-Beaufort Sea stock; Allen and Angliss, 2015). The Western Arctic stock of bowhead whales increased at an annual rate of 3.4 percent from 1978 to 2001, during which time abundance doubled from approximately 5,000 to approximately 10,000 whales (George et al., 2004). Schweder et al. (2009) estimated the annual rate to be 3.2 percent between 1984 and 2003 using a sight-resight analysis of aerial photographs. The size of the Western Arctic stock currently is estimated at 16,892 individuals (95 percent CI = 15,704 to 18,928), based on an abundance estimate generated from large datasets of visual sightings and acoustic locations (Givens et al., 2013).

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 (Figure 11). Most bowhead whales continue to migrate eastward into the Beaufort Sea from April through mid-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 (NMFS, 2015e).

3.3.1 Species Description – Bowhead Whale

Bowhead whales have a dark body, distinctive white chin, two blow holes and no dorsal fin (NMFS, 2015e; ADF&G, 2015e). 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, 2015e). Bowhead whales reach sexual maturity at approximately 35 to 40 feet long, and they likely mate in the Bering Sea during late winter and spring (NMFS, 2015e; ADF&G, 2015e). Females typically have one calf every 3 to 4 years, giving birth between April and early June (NMFS, 2015e; AFSC, 2015). Calves are 13 to 14 feet long, weigh 1 ton and are gray (NMFS, 2015e; ADF&G, 2015e). Bowhead whales use baleen plates to consume zooplankton (i.e., crustaceans), other invertebrates and fish (NMFS, 2015e). Their life expectancy is unknown, but they may live over 100 years (NMFS, 2015e).

3.3.2 Presence of Bowhead Whales in the Action Area

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 (Figure 11). Most bowhead whales continue to migrate eastward into the Beaufort Sea from April through mid-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 (NMFS, 2015e). 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 (Ferguson et al., 2015a; Clarke et al., 2015). BIAs for migration northward through the Bering Sea occurs from March through June; northward and eastward through the eastern Chukchi and Alaskan Beaufort seas during from April through May; and westward through the Alaskan Beaufort Sea from September through October (Ferguson et al., 2015a; Clarke et al., 2015). 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 (Clarke et al., 2015). Bowhead whales are common in the Beaufort Sea on a seasonal basis with an overall density estimate of 6.0 bowhead whales per 1,000 square miles during open-water season surveys in 2007 (Ireland et al., 2009). The Beaufort Sea bowhead whale density used to estimate the potential exposures near West Dock in Prudhoe Bay, is 0.0127 whales per square mile. Bowhead whales are most likely to be affected by HLV traffic and construction noise during their fall migration through the Beaufort and Chukchi Seas.

3.3.3 Bowhead Whale Critical Habitat

Critical habitat has not been designated for the bowhead whale.

BOWHEAD WHALE RANGE FALL MIGRATION ROUTES AND BIOLOGICAL IMPORTANT AREAS

FIGURE 11

ALASKA LNG

LEGEND

- Project Facility
- Existing Facility
- Alaska Place Names
- Potential Marine Transportation Routes
- Alaska LNG Rev C2 Route
- Major Highways
- Action Area
- 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

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

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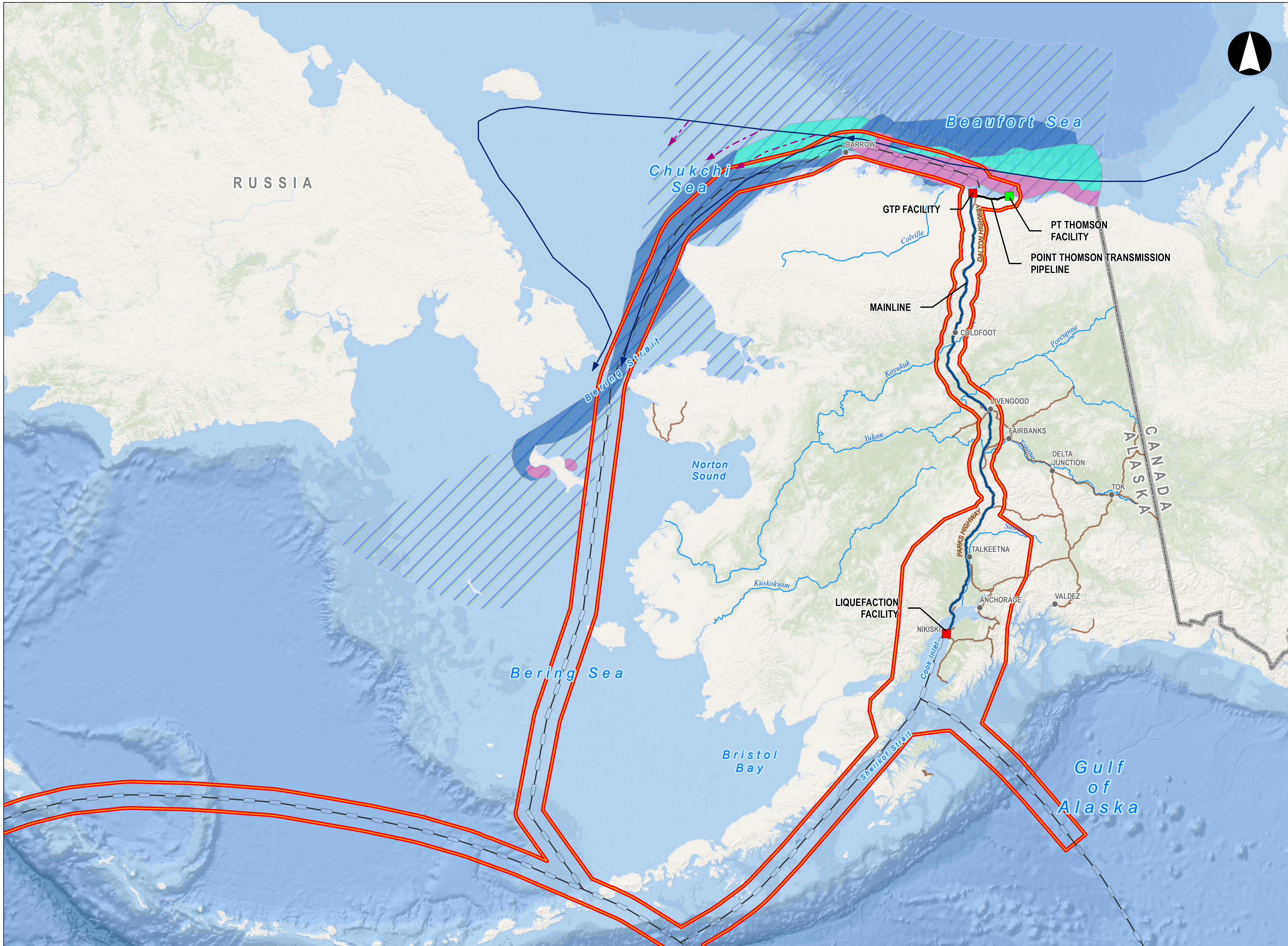
SCALE:	1:9,000,000		
DATE:	2017-03-29	SHEET:	1 of 1

VICINITY MAP



3.4 FIN WHALE

The fin whale was listed as endangered in 1970 under the Endangered Species Conservation Act (predecessor act to the ESA of 1973) primarily due to overexploitation in commercial fisheries (35 FR 8491). This listing covers the entire species throughout its range. Three stocks of fin whales are recognized within U.S. Pacific and western Arctic waters: the Hawaii stock, the California/Washington/Oregon stock, and the Northeast Pacific stock (Allen and Angliss, 2015). Individuals found in Alaska waters belong to the Northeast Pacific stock, which ranges from the Washington/Canada border to the Bering Sea (Allen and Angliss, 2015). The most recent abundance estimate of the Northeast Pacific stock is from surveys conducted in the Bering Sea and near the Kenai Peninsula (Moore et al., 2002b; Zerbini et al., 2006). When combined, these surveys provide a provisional minimal estimate for the stock of 5,600 fin whales.

BIAs for fin whale feeding include waters north, west, and south of Kodiak Island including entrances to Cook Inlet and Shelikof Strait, with greatest densities from June through August; and north of the Alaskan Peninsula within the Middle Shelf domain of the Bering Sea from June through September (Ferguson et al., 2015a, b).

3.4.1 Species Description – Fin Whale

Fin whales average 70 feet in length, and often have been observed traveling in groups, pairs, or alone in pelagic and deep coastal waters. They are baleen whales and feed primarily on small schooling fish and krill. Fin whales reach sexual maturity at 6 to 12 years, and may live up to 100 years. A single calf is born every 2 to 3 years in tropical and subtropical areas during midwinter. The Gulf of Alaska, along the Aleutian Islands, Bering Sea, and Chukchi Sea are used as summer feeding grounds.

Risk factors for fin whales include ship strikes, fishing gear entanglement, and degradation of their habitat from climate change and oil and gas activities in the Chukchi and Beaufort Seas (Allen and Angliss, 2015). Possible changes in fin whale habitat from climate change include changes in prey distribution, as well as increased shipping traffic and range expansion associated with reduced ice coverage (Allen and Angliss, 2015).

3.4.2 Fin Whale Presence in the Action Area

Fin whales typically range in U.S. waters from the North Pacific south to Hawaii, entering into the Bering Sea during ice-free summer months (Allen and Angliss, 2015). Most information about the distribution of fin whales in Alaska comes from acoustic surveys, which indicate that nearly all individuals in the Bering Sea congregate along the shelf-break in the central and eastern Bering Sea (Moore et al., 2000, 2002b). Fin whale calls detected in the southeastern Bering Sea from April 2006 through April 2007 showed peaks in numbers of calls from September through November, February, and March (Stafford et al., 2010). No fin whales have been recorded in Cook Inlet or the Beaufort Sea, and a few individuals have been sighted and detected acoustically in the Chukchi Sea during the open-water months of summer and fall (Brueggeman et al., 2009; Ireland et al., 2009; Delarue et al., 2013). Recent records of fin whales in the Chukchi Sea may coincide with rising sea-surface temperatures and/or may indicate a range expansion similar to that observed for humpback whales (Hashagen et al., 2009; Moore and Huntington, 2008).

The Gulf of Alaska, along with the Aleutian Islands, the Bering Sea, and the Chukchi Sea are used as summer feeding grounds. BIAs for fin whale feeding include waters north, west, and south of Kodiak Island including the entrances to Cook Inlet and Shelikof Strait with greatest densities during June to August (Ferguson et al., 2015a, b). From June through September, fin whale feeding BIAs are found north of the Alaskan Peninsula within the Middle Shelf domain of the Bering Sea (Ferguson et al., 2015a, b).

Two ship strike mortalities of fin whales occurred in Alaska waters between 2008 and 2012, one in 2009 and one in 2010 (Allen and Angliss, 2015). While the potential exists for ship strikes from Project LNGC and HLV shipping routes through important feeding habitats at the entrance to Cook Inlet, through Shelikof Strait, and through the Bering Sea during June through September (see Section 2.1), the risk of strikes is considered low. Therefore, a detailed analysis was not conducted for the fin whale.

3.4.3 Fin Whale Critical Habitat

Critical habitat has not been designated for fin whales.

3.5 GRAY WHALE – WESTERN NORTH PACIFIC DPS

The gray whale was originally listed as an endangered species in 1970 under the precursors to the Endangered Species Act (ESA), primarily due to overexploitation in commercial fisheries (35 FR 8491). The original listing covered the entire species throughout its entire range. In 1994, the Eastern North Pacific (ENP) gray whale population, which feeds in the Chukchi, Beaufort, and northwestern Bering Seas during summer and fall, was removed from the endangered species list as recovered (59 FR 31094; Weller et al., 2013). The Western North Pacific (WNP) gray whale population consists of 140 individuals, of which only 36 are mature females (Cooke et al., 2013). The WNP gray whale remains on the endangered list.

BIAs have been established for gray whale migration routes (Ferguson et al., 2015a, b).

3.5.1 Species Description – Gray Whale - Western North Pacific DPS

Gray whales average 46 feet in length, and often travel in groups of 2 to 3 individuals in coastal shallow waters over the continental shelf. They are baleen whales and feed primarily by dredging through the mud and filtering out bottom-dwelling crustaceans. Gray whales reach sexual maturity at 8 years, and may live for 78 to 80 years. A single calf is born every 2 years in and near lagoons in Baja California in January and February. 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.

Risk factors for WNP gray whales include large-scale oil and gas development programs off Sakhalin Island, poaching, entanglement in fishing gear, industrialization and shipping congestion throughout the migratory corridor, pollution, possible illegal whaling or resumed legal whaling at unsustainable levels, and ship strikes (Weller et al., 2004).

3.5.2 Presence of Western North Pacific DPS Gray Whales in the Action Area

The distribution and migration pattern of the WNP gray whale is not entirely known. In summer, WNP gray whales are found in feeding areas in shallow waters off the coasts of Sakhalin Island and the Kamchatka Peninsula, although some whales observed off Sakhalin have been sighted off Bering Island in the western Bering Sea (Weller et al., 2013). There is recent evidence from photo identification, genetic, and telemetry studies of spatial and temporal overlap between the WNP and ENP gray whales (Weller et al., 2013). These studies show that some WNP gray whales that feed off Sakhalin Island during summer/fall migrate to the west coast of North America during the winter/spring with ENP gray whales (Weller et al., 2013). Typical migration patterns include a northward migration through Unimak Pass to Nunivak Island from March through June, north migration from March through May and south migration from November through January in the Gulf of Alaska, and feeding from April through July along the Alaska Peninsula (Ferguson et al., 2015a, b). However, most gray whales using these migration corridors and feeding areas described previously are likely ENP population gray whales (Ferguson et al., 2015a, b).

Project-related HLV traffic in the Bering Sea is unlikely to encounter WNP gray whales, which would be expected to occur west of shipping routes through the Bering Sea. Because the fall/winter migration route for the portion of the WNP gray whales that winter along the West Coast of North America has not been characterized, the risk of potential ship strikes is unknown. While a potential exists for ship strikes in Project LNGC and HLV shipping routes (see Section 2.1), the risk of strikes is unknown but is expected to be sufficiently low as to be considered discountable. Most gray whales that might be encountered by vessels in the Gulf of Alaska, Aleutian Islands, Bering, Chukchi and Beaufort seas in these areas likely belong to the ENP gray whale population, which is not listed. Therefore, additional, detailed analyses were not conducted for the WNP gray whale.

3.5.3 Gray Whale Critical Habitat

No critical habitat has been designated for the gray whale, Western North Pacific DPS.

3.6 HUMPBACK WHALE – WESTERN NORTH PACIFIC DPS

The humpback whale was listed as endangered in 1970 under the Endangered Species Conservation Act primarily due to overexploitation in commercial fisheries (35 FR 8491). The original listing covered the entire species throughout its range. NMFS completed a comprehensive status review and issued a proposed rule to divide the globally listed species into 14 DPSs, to delist 10 DPSs, to list two DPSs as endangered, and to list two DPSs as threatened (80 FR 22304; Bettridge et al., 2015). In September 2016 (effective 11 October 2016), NMFS (FR 62260) de-listed the species, listed the Western North Pacific, Cape Verde Islands / Northwest Africa, Central America, and Arabian Sea DPSs as endangered, listed the Mexico DPS as threatened, and deemed the remaining 9 of the DPSs as not warranting listing. Humpback whales that may occur in the Project action area could include members of three DPSs: the Hawaii DPS – which has been delisted, the Mexico DPS – which is now listed as threatened, and the Western North Pacific DPS – now listed as endangered. Humpback whales that venture into Cook Inlet are most likely to belong to either the Hawaii or Mexico DPSs.

The Hawaii DPS was estimated in 2008 at about 10,000 whales, with an estimated annual growth rate of between 5.5 and 6.0 percent (Calambokidis et al., 2008). The Mexico DPS has been estimated to contain 6,000 to 7,000 or more whales and with a positive, but unquantified, annual growth rate (Calambokidis et al., 2008; Barlow et al., 2011; Bettridge et al., 2015). The Western North Pacific (WNP) DPS, the only DPS proposed for ESA protection that occurs in the action area, was estimated in 2008 at about 1,000 whales with an estimated annual growth rate of 6.7 percent (Calambokidis et al., 2008).

BIAs for feeding have been identified around the Aleutian Islands into the southern Bering Sea from June through September, around Kodiak Island from July through September, and around the Shumigan Islands from July through August (Ferguson et al., 2015a, b).

3.6.1 Species Description – Humpback Whale – Western North Pacific DPS

Humpback whales average 46 feet in length, and often congregate in groups of 2 to 12 in pelagic and coastal shallow waters. They are baleen whales and feed primarily on small schooling fish and krill. Humpback whales reach sexual maturity at 4 to 7 years, and may live for 50 years. A single calf is born every 1 to 3 years on wintering grounds in Hawaiian and Mexican waters. Humpback whale summer feeding grounds extend from Washington State to the Chukchi Sea.

Risks likely to reduce the population size or growth rate of the WNP humpback whale DPS include energy development, whaling, competition with fisheries, fishing gear entanglement, entanglement in unknown marine debris, and vessel collisions (80 FR 22304).

3.6.2 Presence of Western Northern Pacific Humpback Whales in the Action Area

The Hawaii DPS breeds within the main Hawaiian Islands and commonly use feeding grounds in the northern Gulf of Alaska and Bering Sea (Bettridge et al., 2015). The Mexico DPS breeds along the Pacific coast of mainland Mexico, the Baja California Peninsula, and the Revillagigedos Islands and feeds across a broad range from California to the Aleutian Islands with concentration in the northern and western Gulf of Alaska and Bering Sea feeding grounds (Bettridge et al., 2015). The Western North Pacific DPS breeds in the area of Okinawa, the Philippines, and unknown breeding grounds farther south, and feeds in the northern Pacific primarily off the Russian coast and the Aleutian Islands (80 FR 22304). Occasional sightings of humpback whales in the Beaufort Sea are assumed to represent vagrants from either the Hawaii DPS (Central North Pacific stock; Allen and Angliss, 2015) or the WNP DPS (Hashagen et al., 2009).

Annual ship strike mortality during 2008 to 2014 for the WNP DPS (stock) averaged 0.45 whales per year (Allen and Angliss, 2015). Humpback whales that venture into Cook Inlet are most likely to belong to either the proposed delisted Hawaii or Mexico DPSs. While a potential exists for ship strikes of WNP humpback whales from Project LNGC traffic in Cook Inlet, the Gulf of Alaska, and through the Aleutian Islands, and from HLV traffic through Cook Inlet, the Gulf of Alaska, the Aleutian Island, and the Bering, Chukchi, and Beaufort seas, shipping routes (see Section 2.1), the risk of strikes is low. Therefore, a detailed analysis was not conducted for the WNP humpback whale.

3.6.3 Critical Habitat for the Western Northern Pacific Humpback Whales

No critical habitat has been designated for humpback whales, or the WNP humpback whale.

3.7 NORTH PACIFIC RIGHT WHALE

The North Pacific right whale (*Eubalaena japonica*) was relisted as endangered as a separate species from the North Atlantic right whale, (*Eubalaena glacialis*) (73 FR 12024). Two populations of North Pacific right whales have been identified (NMFS, 2012a). The eastern population occurs predominantly in the U.S. Exclusive Economic Zone (EEZ), including the southeastern Bering Sea and the western Gulf of Alaska. The western population occurs primarily in the EEZs of the Russian Federation, Japan, and China.

The North Pacific right whale is considered one of the most endangered whales in the world, numbering fewer than 500 individuals for the eastern and western populations combined. The eastern population of the North Pacific right whales is considered severely depleted and threatened by extinction. This population is believed to consist of only about 30 individuals (NMFS, 2012a). Wade et al. (2011a) made abundance estimates for the eastern population of North Pacific right whales from mark-recapture data at 31 individuals (95 percent CI 23 to 54) and 28 individuals (95 percent CI 24 to 42) using photographic and genetic identification techniques, respectively. Marques et al. (2011) found a similar abundance estimate of 25 individuals (95 percent CI 13 to 47) using passive acoustic cue counting. The genetic-identification catalogue has a total of 23 individuals sampled from 1997 to 2011 for the eastern population of right whales (LeDuc et al., 2012). No estimate of trend in abundance is currently available (Allen and Angliss, 2015).

3.7.1 Species Description – North Pacific Right Whale

North Pacific right whales average 50 feet in length, and often congregate in groups of 2 to 12 in pelagic and coastal shallow waters. Right whales are large, slow-swimming whales that tend to congregate in coastal areas. They are baleen whales that feed primarily on zooplankton by skimming through schools with their mouths open. Right whales reach sexual maturity at 9 to 10 years, and may live for 50 years. Calves are born at lower latitudes during winter. Their summer range includes the southern Bering Sea and Gulf of Alaska (Figure 12).

Risk factors for right whales include ship strikes, fishing gear entanglement, and degradation of their acoustic habitat. Although no incidental takes of right whales are known to have occurred in the north Pacific as a result of interaction with the fishing industry, a photograph of a right whale off British Columbia and northern Washington State showed potential fishing gear entanglement (Allen and Angliss, 2015). Ship strikes are significant sources of mortality for the North Atlantic stock of right whales, and North Pacific right whales are also likely vulnerable to ship strikes. Because of their rare occurrence and scattered distribution, however, it is impossible to assess the threat of ship strikes to the North Pacific stock of right whales.

3.7.2 Presence of North Pacific Right Whales in the Action Area

The majority of right whale sightings in the past 20 years have been in a portion of the southeastern Bering Sea (Goddard and Rugh, 1998; Munger et al., 2008; Stafford and Mellinger, 2009; Allen and Angliss, 2015), and in the Gulf of Alaska south of Kodiak Island (Allen and Angliss, 2015; Wade et al., 2011b). Analysis of acoustic data indicates that right whales remain in the southeastern Bering Sea from May through December with peak calling rates in August, September, and December (Munger et al., 2008; Stafford and Mellinger, 2009). Recorders deployed from 2007 to 2013 indicate the presence of right whales in the southeastern Bering Sea almost year round, with a peak in August and a sharp decline in detections in early January (Allen and Angliss, 2015). Although there are fewer recent sightings of right whales in the Gulf of Alaska than in the Bering Sea, little survey effort has been conducted in this region (Brownell et al., 2001). Most recently, right whales were observed in Uganik Bay in October 2012, in Pasagshak Bay in May 2010, and in the Barnabas Canyon area off Kodiak Island in August 2004 to 2006 (Allen and Angliss, 2015).

A potential exists for ship strikes in Project LNGC and HLV shipping routes through the Aleutian Islands, southern Bering Sea, and Gulf of Alaska (see Section 2.1), the risk of strikes is unknown, but given the rarity and dispersed nature of right whales, is expected to be very low. LNGC traffic may transit either through Shelikof Strait or through the Kennedy/Stevenson Entrances between the Liquefaction Facility and ports in the Pacific Rim (Figure 12). Vessel traffic would not cross or approach critical habitat, where right whales are more likely to concentrate, in the Bering Sea or on the south side of Kodiak Island and, therefore, would have no effect on the zooplankton prey of North Pacific right whales or the designated critical habitat area. Ballast water exchange would comply with USCG regulations, would occur outside of U.S. waters, and would have no effect on North Pacific right whale critical habitat. Therefore, a detailed analysis was not conducted for the North Pacific right whale.

3.7.3 North Pacific Right Whale Critical Habitat

Critical habitat for North Pacific right whales has been designated in the southeastern Bering Sea and in the Gulf of Alaska south of Kodiak Island (Figure 12; 73 FR 19000). Primary constituent elements (PCEs) of critical habitat for right whales include dense concentrations of prey, the copepods *Calanus marshallae*, *Neocalanus cristatus*, and *N. plumchris*, and the euphausiid *Thysanoessa raschii*, in areas where North Pacific right whales are known or believed to feed (Figure 12; 73 FR 19000). These critical habitat areas have also been identified as BIAs for feeding with highest use in the Bering Sea from July through October, and Kodiak Island from June through September (Ferguson et al., 2015a, b).

NORTH PACIFIC RIGHT WHALE RANGE, CRITICAL HABITAT AND BIOLOGICAL IMPORTANT AREAS

FIGURE 12

ALASKA LNG

LEGEND

- Project Facility
- Existing Facility
- Alaska Place Names
- Potential Marine Transportation Routes
- Alaska LNG Rev C2 Route
- Major Highways
- Major Rivers
- Action Area
- North Pacific Right Whale Critical Habitat
- North Pacific Right Whale Range

Biologically Important Area (BIA)

- Feeding

0 40 80 160 Miles

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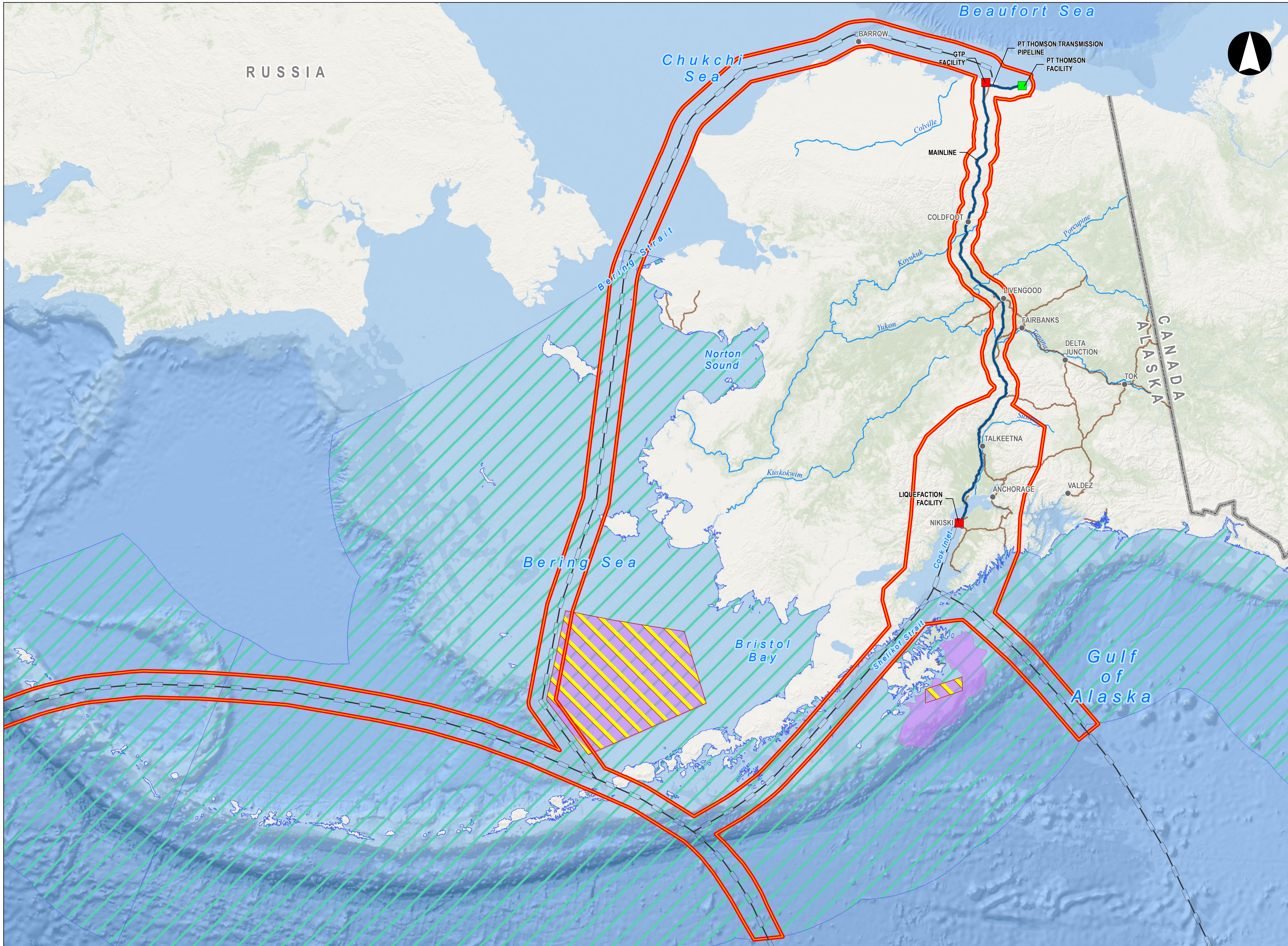
Map may not represent full species range.
Only includes areas within NMFS Alaska region.

PREPARED BY:	AGDC		
SCALE:	1:9,000,000		
DATE:	2017-03-29	SHEET:	1 of 1

VICINITY MAP



X:\AKLNG\Resource Reports\RR03\Appendix C\Figure 12 North Pacific Right Whale Range Critical Habitat and Biological Important Areas.mxd

3.8 SEI WHALE

The sei whale was listed as endangered in 1970 under the Endangered Species Conservation Act (predecessor act to the ESA of 1973) primarily due to overexploitation (35 FR 8491). It is listed globally as a single species.

Kanda et al. (2014) investigated stock structure of North Pacific sei whales based analysis of one microsatellite loci and concluded that North Pacific waters are occupied by a single stock of sei whales. NMFS has determined that data are insufficient to determine population structure, but conservatively does not assume panmixia across the entire North Pacific and has divided sei whales into three discrete areas: waters around Hawaii; California, Oregon, and Washington waters; and Alaskan waters (Carretta et al., 2014).

No reliable abundance estimates are available at the Pacific-wide scale (Carretta et al., 2014). Hakamada et al. (2014) estimated the abundance of sei whales in the central North Pacific (north of 40° North latitude, south of Aleutian Islands, between 170° East and 170° West longitude) in 2010 to be 9,286 (CV 0.35); abundance estimates range between 8,528 and 9,188 in the sensitivity analyses. No reliable abundance estimates are available at this scale (Carretta et al., 2014).

BIAs have not been evaluated for sei whales in the Gulf of Alaska, the Aleutian Islands and Bering Sea, or elsewhere in Alaska waters (Ferguson et al., 2015a, b).

3.8.1 Species Description – Sei Whale

Sei whales average about 50 feet in length, and occur alone or in groups of 2 to 5 in pelagic waters. Sei whales are baleen whales that feed on zooplankton (copepods and krill), small schooling fish, and squid by gulping and skimming. Sei whales reach sexual maturity at 10 years, and may live for 60 years. Calves are born at lower latitudes during winter. Their summer feeding grounds include the Gulf of Alaska

Risks to sei whales include ship strikes and entanglement in fishing gear. Sei whales could also be affected by degradation of the acoustic environment associated with increased shipping and geophysical exploration. In 2011, an entanglement of a juvenile sei whale was documented in Hawaii (Carretta et al 2014). One sei whale death was attributed to collision with a vessel in the North Pacific Ocean in 2003 (NMFS, 2012b).

3.8.2 Sei Whale Presence on the Action Area

Sei whales are present on feeding grounds in the Gulf of Alaska and south of the Aleutian Islands in summer. The average observed ship strike mortality for sei whales in the North Pacific during 2004 to 2008 was 0 whales (Carretta et al., 2014). A potential exists for ship strikes during summer if Project LNGCs or HLVs cross through shipping routes in the Gulf of Alaska and south of the Aleutian Islands (see Section 2.1), the risk of strikes is low. Sei whales are unlikely to be encountered on LNGC and HLV routes through Shelikof Strait, the Aleutian Islands, and southern Bering Sea (see Section 2.1). Therefore, a detailed analysis was not conducted for the sei whale.

3.8.3 Sei Whale Critical Habitat

Critical habitat has not been designated for sei whales.

3.9 SPERM WHALE

The sperm whale was listed as endangered in 1970 under the Endangered Species Conservation Act (precursor to the ESA…) primarily due to overexploitation in commercial fisheries (35 FR 8491). The listing covers the entire species throughout its range; however, three stocks of sperm whales are currently recognized in U.S. waters: Alaska North Pacific stock; the

California/Washington/Oregon stock; and the Hawaii stock (Allen and Angliss, 2015). Information from Mizroch and Rice (2012) based on whaling and movement data, however, indicate no apparent divisions between stocks within the North Pacific.

3.9.1 Species Description – Sperm Whale

Sperm whales average about 40 feet in length, and occur in social groups of 10 to 80 females with young, small male bachelor groups or single mature males in deep pelagic waters. Sperm whales are toothed whales that specialize in feeding on large squid, but will also feed on sharks, skates, and other fish. Female sperm whales reach sexual maturity at 10 years, and produce a single calf at 5 year intervals. Males mature later. Sperm whale lifespan is unknown. Calves are born at lower latitudes during winter. Some sperm whales migrate to higher latitudes in summer, with some males occurring as far north as the Bering Sea.

Risk factors for sperm whales include ship strikes, fishing gear entanglement, and degradation of their acoustic habitat.

3.9.2 Sperm Whale Presence in the Action Area

Sperm whales appear to be nomadic, showing widespread movements between areas of concentration, with males ranging more widely than females (Mizroch and Rice, 2012). Summer surveys conducted between 2001 and 2010 by the NMFS National Marine Mammal Laboratory have found sperm whales most frequently in coastal waters around the central and western Aleutian Islands (Allen and Angliss, 2015). Acoustic surveys have detected sperm whales year-round in the Gulf of Alaska, although they appear to be more common in summer than in winter (Mellinger et al., 2004). This seasonal detection pattern is consistent with the hypothesis that sperm whales migrate to higher latitudes in summer and migrate to lower latitudes in winter (Gosho et al., 1984). No estimates for numbers of sperm whales in Alaska waters are available, nor is there a reliable estimate of abundance for the North Pacific stock (Allen and Angliss, 2015). Critical habitat has not been designated for sperm whales.

From 2008 to 2012, there were no observed serious injuries of a sperm whale associated with commercial fisheries (Allen and Angliss, 2015). While a potential exists for ship strikes in Project LNGC and HLV shipping routes through lower Cook Inlet, Resurrection Bay, the Aleutian Islands and southern Bering Sea (see Section 2.1), the risk of strikes is expected to be low. Therefore, a detailed analysis was not conducted for the sperm whale.

3.9.3 Sperm Whale Critical Habitat

Critical habitat has not been designated for the sperm whale.

3.10 ARCTIC RINGED SEAL

Ringed seals in Alaska waters belong to the Alaska stock, which comprises the portion of the Arctic ringed seal subspecies, *Phoca hispida* that occurs within the Bering, Chukchi, and Beaufort seas (Allen and Angliss, 2015). The Arctic ringed seal was listed as threatened (effective 26 February 2013) because ice projection models predict a reduction in sea ice habitat in the latter half of the century and snow production models predict a reduction in snow accumulation, which could compromise the ability of the seals to construct subnivean lairs (77 FR 76706). The reduction in available suitable ice habitat is expected to result in adverse demographic effects. On March 11, 2016, the United States District Court for the District of Alaska determined that the NMFS's listing decision was arbitrary and capricious. The Court vacated the listing rule and remanded the rule back to the NMFS for reconsideration. Arctic ringed seals are an important subsistence resource to Arctic coastal communities.

3.10.1 Species Description – Arctic Ringed Seal

Ringed seals are the most abundant and smallest of the Alaskan seals, weighing 110 to 150 pounds with an average length of 4 feet (males and females are roughly the same size) (ADF&G, 2015e; AFSC, 2015). They have a small head, short snout, clawed foreflippers and plump body (NMFS, 2015e). While coloring varies, a gray back with black spots and a light underside is most common; the seal's name is derived from the small, light-colored circles (i.e., rings) on its back (AFSC, 2015). Males and females become sexually mature at 5 to 6 years of age, and breed in between April to May (ADF&G, 2015e). Females give birth in late winter-early spring to a single pup, which is nursed for two months, enabling the pup to double its birth weight of 10 pounds (AFSC, 2015; ADF&G, 2015e). Ringed seals consume various invertebrates, fish and amphipods, including crustaceans, Arctic and saffron cod (ADF&G, 2015e). Their life expectancy is 25 to 30 years (NMFS, 2015a). Ringed seals are circumpolar in distribution, occupying the Bering, Chukchi, and Beaufort seas in Alaska (ADF&G, 2015e). Adults breed in heavy shorefast ice, and juveniles migrate south to the ice edge for the winter (ADF&G, 2015e).

The Arctic ringed seal is the most abundant of the ringed seal subspecies and has a circumpolar distribution. A reliable estimate for the entire Alaska stock of Arctic ringed seals is not available (Allen and Angliss, 2015). Kelly et al. (2010) estimated the Alaska stock at 300,000 seals, which they indicate is likely an underestimate because it is based on survey of a portion of the range. However, NMFS considers this an unreliable estimate of minimum population sized because it is based on surveys that are more than 8 years old. Similarly there is no reliable data on trends in population abundance, population trends have been reported as declining but data are both dated and are limited in extent (Allen and Angliss, 2015).

A northern pinniped marine mammal mortality event beginning in mid-July 2011 resulted in about a hundred, mostly ringed seal, pinniped deaths and illnesses associated with hair loss and skin lesions (NMFS, 2014a). This unusual event has subsided with no new occurrences in 2012 or 2013; however, a cause still has not been identified (NMFS, 2014a).

3.10.2 Presence of the Arctic Ringed Seal in the Action Area

Throughout their range, ringed seals have an affinity for ice-covered waters and are well adapted to occupying both shorefast and pack ice (Kelly, 1988a). The seals 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, although land haulouts may be increasingly used because of increases in summer sea ice retreat. Outside of the breeding and molting seasons, ringed seals are distributed in waters of nearly any depth with their distribution strongly related with seasonal and permanent ice-covered water and food availability (NMFS, 2015a). In Alaskan waters, during winter and early spring, ringed seals are abundant in the northern Bering Sea, Norton and Kotzebue Sounds, and throughout the Chukchi and Beaufort seas (Figure 13). They occur as far south as Bristol Bay in years of extensive ice coverage, but generally are not abundant south of Norton Sound except in nearshore areas (Frost, 1985). Ringed seals are expected to occur near West Dock year-round.

3.10.3 Ringed Seal Critical Habitat

Critical habitat was proposed for the Arctic ringed seal before the listing rule for the seal was vacated by the courts. The proposed critical habitat for the Arctic ringed seal includes all contiguous marine waters from the coastline of Alaska to the offshore limit within the U.S. EEZ in the northern Bering, Chukchi, and Beaufort seas (79 FR 73010). Essential features or primary constituent elements of the proposed critical habitat include: sea ice habitat suitable for formation and maintenance of subnivean birth lairs defined as seasonal floating landfast ice or dense stable pack ice with deformations and snowdrifts at least 21 inches (54 cm) deep; sea ice habitat suitable for basking and molting defined as floating sea ice with 15 percent or more concentration; and primary prey resources defined as Arctic cod, saffron cod, shrimps, and amphipods (79 FR 73010). Sea ice in waters less than 6.5 feet is usually grounded to the bottom, does not float, and does not generally provide habitat for ringed seals.

SUMMER AND WINTER RINGED SEAL DISTRIBUTION AND PROPOSED CRITICAL HABITAT

FIGURE 13

ALASKA LNG

LEGEND

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

0 50 100 200 Miles

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

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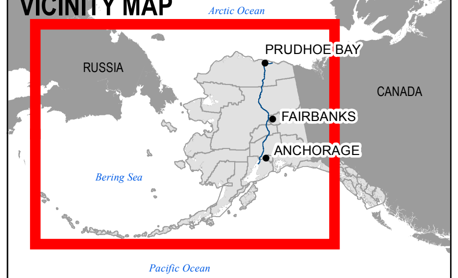
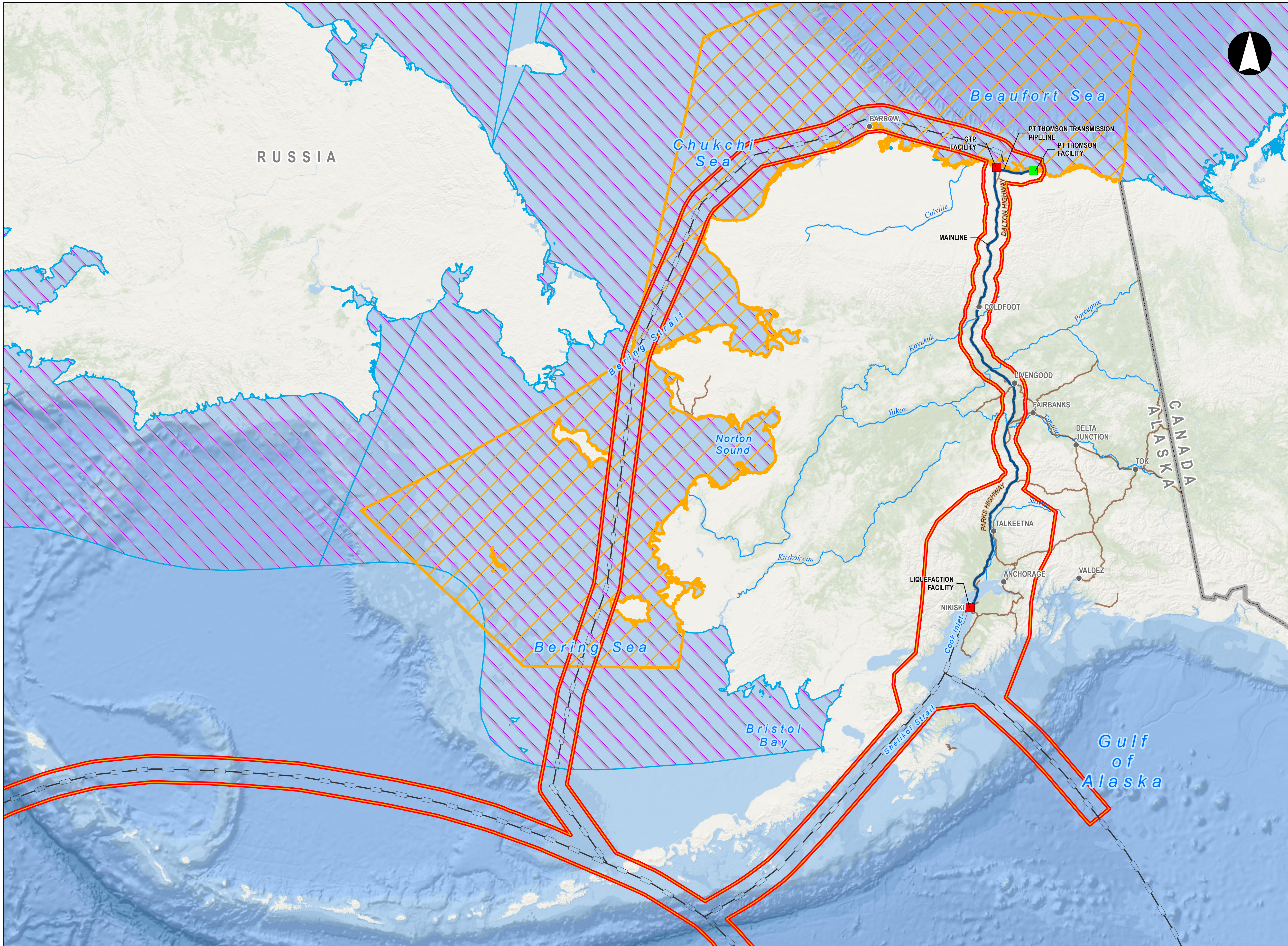
VICINITY MAP





X:\AKLNG\Resource Reports\RR03\Appendix C\Figure 13 Summer and Winter Ringed Seal Distribution and Proposed Critical Habitat.mxd

3.11 BEARDED SEAL – BERINGIA DPS

The distribution of the Beringia DPS of bearded seals (Figure 14) extends over continental shelf waters of the Bering, Chukchi, Beaufort, and East Siberian seas (Allen and Angliss, 2015). On July 25, 2014, the United States District Court for the District of Alaska determined that the NMFS's listing decision was arbitrary and capricious, particularly with respect to the lack of any quantified threat of extinction within the reasonably foreseeable future and the finding that existing protections were adequate. The Court vacated the listing rule and remanded the rule back to the NMFS for reconsideration. The NMFS filed their opening brief for the Federal Appeals Court in May 2015. Recent NMFS BOs include conference findings for the bearded seal Beringia DPS.

Currently, no reliable population estimate exists for the bearded seal Beringia DPS (Allen and Angliss, 2015). Surveys over the past 4 decades have estimated about 125,000 bearded seals in the Bering Sea and 27,000 bearded seals in the Chukchi Sea. Cameron et al. (2010) estimated that the Beringia DPS contained approximately 155,000 bearded seals, although the estimate was considered crude and conservative. No population estimates are available for the Beaufort Sea (Allen and Angliss, 2015). Using shoreline and sea-ice survey data between 13 April and 26 May 2007 in the Bering Sea, Ver Hoef et al. (2014) estimated bearded seal abundance at 61,800 (95 percent Confidence Interval [CI] 34,900-171,600). Conn et al. (2014) reported a preliminary estimate of 299,174 (95 percent CI 245,476 - 360,544) bearded seals in the Bering Sea using data from a more extensive, fixed-wing survey. The differences from the 2007 (Ver Hoef et al., 2014) and 2012 (Conn et al., 2014) estimates are likely attributable to differences in sample areas, and NMFS concludes that no reliable population estimate or trend data are available for the bearded seal (Allen and Angliss, 2015).

3.11.1 Species Description – Beringia DPS Bearded Seal

Bearded seals are the largest of all Arctic seals, ranging in color from silver-gray to dark brown, with small heads, long whiskers and square-shaped foreflippers (ADF&G, 2015e). Adults can be 7 to 8 feet long, weighing 575 to 800 pounds (females weigh more than males) (ADF&G, 2015e). Female and male bearded seals are sexually mature at 5 to 6 and 6 to 7 years of age, respectively; they breed in late May or early June (ADF&G, 2015e). Depending on prey availability, females can have up to one pup annually, which is born in late April or early May (ADF&G, 2015e). Pups are nursed for approximately one month, during which time their weight increases to 190 pounds (ADF&G, 2015e). Bearded seals consume benthic invertebrates (e.g., clams, snails and shrimp) and fish (e.g., sculpins, flatfish and cod) at depths of less than 150 to 200 meters (ADF&G, 2015e). Their life expectancy is approximately 25 years (ADF&G, 2015e).

Bearded seals in Alaska waters belong to the Alaska stock (Allen and Angliss, 2015) and the Beringia DPS. Bearded seals are an important subsistence resource. The bearded seal Beringia DPS was listed as threatened due to concern for the long-term survival of the population as a result of declines in sea-ice cover and quality in the Arctic that is used by bearded seals for whelping and rearing pups, breeding, and haulout during molting (77 FR 76740).

3.11.2 Presence of the Bearded Seal in the Action Area

Bearded seals overwinter in the Bering Sea, migrating north through Bering Strait during April and May, as the sea ice retreats. Seasonal movements and distributions are tied to seasonal changes in sea ice conditions (Cameron et al., 2010). Bearded seals move north in late-spring and summer as the ice melts and then move south in the fall as sea ice forms (Cameron et al., 2010). A few bearded seals remain near coasts and may haul out along shorelines in the Bering, Chukchi, and Beaufort seas (Cameron et al., 2010); they are most common in the Beaufort Sea over the continental shelf during August through October.

Bearded seals occur along marine transportation routes through the Bering, Chukchi and Beaufort seas, and a small number of bearded seals are expected to occur near West Dock.

3.11.3 Bearded Seal Critical Habitat

Critical habitat has not been proposed or designated for the bearded seal Beringia DPS.

BEARDED SEAL RANGE

FIGURE 14

ALASKA LNG

LEGEND

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

0 50 100 200 Miles

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

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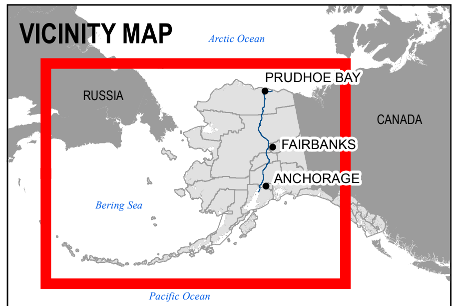
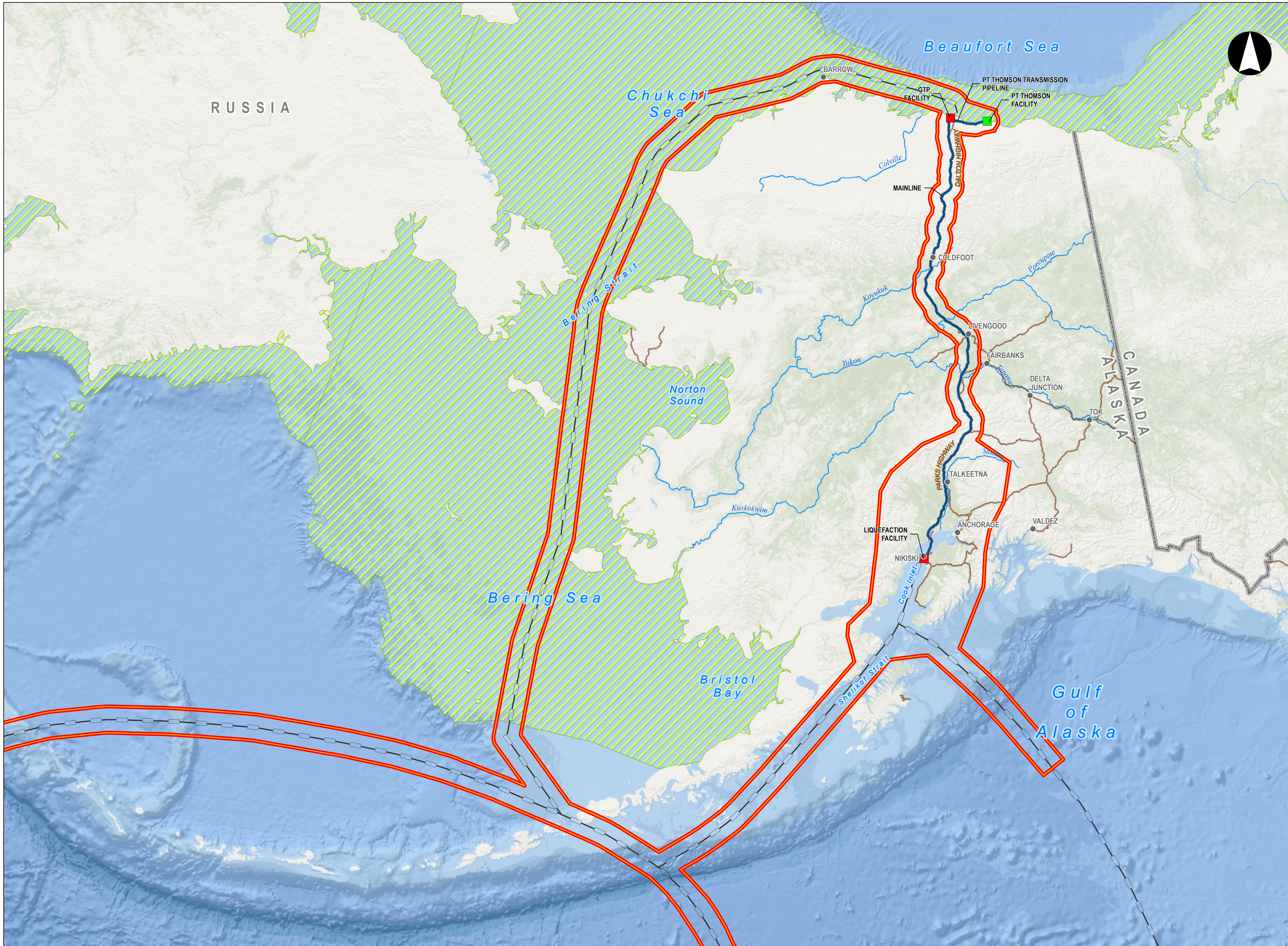
VICINITY MAP





3.12 STELLER SEA LION

The Steller sea lion was listed throughout its range as a threatened species in 1990 because of significant population declines of 63 percent since 1985, and 82 percent since 1960 (55 FR 49204). Potential reasons for the declines that have been identified include: marine habitat regime change that lowered the carrying capacity of the environment; competition for prey with other predators and commercial fisheries; and predation by sharks and killer whales. Sea lions are also harvested for subsistence purposes by Alaska Natives. NMFS has addressed effects of competition with commercial fisheries through intra-agency ESA consultations on federal fishery management plans. In 1997, NMFS reclassified Steller sea lions as two DPSs under the ESA based on genetic studies and phylogeographic analyses from across the sea lion's range (62 FR 24345).

The western DPS includes those animals found west of Cape Suckling, Alaska (144^{o}W) through Prince William Sound and Cook Inlet, along the Alaska Peninsula, through the Aleutian Islands and Bering Sea, to the Kuril Islands, Sea of Okhotsk and to the northern coast of Japan. The western DPS was listed as endangered and the eastern DPS was listed as threatened. In November 2014, NMFS determine that the eastern DPS was recovered and it was delisted (78 FR 66140).

The estimated abundance of 82,516, (pups and nonpups) for the entire (U.S. and Russia) western DPS of Steller sea lions is based on adding the most recent US and Russian pups counts, and multiplying by 4.5 (Allen and Angliss, 2015; Calkins and Pitcher, 1982). The most recent comprehensive aerial photographic and land-based surveys of western Steller sea lions in Alaska were conducted in 2014 (Fritz et al., 2015).

Using a Bayesian hierarchical model, agTrend (Johnson and Fritz, 2014) and 2014 survey results (Fritz et al., 2015), when multiplied by 4.5, yields a total population estimate for the U.S. portion of the western DPS Steller sea lion of 54,850 (90 percent CI 50,931 to 58,788) (Fritz et al., 2015; Johnson and Fritz, 2014). An estimate of the total population size of western DPS Steller sea lions in Alaska can be obtained by multiplying the best estimate of total pup production by 4.5 (Calkins and Pitcher, 1982). Total pup production in the western DPS in Alaska in 2014 was estimated to be 12,189 (90 percent CI 11,318 to 13,064) (Fritz et al., 2015).

Overall, western DPS Steller sea lions in Alaska are estimated to be increasing at about 1.67 percent annually for non-pups and 1.45 annually for pups, based on pup counts conducted at trend sites between 2000-2012 (Fritz et al., 2014; Johnson and Fritz, 2014); although regional differences in trends occur in the Aleutian Islands. Total pup production in the western DPS in Alaska in 2014 was estimated to be 12,189 (90 percent CI 11,318 to 13,064) (Fritz et al., 2015). West of Samalga Pass, pup counts are stable in the central Aleutian Islands, but pup counts are decreasing rapidly in the western Aleutians (Allen and Angliss, 2015). East of Samalga Pass, pup counts are increasing or stable (Allen and Angliss, 2015).

3.12.1 Species Description – Steller Sea Lion

The Steller sea lion is the largest member of the family *Otariidae* (i.e., eared seals) (ADF&G, 2015e). They have external ear flaps, use long forearms resembling flippers for propulsion, and are capable of quadrupedal locomotion on land via rotatable hind flippers (ADF&G, 2015e). Adult females tend to be buff colored on the back, with an average length of 8.6 feet and weight of 579 pounds (ADF&G, 2015e). Adult males are darker on the front of the neck and chest, with an average length of 10.6 feet and weight of 1,245 pounds (ADF&G, 2015e). Steller sea lions are sexually mature at 3 to 7 years, but males are 9 to 13 years old before they hold territories on breeding rookeries (ADF&G, 2015e). Females exhibit rookery site fidelity, are capable of pupping annually, and breed in June by, giving birth the following June to a single pup 3.3 feet long and weighing 35 to 50 pounds (ADF&G, 2015e; NMFS, 2008, 2015e). Steller sea lions are generalists, feeding on seasonally available fish and cephalopods (ADF&G, 2015e). They do not conduct long migrations, but move their haulouts to follow prey concentrations (ADF&G, 2015e). They inhabit the Aleutian chain, the central Bering Sea, the Gulf of Alaska and southeastern Alaska (ADF&G, 2015e). Male Steller sea lions may live 20 years, while females may live 30 years (ADF&G, 2015e).

3.12.2 Presence of Steller Sea Lion in the Action Area

Steller sea lions exist along vessel transit corridors and some could be exposed to HLVs and LNGCs calling at Nikiski. HLVs originating outside of Alaska would transit in regularly used shipping lanes along Southeast Alaska, across the Gulf of Alaska, to either Cook Inlet or through Unimak Pass into the Bering Sea and north into the Chukchi Sea and terminating at West Dock near Prudhoe Bay in the central Alaskan Beaufort Sea. Vessels entering Cook Inlet would pass near rookery sites at Sugarloaf and Marmot Island and several haulout sites in the in the Barren Islands located between Stevens and Kennedy Entrances to Cook Inlet (Figure 15). HLVs and LNGCs calling at Nikiski would pass near these same areas. HLVs in transit to West Dock would likely transit near rookery and haul out sites on the Shumagin Islands, Atkins Island, and Ugamak Island; and through the eastern portion of the Bogoslof foraging area in the Bering Sea.

A few individual Steller sea lions may rarely venture into upper Cook Inlet; although, they are unlikely to occur near the Liquefaction Facility.

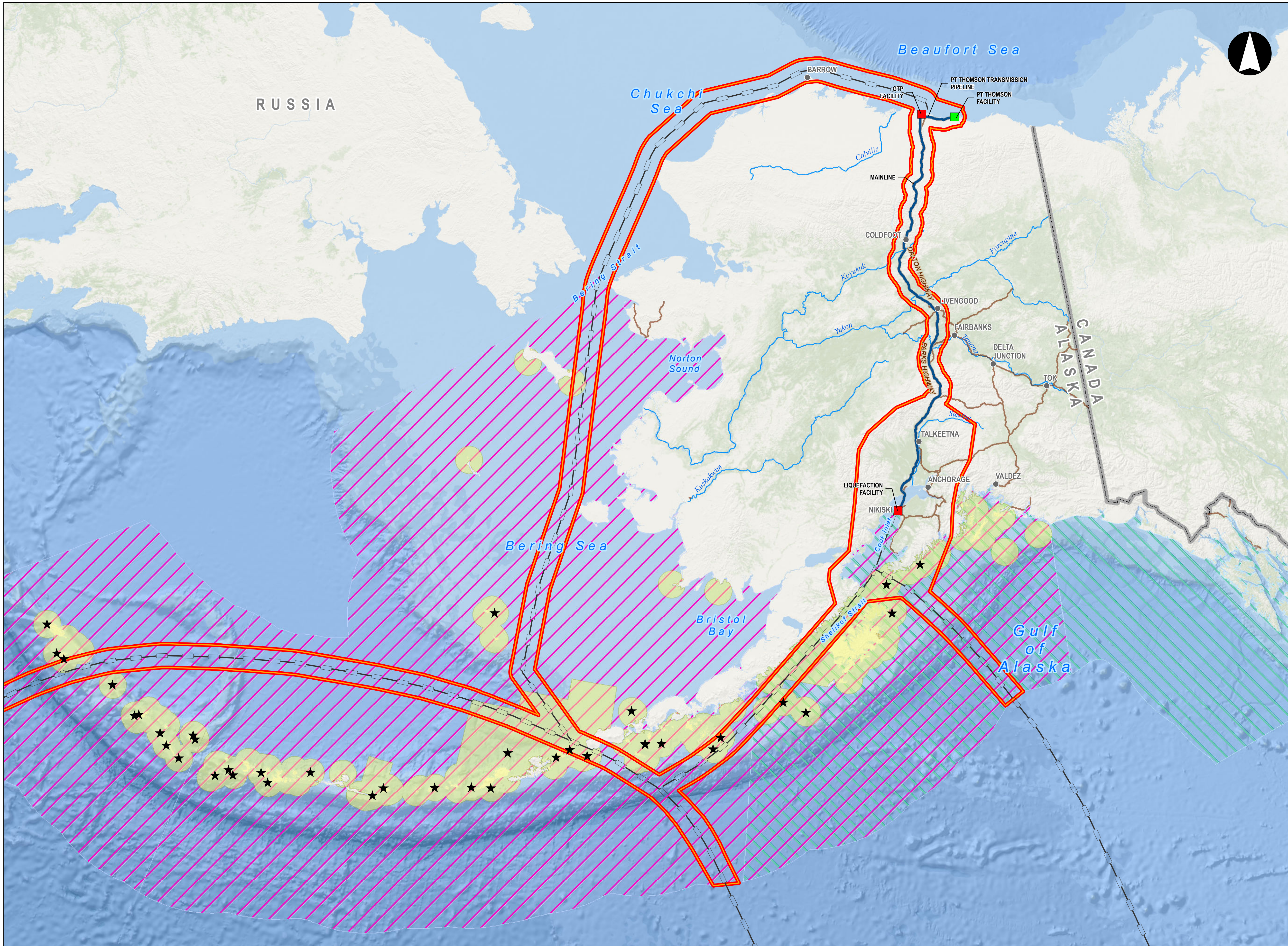
3.12.3 Steller Sea Lion Critical Habitat

In 1993, critical habitat was designated for the Steller sea lion that includes a 20-nautical-mile buffer around all major haulouts and rookeries, as well as associated terrestrial, air, and aquatic zones (58 FR 45269, Figure 16). Portions of the southern reaches of the lower Cook Inlet are designated as critical habitat, including those near the mouth of Cook Inlet (Figure 16). Critical habitat for Steller sea lions contains the physical and biological habitat features essential to the conservation of Steller sea lions, including: terrestrial habitat used for breeding, pupping, rearing pups, and hauling out; and air space above the terrestrial and aquatic habitat free of aircraft (a source of disturbance which can cause flushing form the rookery and haulout sites; and aquatic areas used for foraging). The critical habitat aquatic zone extends 20 nautical miles seaward in state and federally managed waters from the baseline of the base point of each major rookery and major haulout in Alaska that is west of 144° West longitude. It also includes three special aquatic foraging areas in Shelikof Strait between Kodiak Island and the Alaska Peninsula, the Bogoslof Island area north of Unimak Pass along the Bering Shelf, and the Sequam Pass area in the Western Aleutian Islands (Figure 16).

STELLER SEA LION RANGE AND CRITICAL HABITAT

FIGURE 15

ALASKA LNG



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
- Action Area
- Western Steller Sea Lion DPS
- Eastern Steller Sea Lion DPS
- Steller Sea Lion Critical Habitat Area

0 45 90 180 Miles

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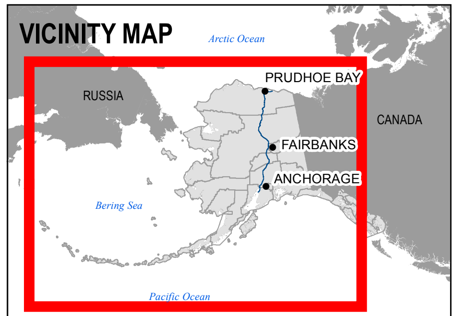


X:\AKLNG\Resource Reports\RR03\Appendix C\Figure 15 Steller Sea Lion Range and Critical Habitat.mxd

STELLER SEA LION BREEDING SITES (ROOKERIES) AND HAUL OUTS IN COOK INLET

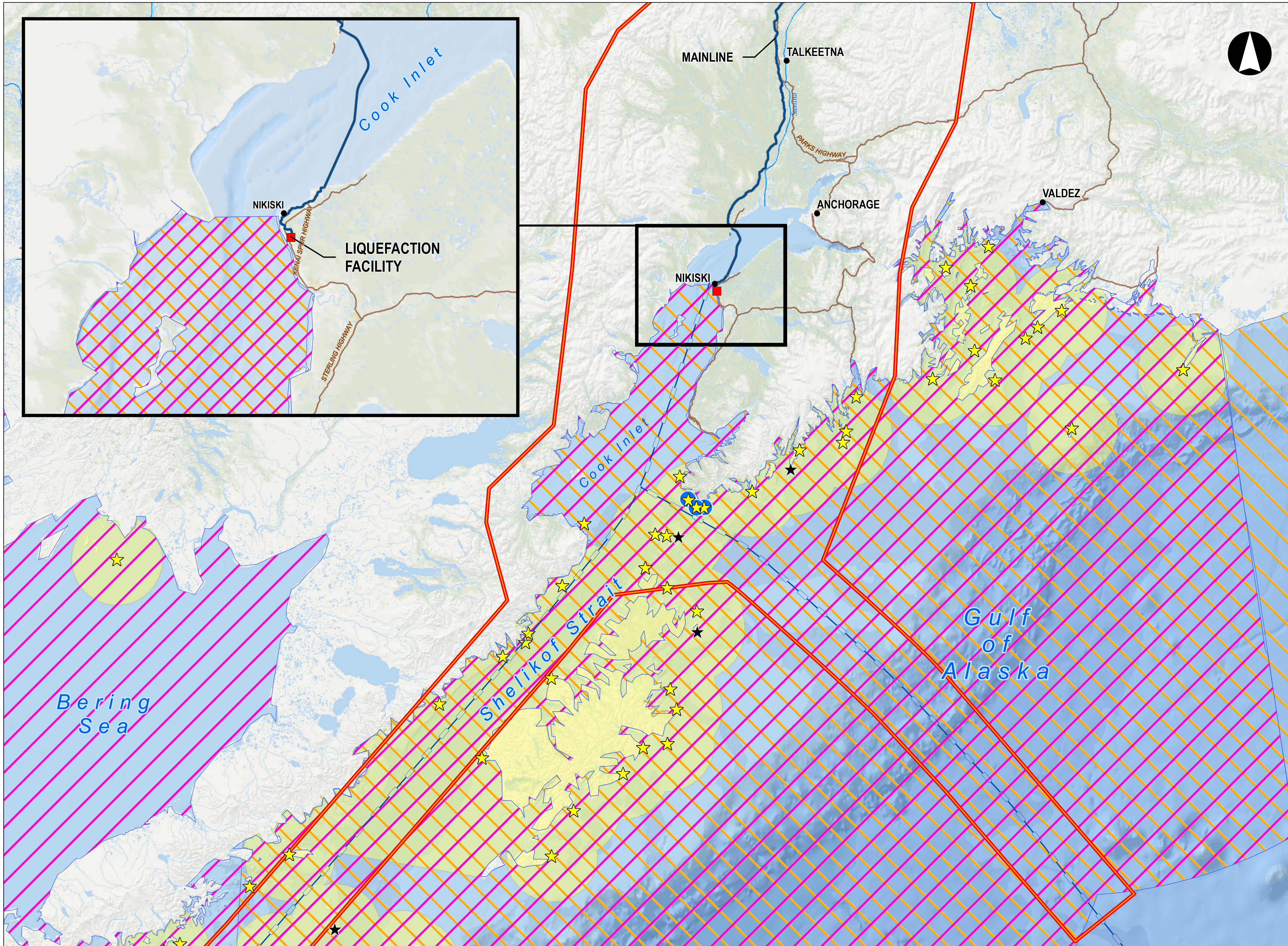
FIGURE 16

ALASKA LNG

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
- Action Area
- Western Steller Sea Lion DPS
- Eastern Steller Sea Lion DPS
- Steller Sea Lion Critical Habitat Area

0 15 30 60 Miles



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VICINITY MAP

X:\AKLNG\Resource Reports\RR03\Appendix C\Figure 16 Stellar Sea Lion Breeding Sites Rookeries and Haul Outs in Cook Inlet.mxd

3.13 PACIFIC WALRUS

Pacific walruses are managed by the USFWS under the MMPA, with co-management agreements between USFWS and the 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 (*Odobenus rosmaurs*) as endangered or threatened and to designate critical habitat under the ESA, as amended (76 FR 7634). After review of all the available scientific and commercial information, the USFWS determined that listing the Pacific walrus as endangered or threatened was warranted; but listing was precluded by higher priority species and the Pacific walrus was added to the candidate list (76 FR 7634). As a candidate for listing, the Pacific walrus receives no protection under the ESA, although walruses are protected under the MMPA. Walrus are an important subsistence resource especially for Chukchi Sea communities; with an estimated annual subsistence harvest of 6,713 animals per year (Allen and Angliss, 2014).

The current size of the Pacific walrus population is not well known. Surveys initiated in 1975 estimated the walrus population at 221,350. In 1980, the estimate was 246,360, dropping to 234,020 in 1985, and 201,039 in 1990 (Allen and Angliss, 2015). A portion of the walrus range was surveyed by a multi-national research team (USFWS, USGS, and various Russian research institutes) in 2006 using thermal imaging and satellite transmitters. As a result of this survey, walruses within the Bering Sea pack ice survey area were estimated at 129,000 individuals, but this amount represents only a partial population estimate because only half of the potential walrus habitat was surveyed (Speckman et al., 2010). In the summer of 2011, Pacific walruses in Alaska were observed with skin lesions, with some associated mortality (NMFS, 2014a). Causes of this outbreak are being investigated. No pathogens have been identified as the source of these events at this time (NMFS, 2014a).

3.13.1 Species Description – Pacific Walrus

Pacific walrus are large pinnipeds possessing two ivory tusks and a thick, tough hide (ADF&G, 2015e). 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, 2015e). Males can also be distinguished from females by their broad muzzle, heavier tusks and “bosses” (i.e., large bumps) on their neck and shoulders (ADF&G, 2015e). Females and males become sexually mature at 6 to 7 and 8 to 10 years of age, respectively and breed in January-March (ADF&G, 2015e). Females typically give birth every 2 years (on ice floes in late spring) to one calf that can weigh up to approximately 140 pounds (ADF&G, 2015e). Calves stay with their mothers for 2 years, during which time their weight increases to approximately 750 pounds (ADF&G, 2015e). Walrus consume a variety of soft invertebrates, including snails, clams, tunicates and sea cucumbers (ADF&G, 2015e). Males occasionally prey on seabirds and seals (ADF&G, 2015e). The life expectancy of a walrus is 40 years (ADF&G, 2015e). Pacific walrus winter on the Bering Sea pack ice (ADF&G, 2015e). In the spring, females and their calves migrate to the Chukchi Sea, while adult males migrate to Bristol Bay (ADF&G, 2015a). Return migrations occur in late fall (ADF&G, 2015e).

3.13.2 Presence of Pacific Walrus in the Action Area

Pacific walrus range throughout the Bering and Chukchi seas, occasionally moving into the Beaufort Sea (Figure 17). Walruses are associated with the pack-ice edge, but they also use shoreline haulouts on islands and remote coastlines during summer ice-free periods. In the winter, Pacific walruses use the Bering Sea pack ice, especially in the area near and south of St. Lawrence Island (Garlich-Miller et al., 2011). In the summer (May or June), most females and calves migrate north with retreating sea ice into the Chukchi Sea. Males occasionally move into the Chukchi Sea, but more commonly migrate south to haulouts in Bristol Bay or the Gulf of Anadyr, in Russia (Garlich-Miller et al., 2011). When the extent of sea ice expands southward in the fall, Pacific walruses return to their winter range in the pack ice of the Bering Sea. Although Pacific walruses rarely occur in the Beaufort Sea during summer months; Ireland et al. (2009) reported an overall estimated density of 1.5 walruses/1,000 square miles in the Beaufort Sea during vessel-based surveys in 2007. Walruses are observed most commonly in the Beaufort Sea during August and September, primarily in nearshore and shelf waters north and northeast of Point Barrow (Jay et al., 2012).

Walruses occur throughout the Bering and Chukchi seas and may be encountered by vessels in transit to West Dock in Prudhoe Bay (Aerts et al., 2008). High numbers of walrus are unlikely to occur near West Dock at Prudhoe Bay.

3.13.3 Pacific Walrus Critical Habitat

Because the Pacific walrus is only a candidate species, no critical habitat has been proposed or designated.

PACIFIC WALRUS RANGE

FIGURE 17

ALASKA LNG

LEGEND

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

0 50 100 200 Miles

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

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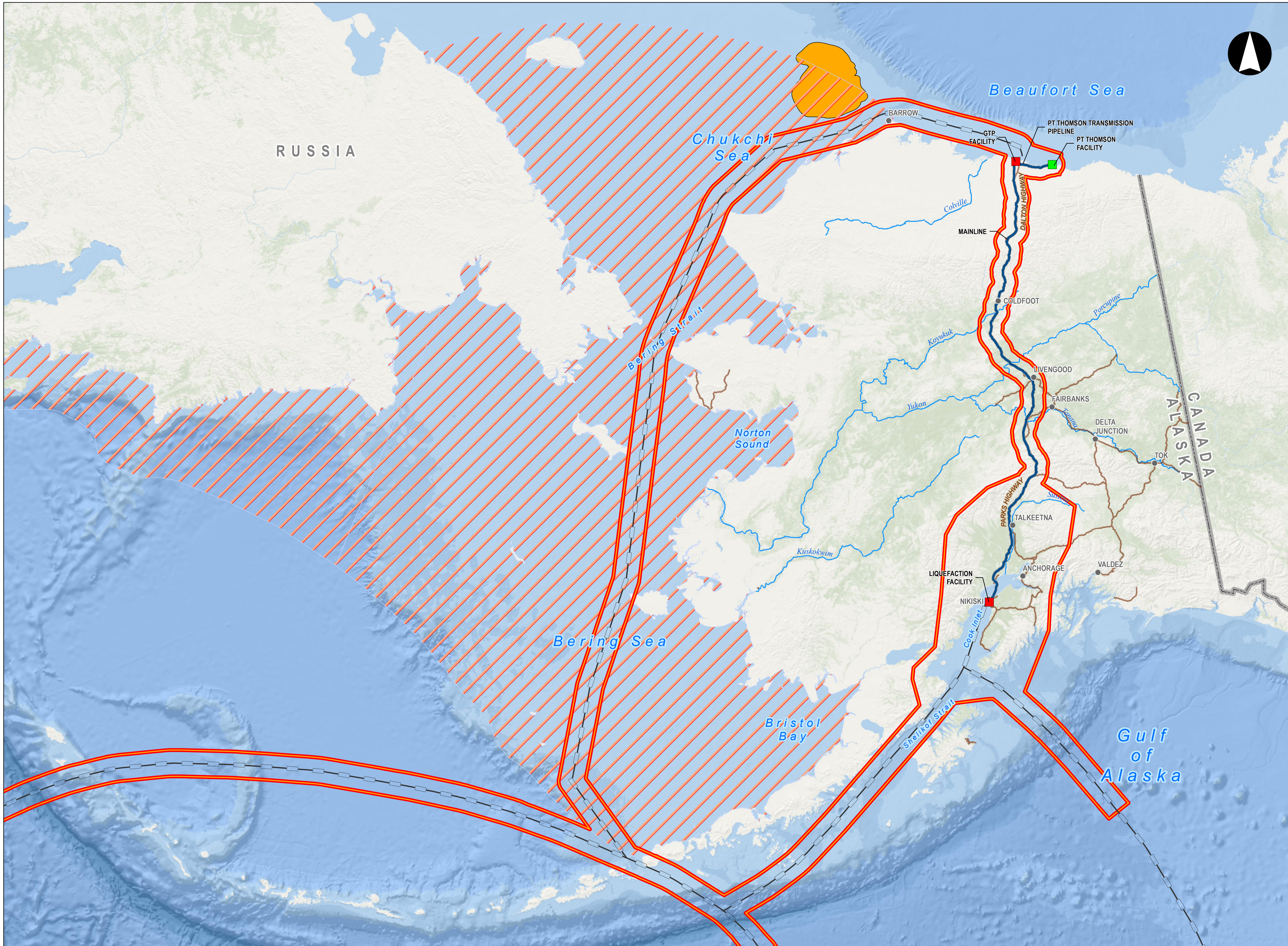


3.14 NORTHERN SEA OTTER – SW ALASKA DPS

The Alaska subspecies of the northern sea otter (*Enhydra lutris kenyoni*) ranges from southeastern Alaska through the Aleutian Islands. Within this range, three stocks or DPSs have been identified based on morphological and some genetic differences between the southwest and southcentral Alaska stocks, and physical barriers to movement across the upper and the lower portions of Cook Inlet (Figure 18; 70 FR 46366). The southwest DPS, which includes sea otters along the Alaska Peninsula and Bristol Bay coasts, and the Aleutian, Barren, Kodiak, and Pribilof Islands, was listed as a threatened in August 2005 (70 FR 46366) due to substantial observed population declines. The cause of the overall decline is not known with certainty, but the weight of evidence points to increased predation, most likely by killer whales (USFWS, 2013b). Other threats include infectious disease, biotoxins, contaminants, oil spills, food limitations, bycatch in commercial fisheries, subsistence harvest, loss of habitat, and illegal take, although most of these are considered of low to moderate importance for recovery (USFWS, 2013b).

The current population estimate for the southwest Alaska DPS is 47,676 otters; which is divided into five management units: western Aleutian Islands; eastern Aleutian Islands; Bristol Bay; southern Alaska Peninsula (west of Castle Cape), and Kodiak, Kamishak Bay, Alaska Peninsula (east of Castle Cape) (Figure 18; 79 FR 22154; USFWS, 2014c). Of these, only the Kodiak, Kamishak Bay, Alaska Peninsula population appears to be stable or increasing (USFWS, 2013b). The overall sea otter population size in southwest Alaska has declined by more than 50% since the mid-1980s, and there is no evidence of recovery (USFWS, 2014c). Declines have not abated in several areas of southwestern Alaska, and recent population viability analyses indicate that if the Western and Eastern Aleutian Islands, Bristol Bay, and South Alaska Peninsula Management Units continue to decline, a status change from threatened to endangered could be warranted (USFWS, 2013b).

Only the Southwest Alaska stock is listed as threatened under the ESA. The current estimated population based on 2000-2004 surveys is 47,676 (Table 7). An estimated 28,955 sea otters occupy the eastern Alaska Peninsula from Castle Cape to Kamishak Bay and the Kodiak Archipelago, and populations in this area appear to be stable or increasing (USFWS, 2014c; Bodkin et al., 2003; Burn and Doroff, 2005; Coletti et al., 2009). The density of sea otters supported by the eastern region may be lower than in the central and western Aleutians (Bodkin et al., 2003; Burn and Doroff, 2005) and surveys in this area suggest that threats are different and may be less severe than elsewhere (USFWS, 2013b).

TABLE 7

Population Estimates for the Southwest Stock of Northern Sea Otters

Survey Area	Survey Year	Unadjusted Estimate	Adjusted Estimate	CV [1]	Minimum Estimate
Aleutian Islands	2000	2,442	8,742	0.22	7,309
North Alaska Peninsula	2000	4,728	11,253	0.34	8,535
South Alaska Peninsula - Offshore	2001	1,005	2,392	0.82	1,311
South Alaska Peninsula – Shoreline	2001	2,190	5,212	0.09	4,845
South Alaska Peninsula – Islands	2001	405	964	0.09	896
Unimak Island	2001	42	100	0.09	93
Kodiak Archipelago	2004	--	11,005	0.19	9,361
Kamishak Bay	2002	--	6,918	0.32	5,340

TABLE 7

Population Estimates for the Southwest Stock of Northern Sea Otters

Survey Area	Survey Year	Unadjusted Estimate	Adjusted Estimate	CV [1]	Minimum Estimate
Current Total	--	--	47,676	--	38,703

Source: Doroff et al. (2003); Burn and Doroff (2005); Coletti et al. (2009); Bodkin et al. (2003) *Cited in*: Allen and Angliss, 2015a

[1] CV is coefficient of variation

3.14.1 Species Description – Northern Sea Otter – SW Alaska DPS

The northern sea otter is the largest member of the weasel family. It has a brown, black, or silver coat, and webbed feet for swimming (ADF&G, 2015e). Adult sea otters are 5 feet long and weigh 50 to 100 pounds; females are smaller than males (ADF&G, 2015e). Females are sexually mature at 2 to 5 years of age, and males at 4 to 6 years (ADF&G, 2015a). Females give birth each year, usually in the late spring in Alaska, to a single pup weighing 3 to 5 pounds (ADF&G, 2015e). Sea otters feed on fish and invertebrates, including clams, octopus, crabs and sea urchins, which they find in shallow coastal waters (ADF&G, 2015e). Their lifespan is 15 to 20 years (ADF&G, 2015e).

3.14.2 Presence of Northern Sea Otter – SW Alaska DPS in the Action Area

The southwest DPS of the northern sea otter is distributed throughout most of its former range, but at low densities in most areas. Designated critical habitat in Unit 5 Kodiak, Kamishak, and Alaska Peninsula is located along the western shoreline of lower Cook Inlet (Figure 18). Sea otters occur throughout the Project area from Redoubt Point in Cook Inlet along the southwestern shore, through Kamishak Bay, around the Kodak Island group, including the Barren Islands in the entrance to Cook Inlet, and west along the Alaska Peninsula to Unimak Pass. Typically, they are found in shallow, rocky reef waters, where adequate forage exists and kelp forests provide cover. Southwest DPS sea otters would occur within the regions transited by vessel traffic into and out of Cook Inlet carrying materials for pipeline and LNG terminal construction and LNGC traffic during operation. The Marine Terminal and Mainline would be constructed outside of the designated shoreline critical habitat in Unit 5. Northern sea otters from the southcentral stock are not likely to occur north of Clam Gulch on the east side of Cook Inlet, which is located about 31 south of the Marine Terminal at Nikiski, but may move farther north on the east side of Cook Inlet as their population expands. The threatened southwest DPS occurs along the western shore of lower Cook Inlet as far north as Tuxedni Bay (Redoubt Point), all of which is part of the Kodiak, Kamishak, Alaska Peninsula critical habitat unit for this listed stock (79 FR 22154).

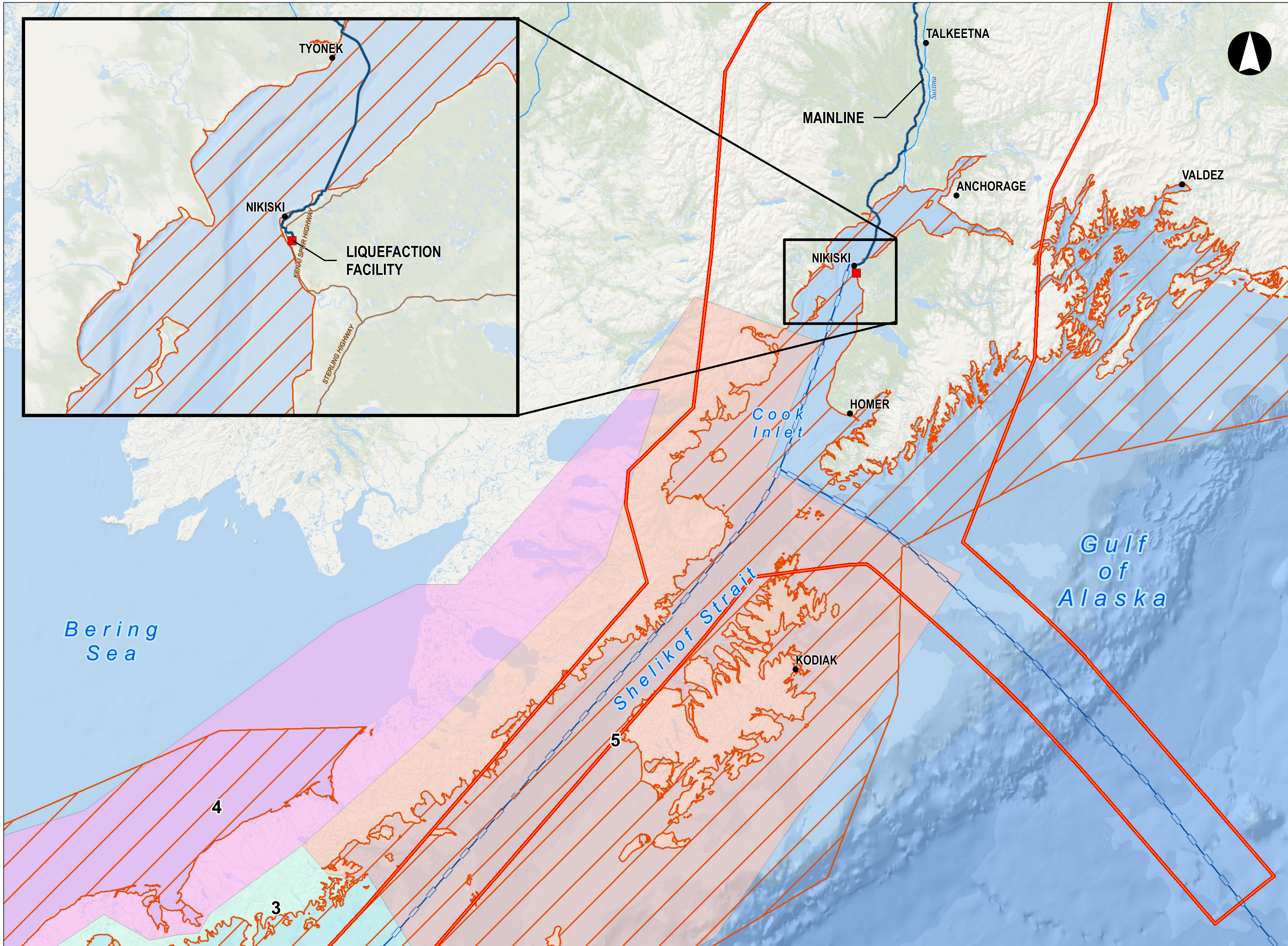
3.14.3 Northern Sea Otter Southwest DPS Critical Habitat

In October 2009, the USFWS designated critical habitat for the southwestern Alaska DPS of the northern sea otter. The designated critical habitat encompasses 5,855 square miles of shallow coastal waters from Attu Island in the Aleutians to Redoubt Point in Cook Inlet (74 FR 51988). The essential elements of critical habitat include: shallow, rocky areas less than 6.6 feet deep; nearshore waters that provide protection or escape from marine predators within 328.1 feet from the mean high tide line; kelp forests that provide protection from marine predators in waters less than 65.6 feet deep; and prey resources within these areas in sufficient quantity and quality to support sea otter's energetic requirements. Critical habitat is divided into 5 habitat units, which correspond to the five management units for the DPS (Figure 18; 74 FR 51988).

NORTHERN SEA OTTER RANGE AND SOUTHWEST ALASKA DPS CRITICAL HABITAT UNITS IN COOK INLET

FIGURE 18

ALASKA LNG



LEGEND

- Project Facility
- Existing Facility
- Alaska Place Names
- Alaska LNG Rev C2 Route
- Potential Marine Transportation Route
- Major Highways
- Major Rivers
- Action Area
- Sea Otter Range

Sea Otter Critical Habitat Units

- Unit 3 - South Alaska Peninsula
- Unit 4 - Bristol Bay
- Unit 5 - Kodiak, Kamishak, Alaska Peninsula

0 12.5 25 50 Miles

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

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VICINITY MAP

X:\AKLNG\Resource Reports\RR03\Appendix C\Figure 18 Northern Sea Otter Range and Southwest Alaska DPS Critical Habitat Units.mxd

3.15 POLAR BEAR

Polar bears were listed by the USFWS as a threatened species throughout their range in May 2008 (73 FR 28212) because their principal habitat, sea ice, is declining, the decline is expected to continue for the foreseeable future, and this loss of habitat threatens the polar bears throughout the entirety of their range. Recent analyses have indicated that adverse consequences of loss of sea ice habitat become more pronounced as the summer ice-free period extends beyond 4 months (Atwood et al., 2015). Polar bears are also protected under the MMPA. Polar bears are a subsistence resource.

Polar bears in Alaska are assigned to two largely discrete stocks or populations (Allen and Angliss, 2014), the Chukchi/Bering seas (CBS) and the Southern Beaufort Sea (SBS). These stocks were and continue to be distinguished by: variations in levels of heavy metal contaminants; morphological characteristics; physical oceanographic features which segregate the stocks; and movement data from mark and recapture and satellite telemetry (Allen and Angliss, 2014). The CBS stock is widely distributed on the pack ice in the Chukchi and northern Bering seas and adjacent coastal areas in Alaska and Russia, extending as far east as the central Beaufort Sea (Amstrup et al., 2005); and the SBS stock occurs south of Banks Island and east of the Baillie Islands, Canada (Amstrup et al., 2000, 2005).

A reliable population estimate for the CBS stock does not exist; a previous estimate of 2,000 bears was based on extrapolation of den surveys (Aars et al., 2006; Lunn et al., 2002; USFWS, 2010; Wiig et al., 2015). More recently the IUCN has discontinued use of this estimate for the CBS stock (Obbard et al., 2010); which is believed to be declining due to illegal harvest in Russia, legal harvest in the U.S., and observed and projected losses in sea ice habitat (Allen and Angliss, 2014; Obbard et al., 2010).

Regarding SBS polar bear stock: most recent estimate of SBS stock, which used an open population mark/recapture analysis, estimated a population size of approximately 900 bears in 2010 (90% C.I. 606-1,212; Bromaghin et al. 2015), down from a previous estimate of 1,526 bears (95% CI = 1,211; 1,841) in 2006 (Regehr et al. 2006). Available trend data suggests this stock has experienced varying periods of stability and decline over the past few decades. Little or no growth was observed during the 1990s (Amstrup et al. 2001). An overall population decline rate of 3% per year was reported from 2001-2005 (Hunter et al. 2007). Regehr et al. (2006, 2009) reported declining survival and recruitment from 2004 through 2006, which were years when summer and fall sea ice were reduced (NSIDC 2014). This led to a 25–50% decline in abundance, which was hypothesized to result from unfavorable ice conditions that limited access to prey, and possibly, low prey abundance (Bromaghin et al. 2015). For reasons not understood, survival of adults and cubs began to improve in 2007 (Bromaghin et al. 2015), which was a record low year for September sea ice (NSIDC 2007). Abundance was comparatively stable between 2008 and 2010.

3.15.1 Species Description – Polar Bear

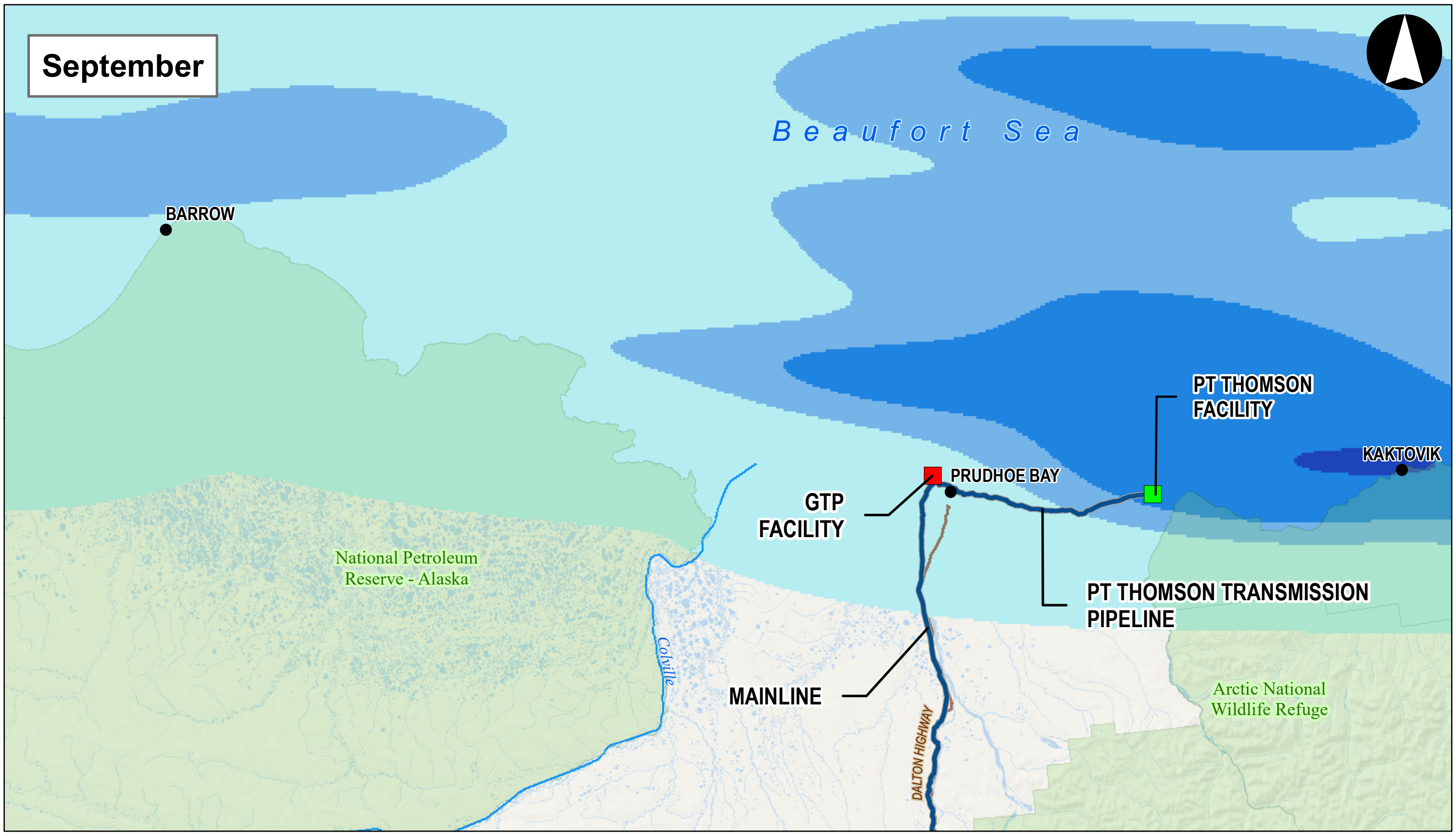
Polar bears are the largest of Alaska's three bears. They have water repellant white or yellowish coats and large webbed feet for swimming and walking on thin ice (ADF&G, 2015e). They proportionally have smaller ears, narrower heads and longer necks than other bears (ADF&G, 2015e). On average, males are 8 to 10 feet long and weigh 600 to 1,200 pounds; females weigh 400 to 700 pounds (ADF&G, 2015e). Females and males become sexually mature at 3 to 6 and 4 to 5 years of age, respectively; they breed during March through May (ADF&G, 2015e). Females typically reproduce every 3 years, creating dens anywhere between October and November in preparation for the cub's birth (1 to 3, but usually twins), which typically occurs in December or January (ADF&G, 2015e). Cubs weigh 1 to 2 pounds at birth, but weigh approximately 20 to 25 pounds when they emerge from natal dens by late March or early April (ADF&G, 2015e). Cubs remain with their mother for about 2.5 years; otherwise, polar bears are solitary animals (ADF&G, 2015e). They primarily feed on ringed seals, but they will also consume bearded seals, walruses and beluga whales, including carcasses (ADF&G, 2015e). The life expectancy of a polar bear is 25 years (ADF&G, 2015e).

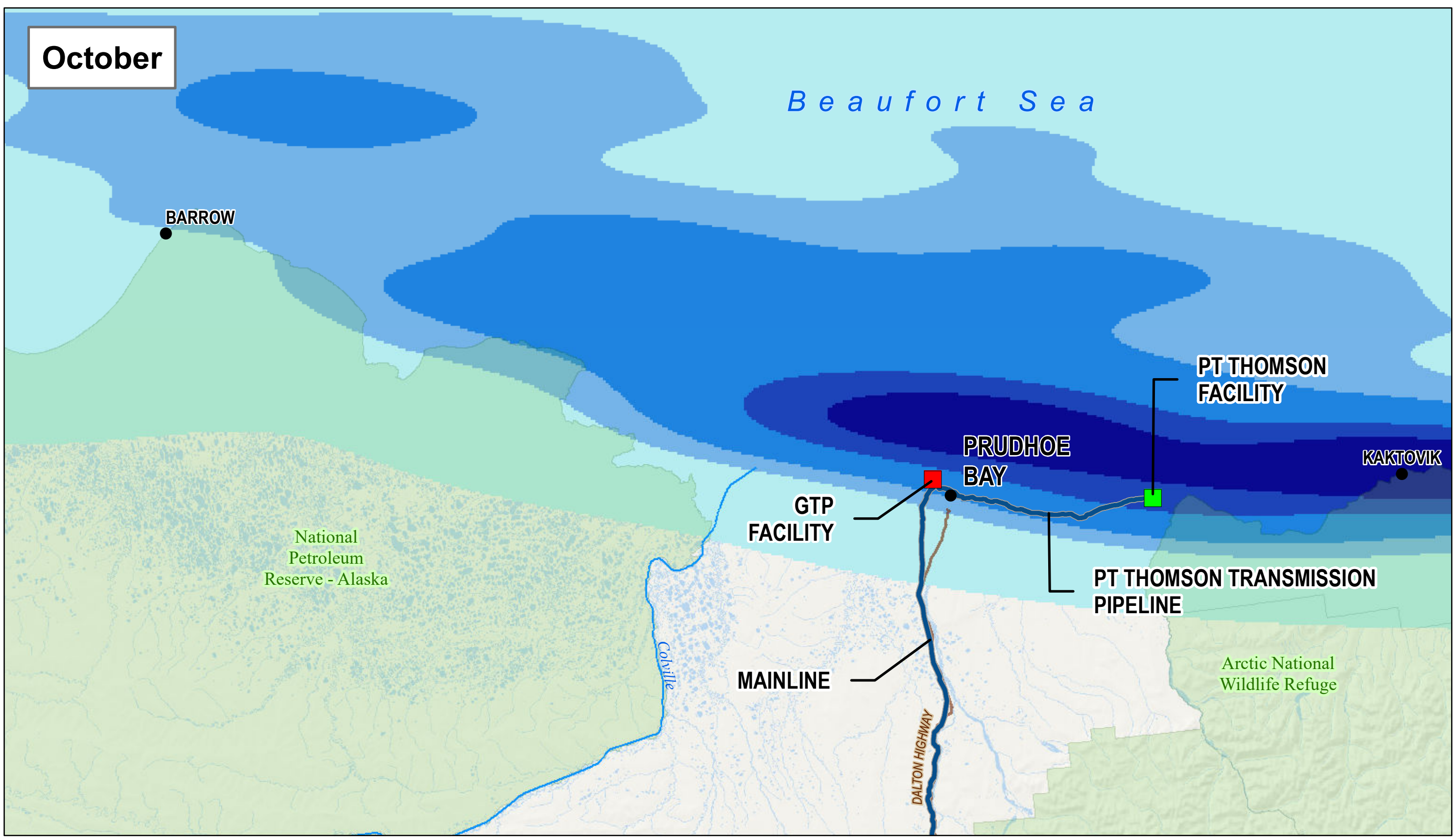
3.15.2 Polar Bear Presence in the Action Area

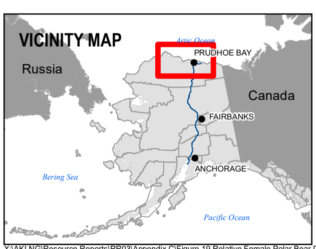
Polar bear distribution and movements are tied to seasonal sea ice dynamics, such that their range is limited to areas covered in sea ice for much of the year (Stirling et al., 1999; Schliebe et al., 2008). Female polar bears in the Beaufort Sea select shallow water areas with active ice near shear zones and leads likely in response to the abundance and accessibility of ringed seals (Durner et al., 2004). Habitat use changes seasonally with the formation, advance, movement, retreat, and melt of sea ice (Schliebe et al., 2008; Durner et al., 2004). During winter and spring, non-denning polar bears tend to concentrate in areas of ice with pressure ridges, at floe edges, and on drifting seasonal ice at least 8 inches thick (Schliebe et al., 2006). Mating usually occurs from March to late May or early June, when both sexes are active on the sea ice. During the pupping season for ringed seals in the spring, polar bears move into the landfast ice zone to hunt. In late summer and early autumn, polar bears move to multi-year ice as the pack ice retreats (Durner et al., 2004; Ferguson et al., 2000). Pack ice is the primary summer habitat for Alaska polar bears; although polar bears in the SBS stock are well known for gathering to feed at the butchering sites of harvested bowhead whales (e.g., Barter Island [Kaktovik], Cross Island, Barrow; Schliebe et al., 2006). With retreat of sea ice from the Alaska coast during summer, polar bears in some parts of Alaska spend more time on land (USFWS, 2015b). Female polar bear relative densities across the Alaskan central Beaufort Sea coast tend to be highest near Kaktovik in September and between Oliktok Point and the western border of the Arctic National Wildlife Refuge in October (Figure 19).

Adult male and non-pregnant female polar bears remain active all year, using temporary dens as shelter during severe weather. Most pregnant female polar bears of the SBS stock construct and enter dens in mid-November, where they hibernate and give birth, emerging in late March or early April (Amstrup, 2000). Dens are excavated in compacted snow drifts on the pack ice or on coastal banks (barrier islands and mainland bluffs), river or stream banks, and other areas with at least 4 feet of vertical topographic relief that accumulate snow drifts (Durner et al., 2001, 2003, 2006). Dens are found most frequently near the edges of stable sea ice on the shoreward side of barrier islands; onshore, in drifts along the coastline and, to a lesser extent, along river or stream banks (Durner et al., 2003). Female polar bears do not necessarily return to the same den, but females tend to den on the same type of substrate (pack ice or land) from year to year and may return to the same general area (Amstrup and Gardner, 1994; Schliebe et al., 2006; Fischbach et al., 2007). Cubs remain with the females for about 2.5 years before weaning (DeMaster and Stirling, 1981; Amstrup et al., 2000). Presence and age of the cubs affects female polar bear distribution and movements, as does the availability of ice suitable for hunting (Amstrup et al., 2000).

An analysis of den locations used by collared polar bears between 1985 and 2005 has documented shifts in den distributions from pack ice to land primarily in response to reduction in sea ice extent and delay in freeze-up northern Alaska (Fischbach et al., 2007). The proportion of dens located on drifting pack ice decreased from 62 percent (1985-1994) to 37 percent (1998-2004) with proportionately fewer dens on pack ice in the western Beaufort Sea, which was attributed to reductions in stable multi-year pack ice, increases in unconsolidated ice, and lengthening of the melt season (Fischbach et al., 2007). Terrestrial areas with the appropriate configuration for accumulating snow drifts large enough for polar bear dens have been mapped across much of the Beaufort Coastal Plain Ecoregion (BCP) portion of the Project area (Durner et al., 2001, 2003, 2006). These areas with documented polar bear den sites are shown in Figure 20.







LEGEND

- Project Facility
- Existing Facility
- Alaska Place Names
- Alaska LNG Rev C2 Route
- Major Highways
- Major Rivers
- State and Federal Conservation Lands

Relative Density of Female Polar Bears (animals per km²)

- 0.00001 -
- 0.005 - 0.010
- 0.011 - 0.025
- 0.026 - 0.040
- 0.041 - 0.065

0 15 30 60 Miles

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RELATIVE FEMALE POLAR BEAR DENSITY DURING SEPTEMBER AND OCTOBER

FIGURE 19

ALASKA LNG

X:\AKLNG\Resource Reports\RR03\Appendix C\Figure 19 Relative Female Polar Bear Density During September and October.mxd

POLAR BEAR DEN SITES AND POTENTIAL DENNING HABITAT IN THE PROJECT AREA

FIGURE 20

ALASKA LNG

LEGEND

- Project Facility
- Existing Facility
- Alaska Place Names
- Polar Bear Maternal Den Sites 1910-2010
- Alaska LNG Rev C2 Route
- Point Thomson Transmission Line
- Potential Denning Habitat
- Major Highways

0 1.5 3 6 Miles

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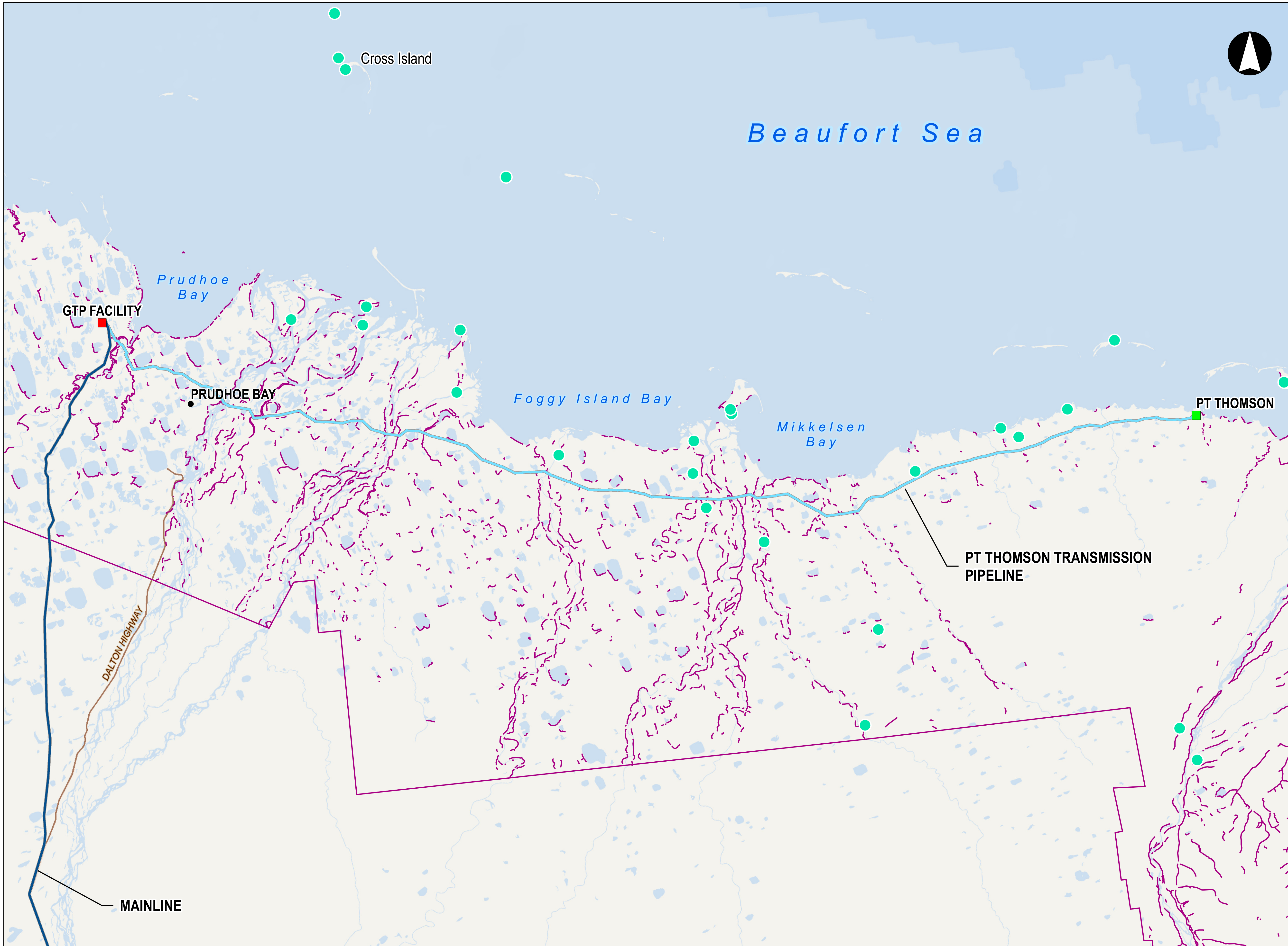


X:\AKLNG\Resource Reports\RR03\Appendix C\Figure 20 Polar Bear Den Sites and Potential Denning Habitat in The Project Area.mxd

Polar bears are more likely to move through the BCP portion of the Project area in fall and winter, when bears are present along the entire Beaufort Sea coast from Demarcation Point to Point Barrow, although polar bears can occur within this area year-round. The PTTL would be constructed in a region that has supported previous polar bear den sites. The GTP is surrounded by areas with ridges and bluffs that could provide den habitat; however, this area contains infrastructure and human activity that would make it unsuitable for polar bear denning. Gestating and post-parturient females can be present in dens (although not obvious) from late November through early April (Amstrup, 2000).

3.15.3 Polar Bear Critical Habitat

In December 2010, the USFWS designated more than 187,000 square miles of offshore barrier islands, terrestrial denning areas, and offshore sea ice as critical habitat for the threatened polar bear under the ESA (75 FR 76086). Primary constituent elements for polar bear habitat were considered to include: (1) sea ice habitat for feeding, breeding, denning, and movements over the continental shelf with adequate prey resources, primarily ringed and bearded seals; (2) terrestrial denning habitat with topographic features such as coastal bluffs and river banks with steep stable slopes, unobstructed, undisturbed access between the den site and the coast, sea ice near the denning habitat prior to fall, and absence of disturbance from humans; and (3) barrier island habitat for denning, refuge from human disturbance, and movements along the coast to access maternal dens and optimal feeding habitat (75 FR 76086). This critical habitat designation rule was vacated in 2013 by the Federal District Court of Alaska subject to an appeal On February 29, 2016, the U.S. Court of Appeals reversed the lower court's decision, reinstating the previously vacated critical habitat designation in its entirety.

3.16 WOOD BISON

Wood bison is one of the two subspecies of North American bison; they are larger, have a more pronounced hump, a forelock, and reduced chaps and beard compared to the plains bison (*Bison bison*). Plains bison were reintroduced in Alaska with establishment of the Delta Herd in 1928 (ADF&G, 2013; Bruning, 2012). In May 2014, USFWS issued a final rule designating reintroduced wood bison as a nonessential experimental population (79 FR 26175). The ADF&G initiated reintroduction of wood bison on April 3, 2015 into the lower Innoko/Yukon River release site from the captive breeding herd at the Alaska Wildlife Conservation Center at Portage, Alaska (Figure 21; ADF&G, 2013). The lower Innoko/Yukon River site was identified as the most appropriate of three potential release sites to initiate the restoration project because of continued concerns about potential management requirements, strong local community support, and because no large-scale economic development projects had been identified for the area (Alaska Wood Bison Management Planning Team, 2015).

3.16.1 Species Description – Wood Bison

Wood bison are large grazing mammals, males stand about 6 feet tall at the shoulder and weigh about 2,000 pounds. Females are smaller weighing about 1,200 pounds. They feed on grasses, sedges and forbs in wet sedge/ grass meadows, around lakes and rivers, and in recent burn areas. Wood bison are forage generalists but prefer slough sedge (*Carex atherodes*) and areas where it is available, especially during winter (Larter and Gates 1991).Female wood bison are sexually mature at 2 years, and may calve when they are 3. Wood bison live in cow/calf (female/young) or bull (male) groups during most of the year, except during the breeding season in late summer. Wood bison move between seasonal ranges traveling from meadow to meadow, with year-round range size dependent on habitat quality and population size.

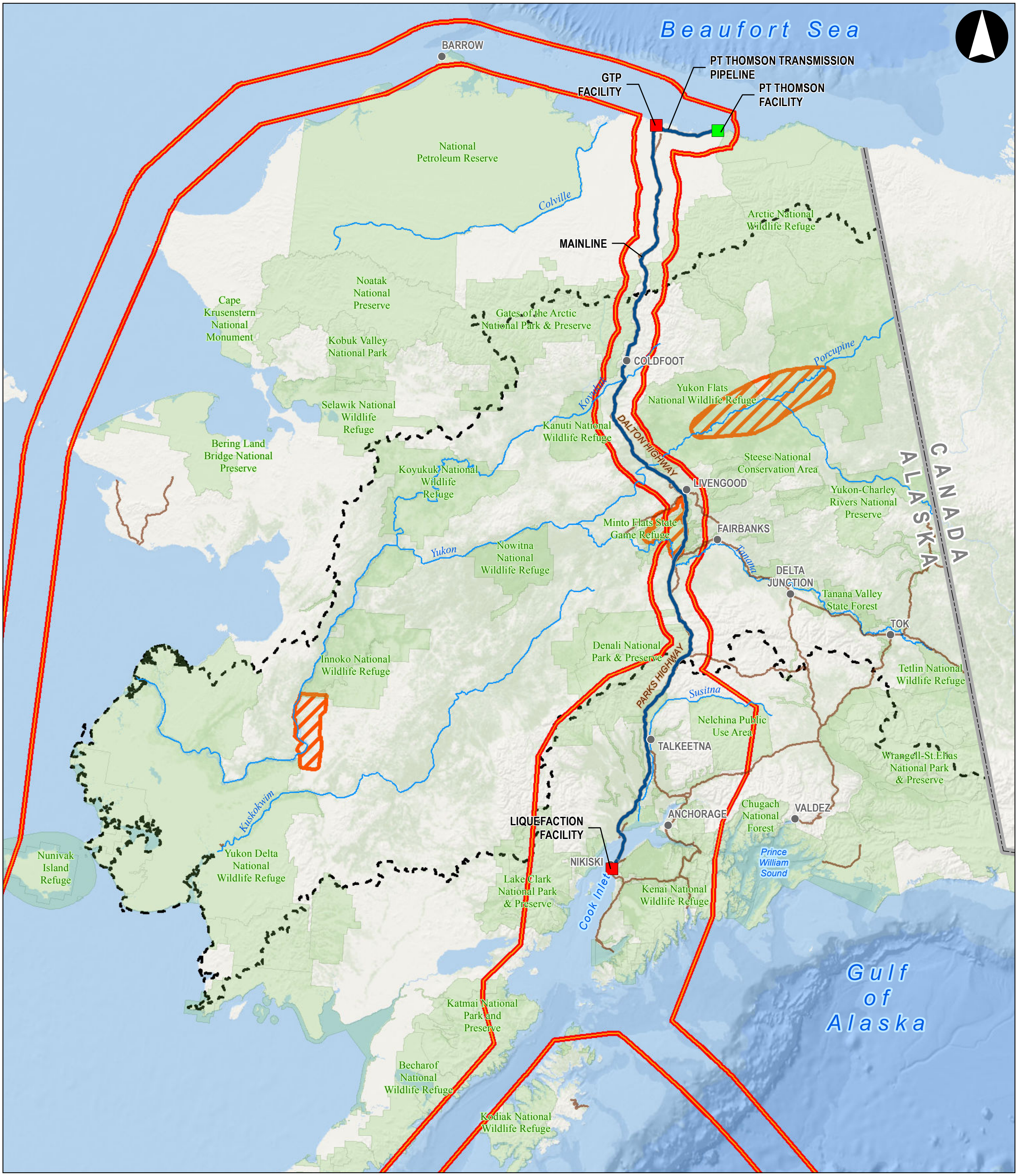
3.16.2 Wood Bison Presence in the Action Area

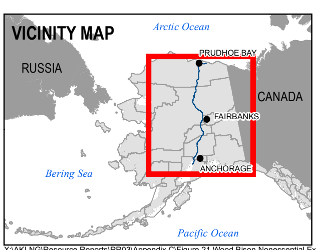
Within the nonessential experimental population (NEP) area and outside of national parks or wildlife refuges, reintroduced wood bison are considered a proposed species under ESA 10(j); within the national parks or wildlife refuge system they are protected as a threatened species. The proposed Mainline would cross through the defined NEP area and one of the proposed reintroduction sites, Minto Flats (Figure 21). Project construction and operation may coincide with wood bison should they range from the lower Innoko/Yukon River reintroduction site or should subsequent reintroductions include either the Minto Flats or the Yukon Flats reintroduction sites (ADF&G, 2013). Project activities potentially coinciding with wood bison occurring on federal lands would require consultation with USFWS and activities on state lands would require conference with USFWS. The wood bison NEP establishment rule allows for incidental take that may occur from oil and gas development and pipelines within the NEP area (79 FR 26175).

Because it is not expected that wood bison from the lower Innoko/Yukon River reintroduction site would range into the Project area, no effect on wood bison is expected. Detailed analyses were therefore not conducted for the wood bison.

3.16.3 Wood Bison Critical Habitat

Critical habitat cannot be designated for non-essential experimental populations.





LEGEND

- Project Facility
- Existing Facility
- Alaska Place Names
- Alaska LNG Rev C2 Route
- Major Highways
- Major Rivers
- Action Area
- State and Federal Conservation Lands
- Wood Bison Nonessential Experimental Population Area
- Wood Bison Proposed Reintroduction Sites

0 50 100 200 Miles

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WOOD BISON NONESSENTIAL EXPERIMENTAL POPULATION AREA AND REINTRODUCTION SITE

FIGURE 21

ALASKA LNG

X:\AKLNG\Resource Reports\RR03\Appendix C\Figure 21 Wood Bison Nonessential Experimental Population Area and Reintroduction Site.mxd

3.17 ESKIMO CURLEW

The Eskimo curlew, listed as endangered by the USFWS (32 FR 4001; 35 FR 8491) and the State of Alaska, may no longer occur in Alaska. As such, there would not be an effect on the Eskimo curlew, and a detailed analysis of effects was not conducted.

3.17.1 Species Description – Eskimo Curlew

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.

3.17.2 Presence of Eskimo Curlew in the Action Area

The Eskimo curlew is believed to no longer occur within Alaska or the action area.

3.17.3 Eskimo Curlew Critical Habitat

Critical habitat has not been designated for the Eskimo curlew.

3.18 SHORT-TAILED ALBATROSS

The short-tailed albatross was designated as an endangered species throughout its range on 31 July 2000. The current population estimate is 4,354 individuals, with a population growth rate of approximately 7.5 percent (range of 5.2 to 9.4 percent) per year (USFWS, 2014d).

While a potential exists for vessel disturbance from the Project during LNGC traffic in the Gulf of Alaska and HLV traffic through the Gulf of Alaska and Bering Sea, due to the widespread distribution of short-tailed albatross, the risk of disturbance is expected to be sufficiently low as to be considered discountable. Therefore, detailed analyses were not conducted for the listed short-tailed albatross.

3.18.1 Species Description – 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; although, they spend most of their life at sea foraging on shrimp, squid (*Todarodes pacificus*), crustaceans, and fish (including bonitos [Sarda sp.], flying fishes (Exocoetidae) and sardines (Clupeidae), (USFWS, 2008). Females reach sexual maturity at 6 to 8 years, and pairs mate for life. Breeding begins in late October.

3.18.2 Short-tailed Albatross Presence in the Action Area

The areas most heavily used by short-tailed albatross include 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., 2007a; Tickell, 2000; USFWS, 2009a). Short-tailed albatross adults spent less than 20 percent of their time over waters exceeding 9,840 feet deep; with adults and subadults frequently within waters shallower than 3,280 feet deep for more than 70 and 80 percent of the time, respectively (Suryan et al., 2007b). The Aleutians and Bering Sea may be especially important during molting (USFWS, 2015a). Recent satellite tracking data indicated individuals were spending an average of 19 consecutive days (maximum of 53 days) within a 62-mile (100-km) radius of some Aleutian passes (USFWS, 2015a). 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 (Figure 22; USFWS, 2015a).

Known threats for the short-tailed albatross include volcanic activity, landslides, and typhoons on their nesting islands; climate change and ocean regime shift; mortality from longline, gillnet, and troll fisheries; contaminants and ingestion of plastics; and oil spills (USFWS, 2014d). Molting short-tailed albatross in the Aleutian Islands may be vulnerable to oil spill or vessel collisions (USFWS, 2014d). Project-related LNGC and HLV traffic would occur within the nonbreeding range of the short-tailed albatross, and shipping is a major source of spills in the Aleutian Islands and Bering Sea. 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 (DNV and ERM, 2010; USFWS, 2015a). Albatross molting in these areas may be less mobile and more sensitive to oil spills (USFWS, 2014d). Aleutian Islands vessel routing measures that establish five Areas to Be Avoided (ATBAs) went into effect on January 1, 2016 for vessels making transoceanic voyages through the Bering Sea and North Pacific Ocean (Nuka, 2015a). Compliance with the Aleutian Islands ATBAs and recommended short-tailed albatross avoidance areas by Project-related vessel traffic would reduce the potential for effects from possible vessel grounding and associated releases on short-tailed albatross (DNV and ERM, 2011; Nuka, 2015b; USFWS, 2015a).

3.18.3 Short-tailed Albatross Critical Habitat

Critical habitat has not been designated for the short-tailed albatross (65 FR 46643).

SHORT-TAILED ALBATROSS SIGHTINGS AND CONCENTRATION AREAS

FIGURE 22

ALASKA LNG

LEGEND

- Project Facility
- Existing Facility
- Alaska Place Names
- Short-Tailed Albatross Sightings
- Alaska LNG Rev C2 Route
- Potential Marine Transportation Routes
- Major Highways
- Major Rivers
- Action Area
- Short-Tailed Albatross Avoidance Areas

0 40 80 160 Miles

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

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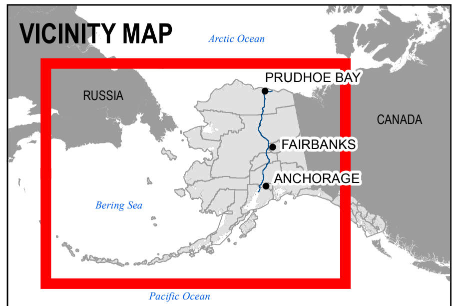
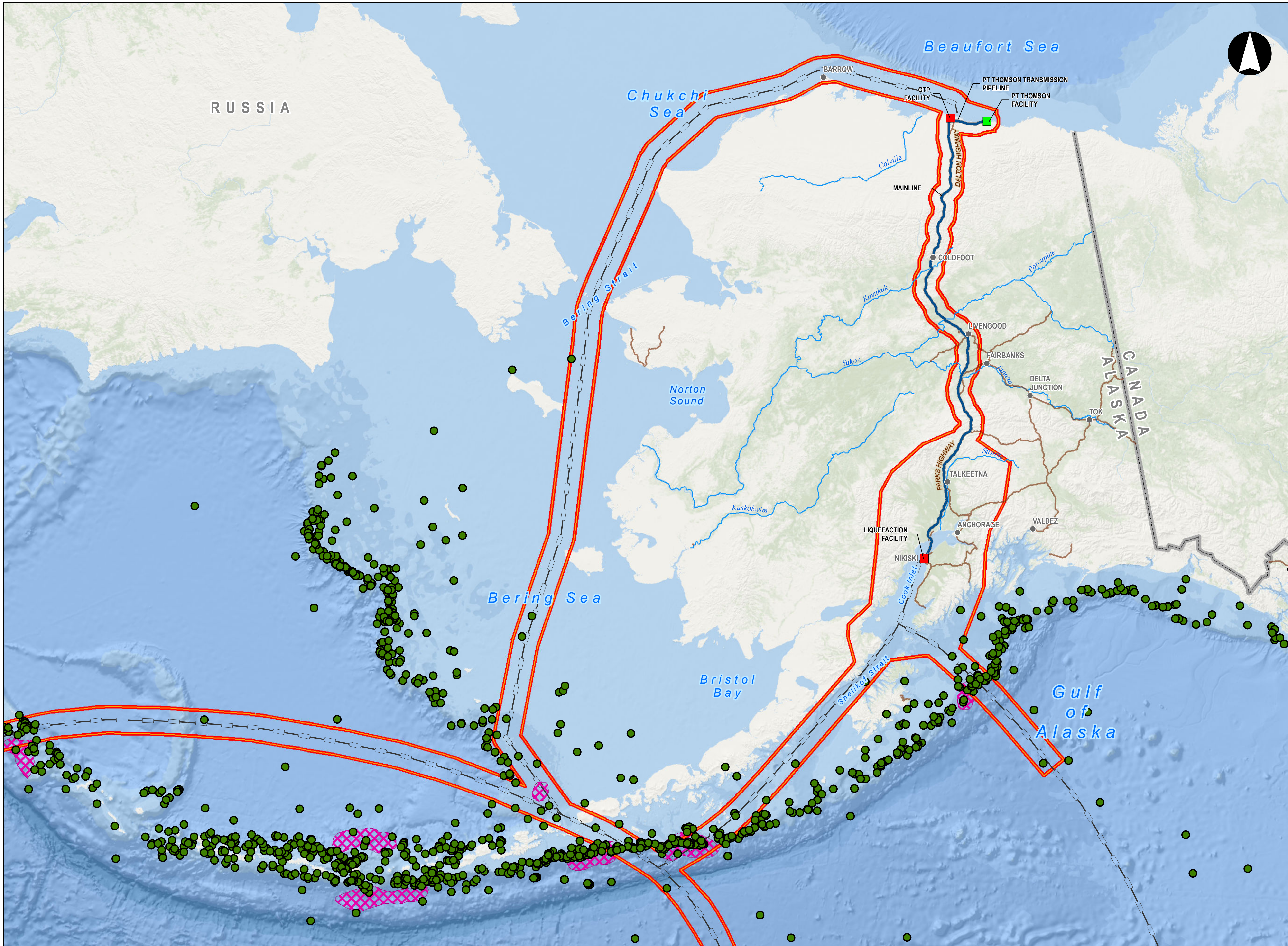
VICINITY MAP





3.19 SPECTACLED EIDER

The spectacled eider was listed as a threatened species throughout its range under the ESA in May 1993 as a result of severely declining populations in western Alaska, and possible declining populations in northern Alaska and eastern Russia (58 FR 27474). The USFWS established a recovery plan for spectacled eiders in 1996 (USFWS, 1996). A review of the species was completed in 2010 that evaluated potential threats to recovery (USFWS, 2010a). Ongoing threats on the breeding ground are thought to include lead contamination, illegal harvest, and predation (USFWS, 2010a).

The most recent range-wide population estimate for spectacled eiders is 369,000 ± 4,900 based on surveys of the known wintering area in 2010 (Larned et al., 2012). Comparison to similar aerial surveys in 1997 and 1998 suggests that the global wintering population is stable (Larned et al., 2012). The BCP breeding population has contained on average 6,896 breeding spectacled eider pairs (range 4,902 to 10,149) based on aerial surveys from 1992 to 2012 (Stehn et al., 2013). Stehn et al. (2013) assessed long-term BCP breeding pair trends that indicated nonsignificant declining trends of 1 to 2 percent per year from 1992 to 2012, and 2003 to 2012. The Russian breeding population of spectacled eiders is much larger than breeding populations in western and northern Alaska (Peterson et al., 2000).

Little information on current threats is available; future threats identified include climate change and offshore oil spills (USFWS, 2010a).

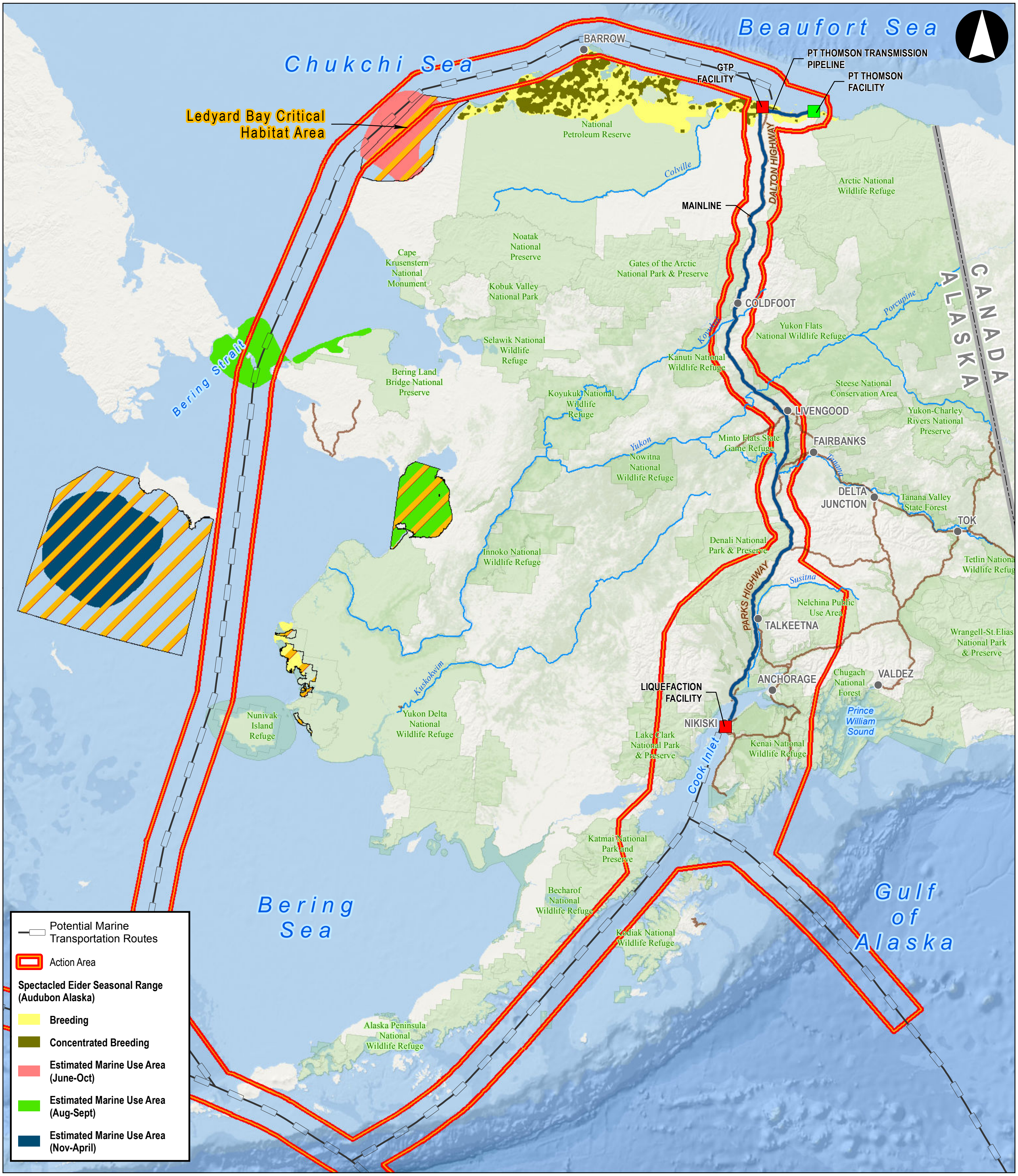
3.19.1 Species Description – Spectacled Eider

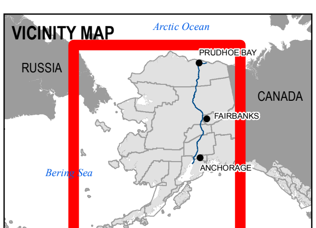
Spectacled eiders are large sea ducks, ranging from 20 to 22 inches long. They spend most of their life on marine waters feeding primarily on clams. Spectacled eiders first breed at 2 to 3 years of age arriving at breeding grounds as pairs in late May or June (ADF&G, 2015e). Females lay one egg per day for a clutch of 3 to 9 oval and olive-green eggs at nest sites on tundra lake islands and peninsulas (ADF&G, 2015e). Eggs are incubated for 24 to 28 days, and young fledge in late August (ADF&G, 2015e). Spectacled eiders feed on amphipods, crustaceans, insects, mollusks, and vegetation by diving and dabbling (ADF&G, 2015e).

3.19.2 Presence of Spectacled Eiders in the Action Area

As illustrated in Figure 23, spectacled eiders nest on tundra habitats on Alaska's BCP and western Alaska, molt in coastal areas of the Chukchi and Bering seas, and winter in polynyas and open water leads in the Bering Sea. The BCP breeding population departs from wintering areas in the Bering Sea following spring leads and openings in the Bering and Chukchi seas, arriving on the BCP from late May to early June (Sexson et al., 2014; Petersen et al., 2000). 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 located within 12 miles from the coast where they use a variety of tundra habitat types (Petersen et al., 2000). Nests are generally constructed by the female and average 3 feet from water with many nests on shorelines, islands, or peninsulas of tundra lakes and ponds (Petersen et al., 2000). Spectacled eider breeding density based on 2009 to 2012 aerial breeding waterfowl surveys is shown in Figure 24. Comparison of the 2009 to 2012 density surface to previous density surfaces shows consistent moderate use of areas south and west of Prudhoe Bay, and southwest of Tigvariak Island (Larned et al., 2011). The female incubates eggs for an average of 24 days and hatching begins in early July (Petersen et al., 2000). Broods are reared near freshwater where they feed on invertebrates along pond edges (Petersen et al., 2000).





LEGEND

- Project Facility
- Existing Facility
- Alaska Place Names
- Alaska LNG Rev C2 Route
- Major Highways
- Major Rivers
- Critical Habitat of Spectacled Eider
- State and Federal Conservation Lands

0 50 100 200 Miles

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SPECTACLED EIDER SEASONAL RANGE AND CRITICAL HABITAT

FIGURE 23

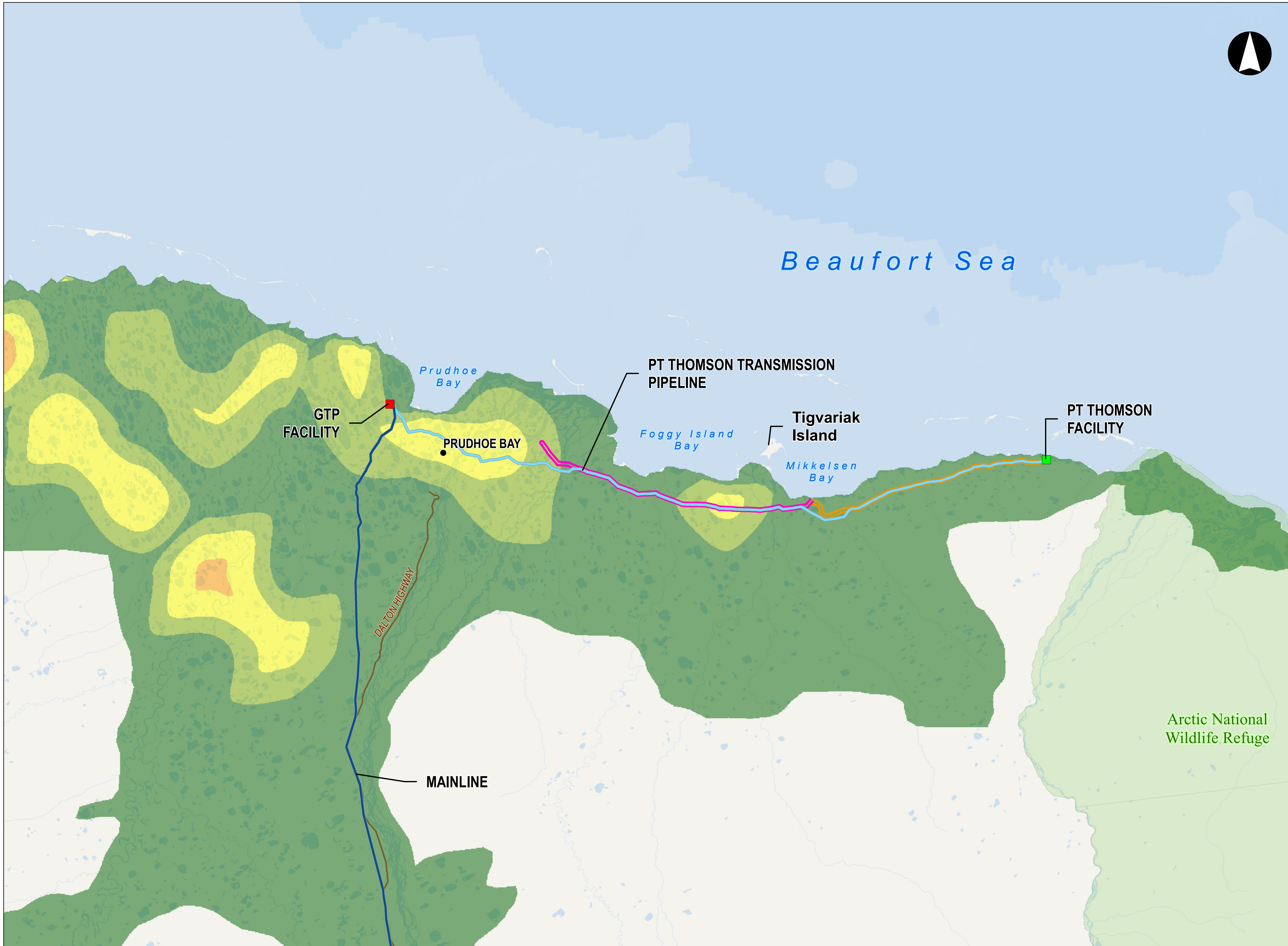
ALASKA LNG

X:\AKLNG\Resource Reports\RR03\Appendix C\Figure 23 Spectacled Eider Seasonal Range and Critical Habitat.mxd

SPECTACLED EIDER 2009 TO 2012 BREEDING PAIR DENSITY BASED ON 2009-2012 AERIAL BREEDING PAIR SURVEYS

FIGURE 24

ALASKA LNG



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

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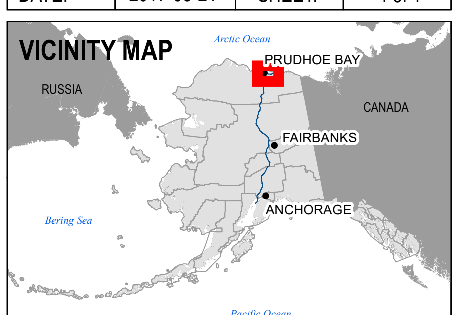
VICINITY MAP



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. 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 23).

Spectacled eiders exhibit strong migratory connectivity and site fidelity with their post-breeding and pre-breeding distributions (Sexson et al., 2014). In addition, spectacled eiders appear to have consistently used the same post-breeding areas for the past 20 years (Sexson et al., 2014). Important areas for pre and post-breeding spectacled eiders in U.S. Waters include: eastern Chukchi Sea, Bering Strait, and Norton Sound (Sexson et al., 2014; Figure 23).

3.19.3 Spectacled Eider Critical Habitat

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 (Figure 23; 66 FR 9146). No critical habitat for nesting was designated on Alaska's North Slope (66 FR 9146).

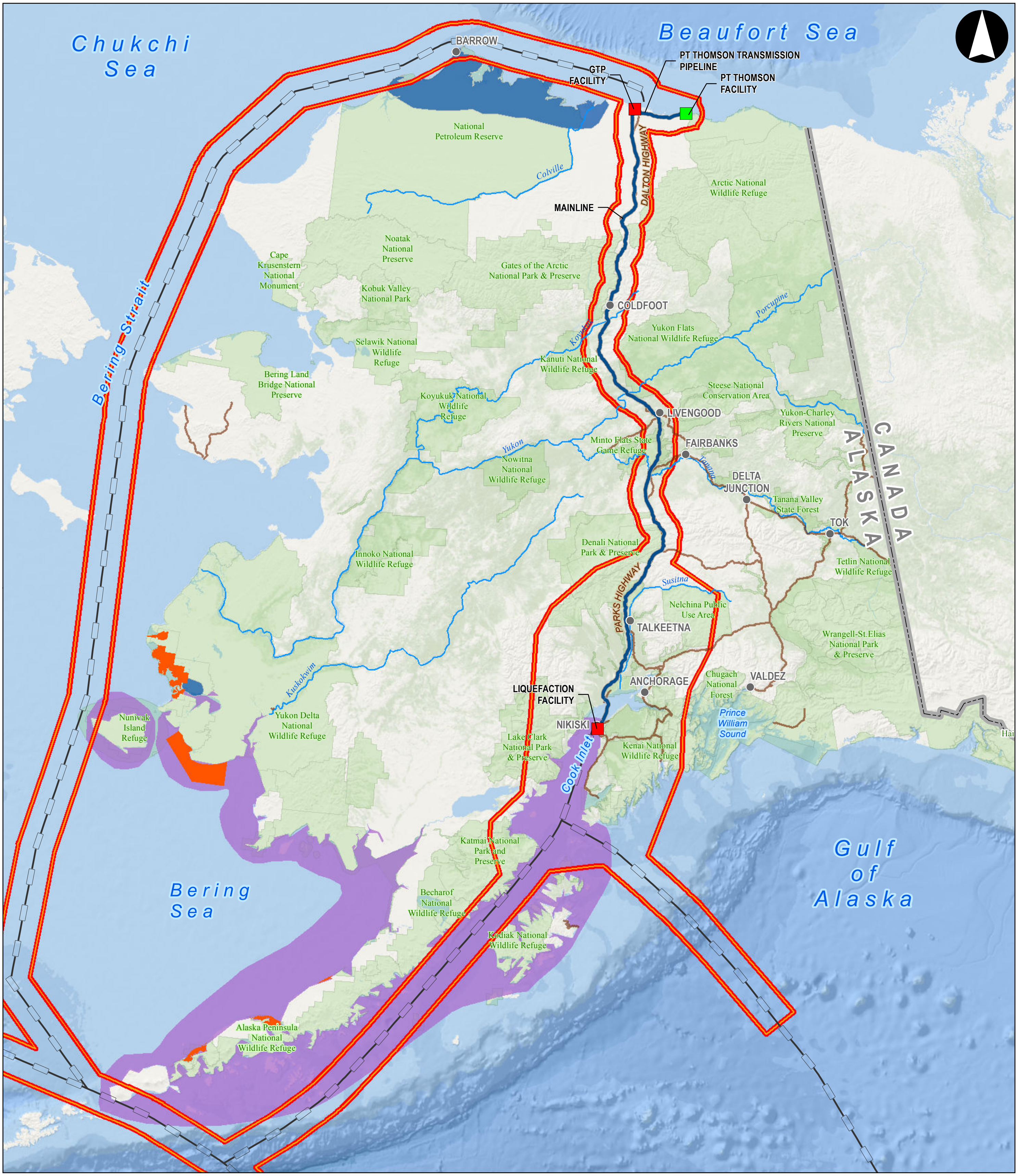
3.20 STELLER'S EIDER – ALASKA BREEDING POPULATION

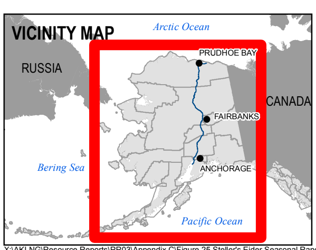
The Alaska-breeding population of Steller's eiders was listed as threatened under the ESA in 1997 because of a substantial decrease in their nesting range and the increased vulnerability of the remaining breeding population to extirpation (62 FR 31748).

The best available recent estimate of the Alaska-breeding population is 576 birds (Stehn and Platte, 2009; USFWS, 2014e). However, Steller's eiders nest irregularly in low numbers on the BCP, such that estimates of abundance and population trends are inconclusive (Stehn et al., 2013; Quakenbush et al., 2004). The Alaska-breeding population of Steller's eiders is joined by the much more numerous Russian breeding populations on molting and wintering habitats in Alaskan waters and critical habitat. The Pacific population of Steller's eiders, which includes Alaska- and Russia-breeding populations, has been monitored during spring migration in southwestern Alaska in most years from 1992 to 2012 (Larned, 2012). Spring staging birds congregate at the mouths of lagoons and other productive habitat. Spring estimates can vary with survey timing, but average 81,453 Steller's eiders (Larned, 2012). Based on these surveys the spring migrant population declined by about 3 percent per year from 2003 to 2012 (Larned, 2012). The ESA-listed Alaska-breeding population represents about 1 percent of Pacific-wintering Steller's eiders (USFWS, 2014e).

3.20.1 Species Description – Steller's Eider

Steller's eiders are the smallest of the eider species (ADF&G, 2015e). The heads of males are white with green shading at the back, iridescent blue-black under the chin, and a black spot behind each ear (ADF&G, 2015e). Their bills are bluish gray, with eyes surrounded by black, and a ventral surface that changes from tan to deep rust (ADF&G, 2015e). Both males and females have iridescent blue wing patches, lined with white (ADF&G, 2015e). Females are mostly brown (ADF&G, 2015e). Steller's eiders are 18 inches long, with a 27-inch wingspan (ADF&G, 2015e). They first breed at 2 to 3 years of age, pairs bond during the winter, and arriving at breeding grounds in the spring (ADF&G, 2015e). Females lay 5 to 7 olive-brown eggs at nest sites on pond or lake islands and peninsulas (ADF&G, 2015e). Steller's eiders feed on freshwater insect larvae and aquatic plants by diving and dabbling, and marine invertebrates such as mollusks and crustaceans (ADF&G, 2015e).





LEGEND

- Project Facility
- Existing Facility
- Alaska Place Names
- Major Rivers
- Alaska LNG Rev C2 Route
- Potential Marine Transportation Route
- Action Area
- State and Federal Conservation Lands
- Steller's Eider Critical Habitat

Steller's Eider Season

- Current Breeding Range
- Molting and Winter Range

0 50 100 200 Miles

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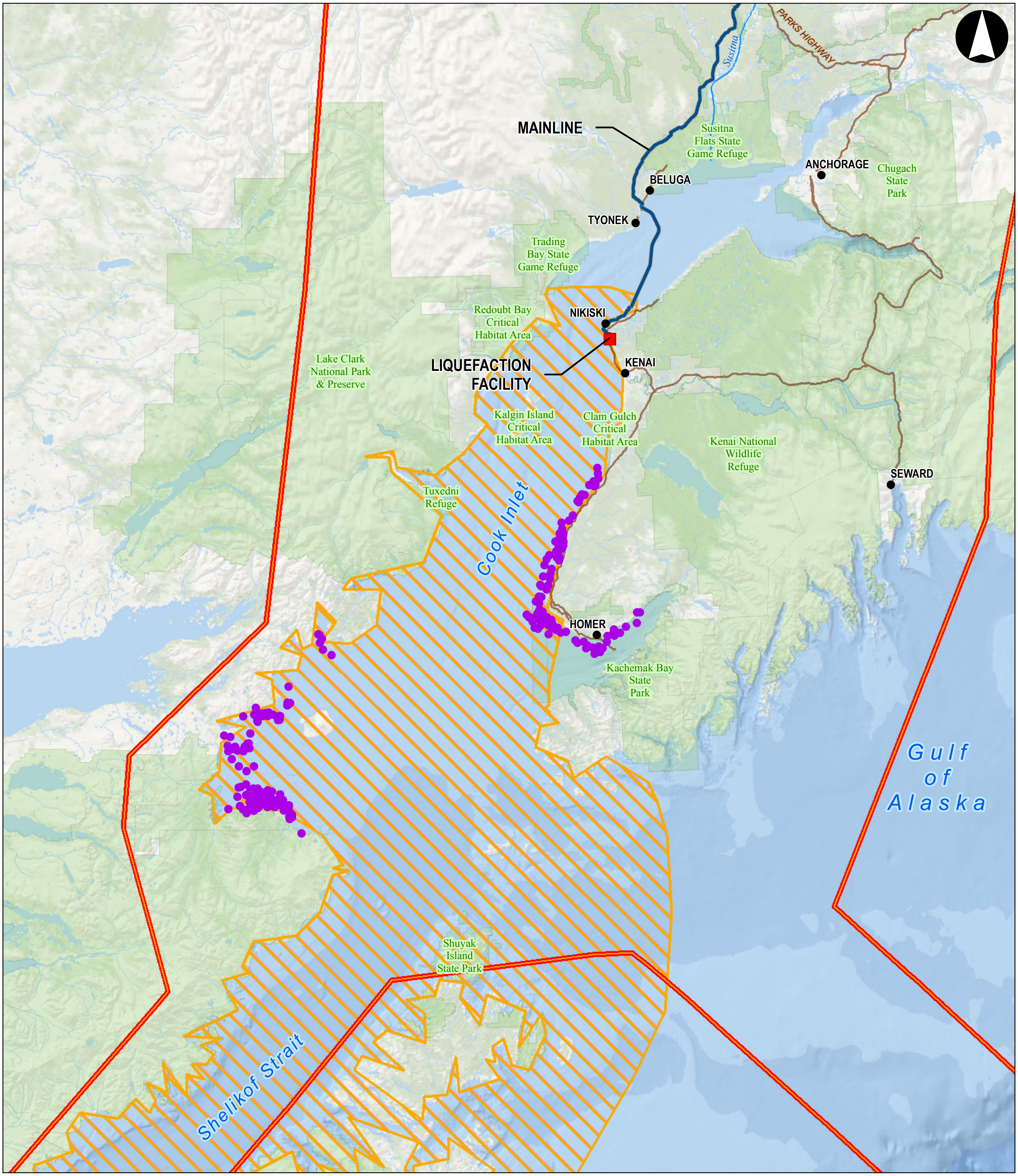
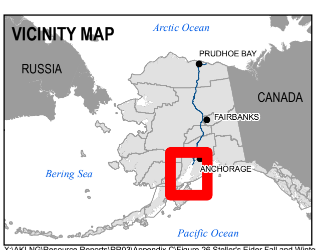
STELLER'S EIDER SEASONAL RANGE AND CRITICAL HABITAT

FIGURE 25

ALASKA LNG

X:\AKLNG\Resource Reports\RR03\Appendix C\Figure 25 Steller's Eider Seasonal Range and Critical Habitat.mxd





LEGEND

- Project Facility
- Existing Facility
- Alaska Place Names
- Steller's Eider Observations
- Alaska LNG Rev C2 Route
- Major Highways
- Major Rivers
- Action Area
- Steller's Eider Molting and Winter Range
- State and Federal Conservation Lands

0 10 20 40 Miles

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STELLER'S EIDER FALL AND WINTER RANGE IN COOK INLET

FIGURE 26

ALASKA LNG

X:\AKLNG\Resource Reports\RR03\Appendix C\Figure 26 Steller's Eider Fall and Winter Range in Cook Inlet.mxd

3.20.2 Presence of Steller’s Eiders in the Action Area

Most Alaska- and Russia-breeding Steller's eider populations winter in marine waters off Alaska and migrate in spring along the Bristol Bay coast of the Alaska Peninsula across Bristol Bay toward Cape Pierce continuing northward along the Bering Sea coast (Larned, 2012). Most stage each year in early spring in estuaries in southwest Alaska, first along the Alaska Peninsula, then in northern Kuskokwim Bay and smaller bays along its perimeter, before continuing north to breeding grounds in Arctic Russia and Alaska. During migration, eiders linger to feed at the mouths of lagoons and other productive habitats (Larned, 2012). Most Steller’s eiders then cross the Bering Strait to breeding grounds in Russia, with a smaller number continuing north to the BCP to breed (Larned, 2012). In May and June, the North Slope Alaska-breeding population migrates to coastal areas along the Eastern Chukchi and Western Beaufort Seas, where Steller’s eiders nest on tundra habitats. More recently, nesting on the BCP has been limited to the vicinity of Barrow (Quakenbush et al., 2002). Although the historic nesting range of this population overlaps with the Project and Steller’s eiders have been observed at Prudhoe Bay during the breeding season, nesting Steller’s eiders have not been documented at Prudhoe Bay (Quakenbush et al., 2002).

Interannual disparity in the number of breeding pairs returning and the number of offspring produced is wide (Obritschkewitsch and Ritchie, 2008); eiders may not breed when lemming numbers are low due to increased predation (Quakenbush and Suydam, 1999). Quakenbush et al. (2004) found that most Steller’s eiders nesting near Barrow use edges of low-centered polygons near ponds with emergent vegetation, particularly those with sedges and pendant grass (*Arctophila fulva*). Eggs hatch from early July to early August, following an incubation period of approximately 24 days (Quakenbush et al., 2004). Broods are raised in nearby freshwater, often within 0.5 miles of their nest sites. Ducklings fledge 32 to 37 days after hatching, and once fledged, depart with the females to marine waters. Non-breeding and post-breeding birds use the nearshore zone of the northeastern Chukchi Sea and large lakes around Barrow for molting and summering, and a few occasionally occur as far east as the U.S.-Canada border (Quakenbush et al., 2002).

Following nesting in high Arctic Russia and Alaska, most Steller's eiders migrate to southwestern Alaska, including lower Cook Inlet, where they generally feed in nearshore, shallow (up to 30 feet deep) marine waters. Migration routes are not well known but appear to be coastal. In mid-winter, Alaska-breeding Steller’s eiders do not appear to segregate from Russia-breeding Steller’s eiders using habitats throughout the Alaska Peninsula (Martin et al., 2015). During wing-molt from late August to early October, most Alaska-breeding Steller’s eiders appear to use the Kuskokwim Shoals critical habitat area (Figure 26; Martin et al., 2015). On the Alaska Peninsula, non-breeding subadults begin arriving in mid-July and peak in early August (Fredrickson, 2001). After molting in the Kuskokwim Shoals, Alaska-breeding birds dispersed to various wintering locations along the Alaska Peninsula, including several areas and harbors with significant levels of vessel traffic and industry, such as Unalaska, Akutan, Cook Inlet, and Kodiak (Rosenberg, 2011; USFWS, 2015a). Molting patterns for Steller’s eiders are similar to those of spectacled eiders. Females molt after the nesting season and males return to molting areas in nearshore marine waters after breeding in late June or July (Fredrickson, 2001). Although no systematic surveys have been conducted, very few Steller’s eiders are known to occur in upper Cook Inlet near the Marine Terminal on the eastern shore of Cook Inlet near Nikiski. Steller’s eiders winter in lower Cook Inlet arriving as early as mid-July and remaining through late April, with highest numbers occurring in January or February (Figure 26; Larned, 2006).

Sea ice in lower Cook Inlet is presumably a major factor influencing use of winter habitats by Steller’s eiders and other marine birds (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), south of the Marine Terminal. In western Cook Inlet, Steller’s eiders were most abundant in the extensive shoals from Douglas Bay to Bruin Bay, a shoal 7 miles southeast of Bruin Bay, and the mouth of Iniskin Bay (Figure 26).

3.20.3 Steller's Eider Critical Habitat

The USFWS designated critical habitat for Steller's eiders in 2001 that includes breeding habitat on the Yukon Kuskokwim Delta; molting habitat in marine waters of Kuskokwim Shoals in northern Kuskokwim Bay, and Seal Islands, Nelson Lagoon, and Izembek Lagoon on the northern side of the Alaska Peninsula (Figure 25; 66 FR 8850). The primary constituent elements for units designated for molting and wintering are marine waters up to 30 feet deep and the underlying substrate, the associated invertebrate fauna in the water column, the underlying marine benthic community, and where present, eelgrass beds and associated flora and fauna (66 C.F.R. 8850).

3.21 PACIFIC SALMON AND STEELHEAD TROUT

The majority of Pacific salmon and steelhead trout populations that spawn in freshwaters of the Pacific Northwest, including Alaska and Canada, are healthy and meet management objectives; however, 12 Chinook (king) salmon populations or Evolutionarily Significant Units (ESUs) and steelhead trout populations or Distinct Population Segments (DPSs) that are listed as threatened or endangered are known or suspected to occur in Alaskan waters (Table 3). These listed populations spawn in Washington, Oregon, or Idaho and migrate to forage in North Pacific waters. Although differentiating marine distribution patterns for specific salmon and steelhead stocks is challenging, it is apparent that salmon and steelhead stocks share feeding grounds and are found in a variety of depths and distances from shore. Salmon and steelhead migrations are influenced by dominant ocean currents and are associated with prey concentrations, which in turn are driven by seasonal plankton production and cold water upwelling (Bracis, 2010).

The following Pacific salmon ESUs and steelhead DPSs are recognized by NMFS as potentially occurring along LNGC and HLV routes through the Gulf of Alaska, Aleutian Islands, and Bering Sea (NMFS, 2015a):

- 1 endangered and 5 threatened Chinook salmon ESUs; and
- 1 endangered and 5 threatened steelhead trout DPSs.

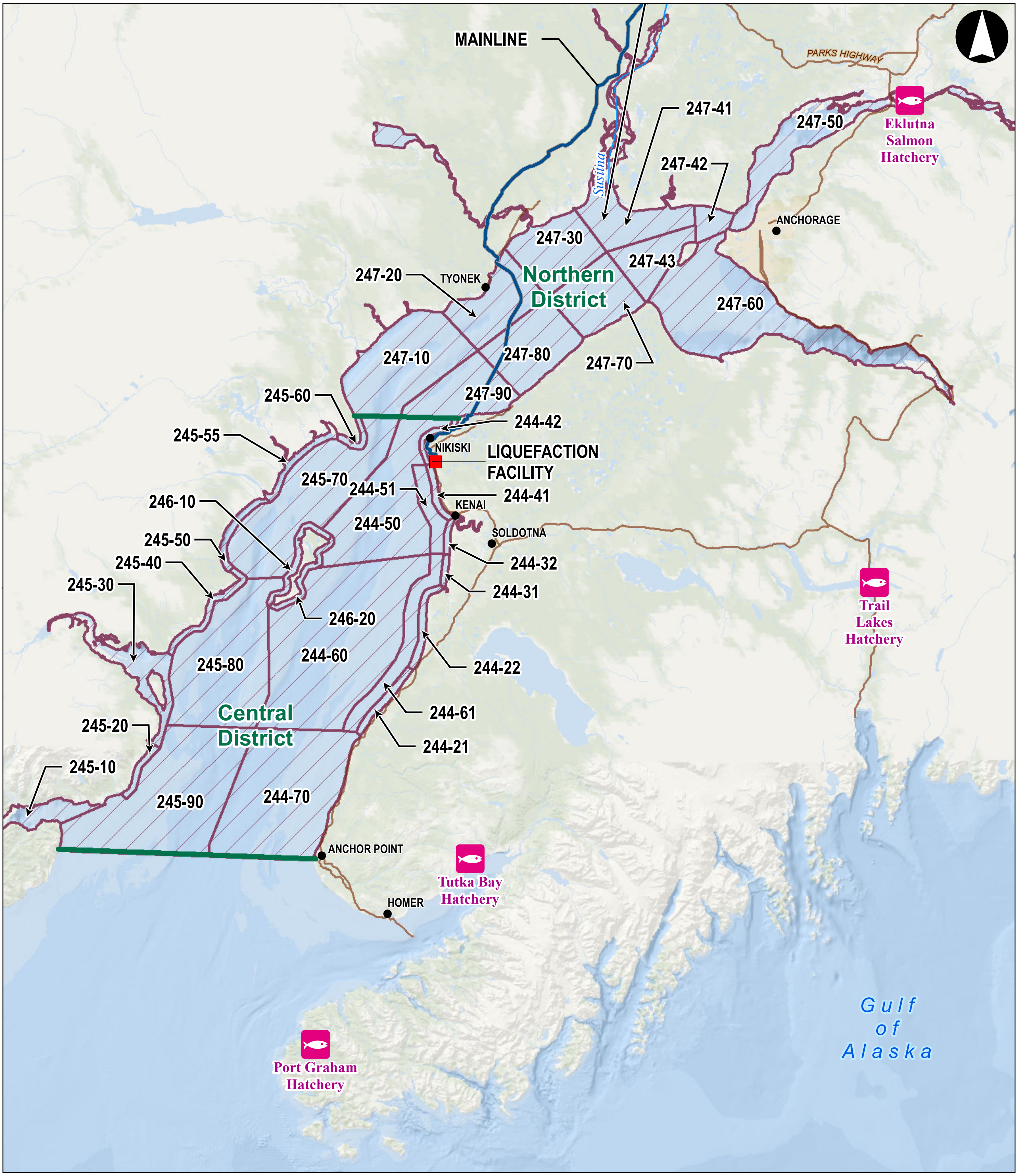
These 12 Chinook salmon and steelhead trout populations have experienced declines in recent decades as a result of multiple effects: freshwater habitat reduction, modification, degradation, and elimination; estuarine rearing habitat reduction, modification, degradation, and elimination; juvenile and adult mortality from hydroelectric and flood control structures; overfishing and bycatch; detrimental effects from invasive aquatic animals and plants; interactions, genetic, and disease effects from hatchery practices; and climate changes that affect hydrologic cycles and marine water productivity. The Project would not contribute to the loss and degradation of freshwater spawning and rearing habitat in Washington, Oregon, and Idaho that were primary factors leading to the listing of these six Chinook salmon ESUs and six steelhead trout DPSs. LNGC and HLV ballast water exchange would comply with USCG regulations, would occur outside of U.S. waters, and measures would be followed to prevent introduction or spread of aquatic invasive animals or plants. No critical habitat is designated in Alaska waters for ESA-listed Chinook salmon ESUs or steelhead trout DPSs.

3.21.1 Chinook Salmon ESUs

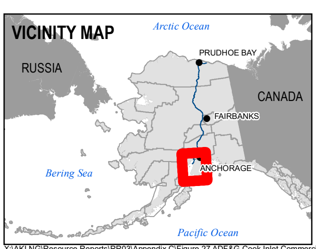
Listed Chinook salmon spawn and rear in freshwaters in Washington, Oregon, or Idaho and migrate to forage in marine waters for up to 5 years before returning to freshwater to spawn. Listed Chinook salmon ESUs are found from the Bering Strait to Southern California. No individuals from listed Chinook salmon ESUs are expected to occur in Cook Inlet, north of the Forelands. Studies of local Cook Inlet populations of Chinook indicate that juvenile fish moved rapidly out of upper Cook Inlet north of the Forelands (Moulton, 1997). In addition, no Chinook salmon originating from listed ESUs have been identified by Coded Wire Tag (CWT) recoveries from Northern District Cook Inlet fisheries (District 247 on Figure 27) from 1990 to 2015 (ADF&G, 2015a). All but one CWT recovery from Chinook in District 247 originated from Alaska populations with one recovery from a British Columbia population (ADF&G, 2015a).

Construction-related shipping and LNGCs would coincide with the at-sea distributions of Chinook salmon ESUs. The highest potential for overlap between Chinook at-sea distributions and project-related shipping would occur outside of Cook Inlet during passage through Shelikof Strait, in the northern Gulf of Alaska, and through the Aleutian-Bering Sea area based on CWT recoveries from Washington, Oregon, and Idaho Chinook salmon from 1981 to 2013 (Celewycz et al., 2014).

A total of 21 Chinook salmon from Washington and Oregon populations included several ESA-listed ESUs have been identified by CWT recoveries from the Central District Cook Inlet fisheries (Table 8; District 244-70/244-20; ADF&G, 2015b). The Upper Willamette River Chinook salmon ESU occurred most frequently in the CWT recoveries from the Central District Cook Inlet accounting for 62 percent of the tag recoveries from Chinook populations originating outside of Alaska (Table 8; ADF&G, 2015b). The Upper Willamette River Chinook salmon ESU occurred most frequently in the CWT recoveries from the Lower District Cook Inlet (District 241) accounting for 42 percent of tag recoveries from Chinook populations originating in Washington, Oregon, or Idaho (Table 9; ADF&G, 2015c).



VICINITY MAP



LEGEND

- Fish Hatcheries
- Project Facility
- Alaska Place Names
- Alaska LNG Rev C2 Route
- Major Highways
- Major Rivers
- Commercial Fisheries Statistical Areas

0 5 10 20 Miles

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ADF&G COOK INLET COMMERCIAL FISHERIES DISTRICTS

FIGURE 27

ALASKA LNG

X:\AKLNG\Resource Reports\RR03\Appendix C\Figure 27 ADF&G Cook Inlet Commercial Fisheries Districts.mxd

TABLE 8

Chinook Salmon Coded Wire Tag Recoveries from Central Cook Inlet District 244, 1990 to 2014

Population Origin	ESA Status	1991	1996	1998	2000	2001	2002	2003	2013	2014	Total
Coastal Washington	None		1								1
Lower Columbia River	None			1			1	1			3
Lower Columbia River ESU	T					1					1
Upper Columbia-Okanogan	None					1					1
Coastal Oregon	None	1									1
Upper Willamette River	None					1					1
Upper Willamette River ESU	T				2	6	2		1	2	13
Total		1	1	1	2	9	3	1	1	2	21

Source: ADF&G, 2015b

T = Threatened

Note: All fish were sport caught during May or June; recorded from Statistical Areas (Figure 27) 244-70 (86%), 244-20 (9%), or unrecorded (5%); hatchery origin; and assigned to ESU based on hatchery of origin.

TABLE 9

Chinook Salmon Coded Wire Tag Recoveries from Lower Cook Inlet District 241, 2005 to 2014

Population Origin	ESA Status	2005	2006	2009	2010	2011	2012	2013	2014	2015	Total
Coastal Washington	None								12		12
Puget Sound ESU	T								1		1
Lower Columbia River	None				1	1	1	1	16	2	22
Lower Columbia River ESU	T		1						1		2
Mid-Columbia River	None							1	2		3
Upper Columbia River	None	2			3	2		2	16	1	26
Coastal Oregon	None								2		2
Upper Willamette River	None								2		2
Upper Willamette River ESU	T			3	7		3		32	7	52
Snake River ESU	T								1		1
Total		2	1	3	11	3	4	4	85	10	123

Source: ADF&G, 2015c

Note: All fish were sport caught (12% Jan-Mar, 13% Apr-Jun, 51% Jul-Sep, 23% Oct-Dec); recorded from Subdistrict 241; all but one was hatchery origin; and assigned to ESU based on hatchery of origin.

ESA-listed Chinook salmon ESUs in the Bering Sea-Aleutian Islands and Gulf of Alaska fisheries based on CWT include: Lower Columbia River, Upper Columbia River Spring, Upper Willamette River, and Snake River Fall ESUs (NMFS, 2013a). Small numbers of the Puget Sound Chinook salmon ESU, and Snake River Spring/Summer Chinook salmon ESU have also been documented by research surveys in the Gulf of Alaska (NMFS, 2013a).

Vessel traffic would create surface water disturbance and noise that could potentially be perceived by fish but like existing marine vessel traffic, would not reduce the current or expected future survival or reproduction of these ESUs such that any potential effects would be discountable. There would not be an effect on critical habitats for these Chinook ESUs that occur in freshwaters and estuaries outside of Alaska. Therefore, detailed analyses were not conducted for the listed Chinook salmon ESUs.

3.21.2 Steelhead Trout DPSs

Listed steelhead trout (anadromous rainbow trout) spawn and rear in freshwaters of Washington, Oregon, or Idaho for several years, and migrate to forage in marine waters for up to 3 years before returning to freshwater to spawn. Unlike the Pacific salmon, which die after spawning, steelhead may complete the transition between marine and freshwater several times living for up to 11 years. Young steelhead originating in North American rivers move offshore into pelagic waters of the Gulf of Alaska in their second year of ocean residency (Light et al., 1989). At-sea movements are characteristically northward and westward from spring through summer then southward and eastward from autumn through winter (Light et al., 1989). Tagging studies have found little or no difference in ocean distribution among stocks, groups, or races (Light et al., 1989). Snake River Basin steelhead DPS have been documented by research surveys in the Gulf of Alaska (NMFS, 2013a). No CWTs for steelhead originating from Washington, Oregon, or Idaho have been recovered in Cook Inlet fisheries (ADF&G, 2015d).

Vessel traffic would create surface water disturbance and noise that could potentially be perceived by fish, but, like existing marine vessel traffic, would not reduce the current or expected future survival or reproduction these DPSs such that any potential effects would be discountable. There would not be an effect on critical habitats for these DPSs that occur in freshwaters and estuaries outside of Alaska. Therefore, no detailed analyses were conducted for the listed steelhead DPSs.

4.0 ENVIRONMENTAL BASELINE

The following sections summarize the environmental baseline in those portions of the action area where the likely presence of listed species or critical habitats have been identified. The environmental baseline is a summary of the past and present effects of all Federal, State, or private actions and other human activities in an action area, the anticipated effects of all proposed Federal projects in an action area that have already undergone formal or early Section 7 consultation, and the effect of State or private actions that are contemporaneous with the consultation in process (50 CFR §402.02).

4.1 NEARSHORE BEAUFORT SEA

This area includes those portions of the Beaufort Sea that are located within the action area identified in Figure 5, encompassing the land area from Gwyder Bay in the west to Flaxman Island in the East, and extending 15 to 30 miles offshore from the Beaufort Sea shoreline. There are no communities within this portion of the action area; the Village of Kaktovik with a population of approximately 300 is located about 50 miles to the east, and Nuiqsut, with a population of about 400, is located approximately 40 miles to the west.

Evaluated species that occur within this portion of the action area and could be affected are bowhead whale, beluga whale, polar bear, spectacled eider, and Steller's eider. Anthropogenic risk factors for these species would be associated with the primary human activities in the area, which are oil and gas exploration and production, docks and causeways, vessel traffic, and subsistence. Commercial fishing is currently prohibited in the Beaufort Sea under the Arctic Fishery Management Plan (NPFMC, 2009).

4.1.1 Threats to Evaluated Species in the Area

USFWS (2012) identified the following as factors which have likely contributed to the environmental baseline of spectacled eiders and polar bears for the same general area in the biological opinion for ExxonMobil's Point Thomson Project:

- For spectacled eider – collisions with structures, long-term habitat loss through development and disturbance, environmental contaminants, increased predation, and climate change; and
- For polar bear – oil and gas development, subsistence hunting, environmental contaminants and climate change.

These factors are discussed in the following sections.

4.1.2 Oil and Gas Exploration and Production

Oil and gas exploration and production is regulated in federal waters (waters > 3 nautical miles from the coast) by the Bureau of Ocean Energy Management and in state waters by Alaska Department of Natural Resources (ADNR). Most exploration activities consist of geophysical surveys (seismic surveys and shallow hazard surveys) and exploration drilling. Production includes the drilling of development wells, construction and operation of production facilities on platforms or artificial islands, and construction and operation of pipelines.

Geophysical surveys in the offshore environment can result in the disturbance of wildlife, including the evaluated species, from vessel traffic and the generation of underwater sound from some types of geophysical equipment that exceeds sound level thresholds that NMFS believes results in disturbance of marine mammals. Geophysical operators must obtain authorization for any such disturbance of marine mammals from NMFS (whales and seals) and USFWS (polar bears). Geophysical surveys in the Beaufort Sea have been issued incidental take authorizations for bowhead whales, belugas, ringed seals, bearded seals, walrus, and polar bear. These agencies cannot issue such authorizations unless the proposed activities have been evaluated and found to result in only incidental Level B (behavioral disturbance) takes of small numbers of individuals of the species and, in total, would have a negligible impact on the species. These types of disturbances are temporary, with no long term effects, such as the altering of migration routes or habitat use, having been documented.

Thirty-one exploration wells have been drilled in federal waters of the Beaufort Sea to date; 21 of these have been drilled in the subject part of the action area. Numerous other exploration wells have been drilled in state waters. Effects on marine mammals from exploration drilling are primarily associated with: generation of underwater sound associated with drilling and placement of the drilling unit and discharges, the most substantial of which is the discharge of cuttings and drilling fluids (muds). As with the geophysical surveys, the sound generated by exploration activities has been found to result in the disturbance of small numbers of individuals of the species and have a negligible impact on the species. Investigations of sediment quality at former exploration drill sites in the Beaufort Sea have indicated little, if any, residual effect on the habitat or benthic organisms. Concentrations of some metals in the sediment, such as barium, have been documented, but concentrations remain below effects levels (Dunton et al., 2009; Trefry and Trocine, 2009).

4.1.2.1 Disturbance and Mortalities

Spectacled and Steller's Eiders

Spectacled and Steller's eiders use and migrate through the coastal waters of the Beaufort Sea and Chukchi Sea within the action area just before and during the open water period, and are susceptible to disturbance by vessel traffic and collisions with vessels and structures. Fatal spectacled eider collisions with ships in the Bering Sea are apparently rare but have been reported. Lovvorn et al. (2003) reported the collision of three spectacled eiders with a research vessel in the wintering area.

Spectacled and Steller's eiders move their broods to nearshore waters of the Beaufort and Chukchi Sea and both species molt in nearshore waters as well. During mottling, especially, they can be concentrated in certain areas and would be most susceptible to disturbance from vessel with potential for subsequent effects on their energetics. Spectacled eiders concentrate in large numbers to molt in Ledyard Bay. These waters have been designated as critical habitat and the planned Project vessel routes would avoid these waters.

In general, spectacled and Steller's eiders appear to be relatively tolerant of large vessels (MMS 2006; USACE, 2000a, b, c, d). Studies (Lacroix et al., 2003) of the effect of vessel traffic associated with offshore seismic surveys on other sea ducks such as the long-tailed duck, have found little effect on movements, diving behavior, site fidelity.

Eiders may also collide with structures, of which there are relatively few within the action area. No spectacled or Steller's eiders were known to collide with the offshore Northstar Island, an artificial island and oil and gas production facility in the action area over 3 years of monitoring (Day et al., 2004).

Polar Bears

Lethal take associated with the oil and gas industry has occurred on only one occasion since 1991. A polar bear was accidentally killed in August 2011 due to the misuse of a crackershell round. Prior to that incident, lethal takes of adult polar bears by industry in Alaska were also rare with only two known occurrences since 1968. Polar bears often occur in areas where offshore oil and gas exploration or development is being conducted, and such occurrences sometimes result in behavioral disturbances.

LGL (2013) summarized polar bear sightings that occurred during oil and gas exploration in the Beaufort Sea in 2006-2012, during which there were 94 polar bear sightings (276 individuals) from vessels. Recorded total trip miles of oil and gas vessels during that period ranged from less than 6,000 to about 43,000 miles per year, indicating that polar bear sightings are rare events on a per vessel mile basis. Most observed bears (71%) were first sighted on land, but they were also sighted in water (17%) and ice (11%). Most of the bears sighted on land were on Cross Island or other barrier islands. The average group size per sighting was three bears (range 1–24), with the larger group sightings (>3 bears) being associated with Cross Island or other barrier islands.

The closest point of approach (CPA) for polar bears from these vessels was 0.07 mile (range 0.02–0.12 mile), for bears on ice the mean was 0.99 mile (range 0.5–2.3 miles), and for bears on land the mean was 0.95 mile (range 0.27–2.5 miles). Vessels maintained a larger CPA to bears seen on ice or land due to the greater sightability of bears on land and ice, which allowed earlier detection by PSOs.

Movements of the 79 bears on ice or land with respect to the vessel included “no movement” in 61% of sightings, “neutral” in 24% of the sightings, “move away” in 11% of the sightings, and “move towards” in 2% of the sightings. Reaction to the vessel for bears on ice and land included “no reaction” in 80% of sightings, “look” in 13% of sightings, one polar bear was seen “increasing in speed” as a reaction to the vessel, and another was observed “rushing” as a reaction to the vessel. Movement patterns for the 16 bears sighted in water with respect to the vessel included “neutral” in 67% of the sightings, “move away” in 20% of the sightings and “move towards” in 13% of the sightings. Reactions to the vessel included “no reaction” in 47% of sightings, “look” in 47% of sightings, and a report of one polar bear interacting with the vessel.

These data indicate that polar bear sightings from vessels are relatively rare occurrences. When they do occur, only about half the bears react, and the remainder exhibit temporary behavioral disturbances such as moving toward or away from the vessel, or just looking at the vessel. There was no evidence of any long term effect on polar bear distribution, movements, or survival.

4.1.3 Vessel Traffic

Reviews of vessel traffic in the Beaufort Sea have been presented by ICCT (2015), McConnell (2013), USCG (2013), and an LGL (2013). OCCT (2015) and USCG show a steady increase in the number of vessels operating in the U.S. Arctic from 2008 (120 vessels) through 2012 (250 vessels). ICCT (2015) predicts continuing growth in vessel traffic in the U.S. Arctic in the future. LGL (2013) indicated that the number of AIS-equipped vessels in the Beaufort Sea in 2012 consisted of about equal numbers of commercial, recreational, tourism, research, and military/USCG vessels, and a greater level of oil and gas vessels.

Polar Bear

The effects of oil and gas vessel traffic on polar bears is discussed in Section 4.1.2.1. Other types of vessels would be expected to have similar effects consisting of brief behavioral responses. The USFWS (2008) concluded in its Programmatic BO that vessel traffic could result in short-term behavioral disturbance of polar bears or attract animals if in pack ice. USFWS (2012) conducted a thorough review of the effects of vessel traffic associated with oil and gas surveys and found that vessel traffic could briefly have an energetic cost to a few polar bears, but would not result in significant disruption of behavior patterns, and would have a negligible impact on polar bear populations. There is no indication that vessel traffic is having any effect on polar bears at a population level.

4.1.4 Subsistence

Spectacled Eider

Subsistence harvests of Spectacled eiders? are discussed in Section 4.2.3. This harvest is currently considered sustainable.

Polar Bear

Subsistence harvests of polar bears are discussed in Section 4.2.3. This harvest is currently considered sustainable (Agreement between the United States of America and the Russian Federation on the conservation and Management of Alaska-Chukotka Polar Bear Population).

4.2 ARCTIC COASTAL PLAIN

This area includes those portions of the Arctic Coastal Plain that are located within the action area identified in Figure 5, encompassing the land area from Gwyder Bay in the west to Flaxman Island in the East, and extending 14 to 32 miles inland from the Beaufort Sea shoreline. There are no communities within this portion of the action area; the Village of Kaktovik with a population of approximately 300 is located about 50 miles to the east, and the Village of Nuiqsut with a population of about 400 is located approximately 40 miles to the west.

Evaluated species that may occur in the area are Steller's eider, spectacled eider, and polar bear. Use of the area by Steller's eider would be limited to possible nesting; however, instances of Steller's eiders nesting in the area are rare with USFWS reporting only 5 observations of nesting Steller's eider east of the Colville River during nesting surveys conducted annually from 1992 through 2010, with the most recent observation occurring in 1998 (USFWS, 2012). Similar to the finding of USFWS (2012) in the BO for the Point Thomson Project (similar in scope and same area as the Project), adverse effects to this Steller's eiders from the Project are extremely unlikely to occur as Steller's eiders are unlikely to nest near or migrate through this portion of the action area. Potential effects are therefore discountable, and Steller's eiders are not discussed further in this section.

With the decline of spectacled eiders in the Yukon-Kuskokwim Delta, the BCP currently supports most of the Alaska breeding population of spectacled eiders. Data from the nesting population in the Prudhoe Bay area suggested that it might have declined by as much as 80 percent between 1981 and 1992 (Warnock and Troy, 1992; TERA, 1993). However, the USFWS (Larned et. al., 2012) reported a stable population across the BCP over the last 10 years (2001-2011) with a mean population growth over that period of 0.997 (90 percent confidence interval of 0.965-1.029). Recent density of nesting spectacled eiders on the BCP are indicated in Figure 24.

Declining survival, recruitment, and body size (Regehr et al., 2006; Regehr et al., 2010; Rode et al., 2010), low population growth rates during years of reduced sea ice (2004 and 2005), and an overall declining population growth rate of 3% per year from 2001 to 2005 (Hunter et al., 2007) suggest that the SBS polar bear stock is now declining.

4.2.1 Threats to Evaluated Species in the Area

USFWS (2012) identified the following as factors, which have likely contributed to the current status of spectacled eiders and polar bears for the same general area in the biological opinion for ExxonMobil's Point Thomson Project:

- For spectacled eider - collisions with structures, long-term habitat loss through development and disturbance, environmental contaminants, increased predation, and climate change; and
- For polar bear - oil and gas development, hunting, environmental contaminants and climate change.

These factors are discussed in the following sections.

4.2.2 Oil and Gas Exploration and Development

Oil and gas development in the area began with the discovery of the Prudhoe Bay Oilfield in 1968. The Prudhoe Bay Oilfield was the first oil and gas development in the Arctic and is the largest in the United States.

4.2.2.1 Habitat Loss

Investigators have provided several accountings of the cumulative effects on habitat from oil and gas development on the North Slope of Alaska (Walker et al., 1987; National Research Council, 2003; Raynolds et al., 2014; Walker et al., 2014). Raynolds et al. (2014) reported that as of 2011, there were 127 production pads, 25 facility pads, 145 support pads (power stations, camps staging areas, etc.), 103 exploration sites, 13 offshore exploration islands, 7 offshore production islands, 9 airstrips, 4 exploration airstrips, 2,037 culverts, 27 bridges, 50 caribou crossings, and one active landfill. The road network consisted of 416 miles of granular roads, 96 miles of abandoned peat roads, 7 miles of causeways, 60 miles of abandoned tractor trails, and 34 miles of exploration roads with thin granular material or tundra scars. The 491-mile pipeline network includes groups of parallel pipelines elevated 3.3 to 6.6 feet above the tundra surface on vertical supports. Pipeline corridors included anywhere from one to 21 closely spaced parallel pipelines with diameters up to 24 inches. The length of major powerlines with towers totaled 336 miles. The total oilfield infrastructure covered 18,357 acres of the North Slope by 2011, mainly consisting of 5,795 acres of granular pads, 6,763 acres of granular mines, and 3,101 acres of granular roads and causeways. Impacted areas also included airstrips (309 acres), offshore granular pads and islands (203 acres), exploration sites (717 acres), exploration airstrips (49 acres), peat roads (516 acres), tractor trails/scars (257 acres), exploration roads (178 acres), and areas where pads have been removed and are in the process of recovery (470 acres). The total infrastructure area is 18,357 acres.

Granular areas within the Arctic Coastal Plain portion of the action area are indicated in Table 10. The onshore area within the Prudhoe Bay portion of the action area encompasses approximately 974,300 acres. Within that area, granular material covers approximately 6,616 acres (Table 10) or less than 1 percent of the area, and there are about 252 miles of roads and 78 miles of pipelines (Table 11).

TABLE 10

Existing Granular Areas within the Prudhoe Bay Portion of the Action Area

Granular Infrastructure Type	Number of Structures	Area(acres)
Roads	204	1,940
Airstrip	2	212
Drill Site	53	1,993
Exploration	52	296
Process	26	625
Process and Drill Site	3	88
Support	138	1,414
U.S. Government	2	49
Total	--	6,616

TABLE 11

Onshore Linear Structures within the Prudhoe Bay Portion of the Action Area

Structure Type	Miles of Structures
Granular Roads	251
Peat Roads	2
Abandoned Trails	53
Aboveground Pipelines	52
Buried Pipelines	26

4.2.2.1.1 Spectacled Eider

Habitat loss or destruction was not identified as a factor in the decline of the spectacled eider at the time of listing (1993, FR 27474). USFWS concluded that habitat loss is unlikely to be a factor as breeding/nesting habitat encompasses vast expanses of coastal tundra, and most of the decline was reported in the Yukon-Kuskokwim Delta area where there has been no development or other substantial threats to the principal breeding habitat. Habitat loss was also not indicated to be a cause for decline in the Spectacled Eider Recovery Plan (USFWS, 1996), nor was habitat management identified as a recovery strategy. In their BO for the Point Thomson Project, USFWS (2012) did indicate a belief that long-term habitat loss through development and disturbance may have contributed to the current status of spectacled eiders in the area; however, USFWS also stated that extent of the effect is unknown. USFWS further reported that, given the extent of development in this area, it is likely that eiders have experienced some loss of production resulting from direct and indirect habitat loss, but that the degree to which spectacled eiders can reproduce in disturbed areas or move to other less disturbed areas to reproduce, and the potential population level consequences of previous development in the area are unknown.

Recent spectacled eider densities in the action area as mapped by USFWS are summarized in Table 12. Mean density of nesting spectacled eider pairs across the action area is 0.103 pairs per square mile (Table 12). Assuming this average density, the loss of 6,616 acres would potentially represent nesting habitat for about one nesting pair per year that the gravel has been in place and continues to do so. At a micro-habitat level, the type of habitat preferred by nesting eiders has likely been avoided to some degree during the development process. Also, as suggested by USFWS (2012), the loss of habitat does not necessarily equate to loss of nesting birds, as the degree to which the birds would move to other areas to reproduce is unknown. For these reasons, it is unlikely that habitat loss through oil and gas development had, or is having, a substantial effect on spectacled eider populations.

TABLE 12

Onshore Linear Structures within the Prudhoe Bay Portion of the Action Area

Density	Density Range	Density Range Midpoint (pairs/square mile)	Acres in Action Area	Square Miles in Action Area
Low Density	0 to 0.073	0.036	597,192	933.1
Low-medium Density	0.073 to 0.287	0.180	171,833	268.5
Medium Density	0.287 to 0.611	0.449	79,280	123.9
Mean Density	--	0.103	852,955	1,325.5

4.2.2.1.2 Polar Bear

Approximately 794,034 acres within the onshore portion of the action area (81 percent) has been identified by USGS as polar bear maternal denning area, and within that area they have mapped approximately 661 miles of linear denning habitat (Figure 20). Potential polar bear denning habitat has been affected by oil and gas exploration and development given a granular footprint in the action area of 6,616 acres and additional miles of linear structures. However, it appears that terrestrial denning habitat is likely not a limiting factor on the polar bear population.

The polar bear was listed as a threatened species in 2008 because data indicated that sea ice polar bear habitat was declining throughout the species range due to climate change (FR 28212). Although sea ice is the principal polar bear habitat, terrestrial habitat is used seasonally for maternal denning and for feeding and resting in the absence of suitable sea ice. Polar bears den both onshore and offshore on the ice, but onshore denning may be increasing with the loss of sea ice. The loss of habitat from oil and gas development was not implicated in the listing of polar bears, but it was noted that some alteration of polar bear habitat has occurred from oil and gas exploration and development. A lack of direct quantifiable effects on polar bear habitat from oil and gas development was noted (FR 28212).

4.2.2.2 Disturbance and Mortalities

4.2.2.2.1 Spectacled Eiders

Collisions of Spectacled Eiders with Structures

Bird mortality from collisions with buildings, vehicles, aircraft, vessels, towers, pipelines, platforms, or other structures associated with onshore and offshore oil and gas development is likely to persist into the future, and is expected to increase with increasing levels of development. The oil and gas industry has developed and implemented anti-collision practices, including providing better lighting of facilities, burying power lines, and attaching power lines to pipelines, in an attempt to reduce the number of bird collisions oil and gas infrastructure.

Known collision mortality to spectacled and Steller's eiders has occurred in Barrow and Deadhorse, probably as the result of collisions with overhead lines and guywires (Minerals Management Service, 2003, citing USFWS unpublished data). No spectacled or Steller's eiders were found in a study of bird collisions with overhead powerlines at the Lisburne development (Anderson and Murphy, 1988).

Collisions with vehicles, buildings, or oil field infrastructure probably do not represent a significant source of Special Status Species mortality at the population level. However, losses due to collisions in developed areas accumulate with increases in development and add incrementally to other impacts.

4.2.2.2.2 Polar Bear

Polar Bear Mortalities – Vehicle Collisions, Hazing, Poisoning

Lethal take associated with the oil and gas industry has occurred on only one occasion during the periods covered by the Chukchi Sea (1991–1996 and 2008–present) and Beaufort Sea (1993–present) ITRs, when a polar bear was accidentally killed in August 2011 due to the misuse of a crackershell round. Prior to issuance of these regulations, lethal takes of adults by industry in Alaska were also rare with only two known occurrences since 1968.

Disturbance

Interactions in the Action Area (i.e., in the Prudhoe Bay area) have been minimized by implementation of Incidental Take Regulations (ITRs) for the Beaufort Sea (USFWS, 2006, 2011) and the associated Letters of Authorization (LOAs) issued under the MMPA. The ITRs only authorize non-lethal incidental take. As part of the LOAs issued pursuant to these regulations, the oil and gas industry is required to report the number of polar bears observed, their response, and if deterrence activities were required. Recent data from the region regulated under the Beaufort Sea ITRs indicate an average of 306 polar bears were observed annually by the oil and gas industry from 2006 to 2009 (range 170–420). About 81% of these bears showed no change in their behavior, 4% altered their behavior by moving away from (or towards) the industrial activity, while the remaining 15% were intentionally harassed (hazed) to actively deter the bears.

4.2.3 Hunting and Subsistence

4.2.3.1 Spectacled Eider

Sport and subsistence hunting of spectacled eiders has been closed under the Migratory Bird Treaty Act since 1991; however, illegal harvest of hundreds of spectacled eiders likely occurs annually in Alaska. ADF&G (2016) reported a harvest of 0-400 birds on the North Slope per year from 2004 through 2013. The 2007 Alaska Migratory Bird Co-Management Council (AMBCC) Subsistence Migratory Bird Harvest Survey Yukon - Kuskokwim Delta 2001 – 2005 With 1985-2005 Species Tables

4.2.3.2 Polar Bear

Most hunting of polar bears prior to the 1950s was by indigenous people for subsistence. Sport hunting increased in the 1950s and 1960s and resulted in population declines (Prestrud and Stirling, 1994). Since passage of the MMPA in 1972 and ratification of the International Agreement on the Conservation of Polar Bears in 1973, polar bear hunting has been prohibited. Coastal dwelling Alaska Natives may continue to take polar bears for subsistence or handicraft purposes. The MMPA has no restrictions on the number, season, or age of polar bears that can be harvested by Alaska Natives; however, there is a more restrictive Native-to-Native agreement between Inupiat from Alaska and Inuvialuit in Canada. The Inuvialuit-Inupiat Polar Bear Management Agreement establishes a harvest quota, which is currently 70 bears per year. The Native subsistence harvest from the SBS stock has averaged 36 bears removed per year (USFWS, 2011). During the period 2005–2009, six polar bears were harvested by residents of Nuiqsut and 11 by residents of Kaktovik (USFWS, 2011), which are the closest Alaska Native communities to the action area. This harvest is currently considered sustainable.

4.2.4 Environmental Contaminants

4.2.4.1 Spectacled Eider

The deposition of lead shot in tundra or nearshore habitats used for foraging is considered a threat to spectacled eiders. Lead poisoning of spectacled eiders has been documented on the YKD (Franson et al., 1995; Grand et al., 1998) and Steller's eiders on the ACP (Trust et al., 1997; USFWS, unpublished data). Female Steller's eiders nesting at Barrow in 1999 had blood lead concentrations that reflected exposure to lead (>0.2 ppm lead; A. Matz, USFWS, unpublished data), and six of the seven tested had blood lead concentrations that indicated poisoning (>0.5 ppm lead; Franson and Pain, 2011). Additional lead isotope tests confirmed the lead in the Steller's eider blood was of lead shot origin, rather than natural sources such as sediments (A. Matz, USFWS, unpublished data). Use of lead shot for hunting waterfowl is prohibited statewide, and for hunting all birds north of the Brooks Range, and USFWS reports good compliance in most areas with the lead shot prohibitions. Further, it is expected that the availability of lead shot in spectacled eider foraging habitat within and near the Action Area to be substantially lower than in other areas on the BCP, that are used more frequently for waterfowl hunting.

Other contaminants, including petroleum hydrocarbons from local sources and globally distributed heavy metals, may also affect spectacled eiders. For example, Trust et. al. (2000) reported high concentrations of metals and subtle biochemical changes in spectacled eiders wintering near St. Lawrence Island.

4.3 COOK INLET BASIN

4.3.1 Factors Affecting Listed Species

The listed species may be affected by various manmade and natural factors present in upper and mid-Cook Inlet. Over 61 percent of the entire Alaskan human population (735,601) resides within southcentral Alaska or the Cook Inlet region. The Alaska Department of Labor and Workforce Development (2014) estimates the 2014 population for the Municipality of Anchorage alone was 300,950, while the Matanuska-Susitna Borough was 98,063 and Kenai Peninsula Borough was 57,212 (State DOLWD). The high degree of human activity, especially within upper Cook Inlet, has produced a number of anthropogenic risk factors including: coastal development, ship strikes, noise pollution, water pollution, prey reduction, direct mortalities, and research that listed marine mammals must contend with along with natural factors such as environmental change. These threats may occur individually or collectively (NMFS, 2008a), and may also affect critical habitat. These factors are discussed individually in the following sections.

4.3.1.1 Coastal Development

Beluga whales and Steller sea lions, in particular, use nearshore environments to rest, feed, and breed and, thus, may be affected by any coastal development that affects these activities. For the most part, the Cook Inlet shoreline is undeveloped, but there are a number of port facilities, airports, housing developments, wastewater treatment plants, roads, and railroads that occur along or close to the shoreline, and there are several onshore and offshore oil and gas development facilities within Cook Inlet.

4.3.1.1.1 Port Facilities

Port facilities in Cook Inlet with in-water structures are found at Anchorage, Point Mackenzie, Nikiski, Kenai, Homer, Seldovia, and Port Graham, while barge landings are found at Tyonek, Drift River, and Anchor Point.

The Port of Anchorage (POA) is Alaska's largest seaport and provides 90 percent of the consumer goods for approximately 85 percent of all of Alaska. It includes three cargo terminals, two petroleum terminals, one dry barge berth, two railway spurs, and a small craft floating dock, plus 220 acres of land facility. Approximately 450 ships or tug/barges call at the POA each year. The POA began an expansion project in 2006, the POA Intermodal Expansion Project, but parts of the project stalled in 2011 due to construction problems with sheet pile placement. The project is expected to resume in 2016 and be completed by 2022. When ultimately completed, the project will rebuild aging infrastructure and provide additional space for cargo handling.

During the project's sheet pile driving activities conducted between 2009 and 2011, the POA acoustically harassed 40 Cook Inlet beluga whales, ranging from a high of 23 in 2009 and a low of 4 in 2011. The POA was authorized by NMFS to harass 34 annually. A single Steller sea lion was sighted at the facility in 2009, and take of this animal was ostensibly avoided by shutting down the pile driving activity.

Additionally, dredging is conducted annually under the direction of the U.S. Army Corps of Engineers (2013) to maintain a water depth of 35 feet at the POA terminals. In 2013, approximately 2.8 million cubic yards of material was removed in about 35 days. The existing permit allows maintenance dredging to occur through 2017, and it is assumed that dredging activity will occur in 2015. The effect of this dredging activity on Cook Inlet belugas is unknown; however, the re-suspension of sediments and entrained contaminants in the water column due to dredging was considered a threat to St. Lawrence beluga whales (DFO 2012). This threat is probably less likely in Cook Inlet because of a lack of contamination history compared to the St. Lawrence River, and Cook Inlet belugas are already adapted to water heavily laden with silt from glacial runoff.

Port MacKenzie is located on the western shore of Knik Arm, approximately 3.1 miles northwest of Point MacKenzie. The port is owned and operated by the Matanuska-Susitna Borough, and includes both a deep-draft dock and a barge dock. Knik Arm is seasonally important to beluga whales during late summer salmon runs heading up the Knik River (Rodrigues et al. 2006). Operations at Port MacKenzie include dry bulk cargo movement and storage. WesPac is developing Liquefied Natural Gas (LNG) facilities in several parts of the nation, and plans to build a small or mid-sized LNG facility at Port MacKenzie on upper Cook Inlet for distribution to Alaskan communities. Facilities will be built on the uplands and no dock expansions are anticipated in the near future; however, an increase in vessel traffic will likely be an effect when operations begin in 2017.

The Drift River facility in Redoubt Bay is used primarily as a loading platform for shipments of crude oil. The docking facility there is connected to a shoreside tank farm and designed to accommodate tankers in the 150,000 deadweight-ton class. In 2009, a volcanic eruption forced the evacuation of the terminal and an eventual draw-down of oil storage. Hilcorp Alaska bought the facility in 2012 and, after numerous improvements, partially reopened the facility to oil storage and tanker loading operations. The Trans-Foreland pipeline, when constructed, is meant to eliminate some of the need for oil storage at this terminal.

Nikiski is home to several privately owned docks (including those belonging to oil and gas companies). Activity at Nikiski includes the shipping and receiving of anhydrous ammonia, dry bulk urea, LNG, petroleum products, sulfuric acid, caustic soda, and crude oil. In 2014, the Arctic Slope Regional Corporation expanded and updated its dock in Nikiski, referred to as the Rig Tenders Dock, in anticipation of increased oil and gas activity in Cook Inlet and to serve activities in the Chukchi and Beaufort seas.

Ladd Landing beach, located on the Western Cook Inlet near Tyonek, serves as public access to the Three Mile Subdivision, and as a staging area for various commercial fishing sites in the area. Numerous development projects are proposing development in this area that will include a facility for cargo loading. PacRim's proposed plans are to build a conveyor to transport the coal from a mine service area to the Ladd Coal Export Terminal located within the Ladd Landing Development. The coal conveyor would transfer 15 to 18 million tons of coal per year. Project effects on beluga whales are not known at this time, though the applicant proposes that any construction would avoid beluga spring migration. PacRim's recent application identified there would be coal dust control at the storage and transfer areas but details on the controls are not known at this time. Donlin Gold (2012) also had plans for expanding the barge landing at Beluga and developing a temporary construction camp and staging areas. The "Beluga Barge Landing" is south of the Three Mile Subdivision near the proposed location for the Chuitna Mine cargo loading facility. Donlin Gold is engaged in the National Environmental Policy Act process and will not begin construction until all permits are issued. No in-water work will occur during the summer of 2015; however, potential effects on beluga whales will result from increased vessel traffic and construction activities when the project is approved.

4.3.1.1.2 Other Coastal Development

The City of Kenai proposes to discharge 4,282 cubic meters (5,600 cubic yards) of granular fill into 1.35 acres of estuarine intertidal emergent wetlands to facilitate the construction of an access road from Sea Catch Drive to South Beach near the confluence of the Kenai River. The proposed road would serve as access to the mouth of the Kenai River in support of a personal use salmon dipnet fishery that occurs annually and will be open to beach access for other user groups. The new road will eliminate vehicle traffic on the intertidal shoreline. Construction activities are proposed to occur during the summer of 2015.

Numerous tidal energy projects have been proposed in Cook Inlet. The state has issued a lease for the East Foreland tidal demonstration project near Nikiski proposed by Ocean Renewable Power Company, LLC (ORPC). ORPC (2014) collected baseline data to characterize pre-deployment patterns of marine mammal distribution, relative abundance, and behavior in the deployment area at East Foreland and at Fire Island. Baseline data was obtained from passive acoustic monitoring devices and by visual observations, which are now complete. Upon the recommendation of NMFS, the pilot demonstration project is projected to be installed at East Forelands in 2016 or 2017 instead of the Fire Island location. Also, in 2014, FERC granted a permit to Turnagain Arm Tidal Energy Corp for a continued feasibility study to develop a 240 megawatt (MW) Alaska tidal energy project. The project would consist of a 12.9-km (eight-mile) long tidal fence located between Fire Island and Point Possession.

4.3.1.1.3 Oil and Gas Exploration and Development

State lease sales for oil and gas development in Cook Inlet began in 1959 (ADNR 2014). Since then, the state has held 56 oil and gas lease sales in the Cook Inlet area. As of December 31, 2013, approximately 450,000 hectares (1.1 million acres) were under lease in the Cook Inlet sale area, which includes 173,563 hectares (428,884 acres) onshore and 281,885 hectares (696,552 acres) offshore (ADNR, 2015). The most recent lease sale in May 2014 resulted in an additional 43,885 hectares (108,443 acres) leased, but exploration and development from the recent sale is not expected to occur in 2015.

Oil and gas exploration and development activities routinely occur within the proposed Action Area in Cook Inlet. Much of the Cook Inlet region overlies reserves of oil and natural gas. Upper Cook Inlet and the Kenai Peninsula have an association with the petroleum industry that dates back to the 1950s. Until recently, oil and gas production and royalties were on a slow decline; however, investment in existing infrastructure and reconstructed unit operations has resulted in increasing oil and gas development.

There are 16 offshore oil and gas platforms in Cook Inlet, 14 of which were installed between 1964 and 1968, the others in 1986 and 2000. Twelve platforms are actively producing oil and gas and four are experiencing varying degrees of inactivity. There are no platforms in lower Cook Inlet. However, BlueCrest Energy will be partnering with California-based WesPac to develop natural gas resources in the Cosmopolitan State oil and gas prospect from an offshore location in 2016 and 2017. Planned work during 2015 includes installation of a water intake structure and additional exploratory drilling at the well site.

Hilcorp is conducting field studies at the Ivan River Unit and North and South Middle Ground Shoal Unit to consider reactivating the Dillon Platform. Additionally, Hilcorp was successful in obtaining new leases in the middle shoal area during 2014 lease sales. It is not expected that they will conduct any in-water work during 2015; however, it is possible that there will be additional vessel or air traffic in support of these studies. Effects on beluga whales would be minimal and likely consist of additional background marine and air traffic.

In 2014, Furie Operating Alaska, LLC, applied for approvals to develop and transport natural gas from the Kitchen Lights Unit (KLU) located approximately 10 miles northwest of Boulder Point, near Nikiski. The development wells will be drilled from a jack-up rig over the fixed platform. Well tubulars will pass through a caisson that will be fixed to the seafloor by piles driven 120 feet into the seabed. Furie has received approvals from state and federal agencies and the Kenai Peninsula Borough. The platform (KLU Platform A) was constructed in Corpus Christi, Texas, and will be shipped to Alaska early in 2015. The effect on belugas would be noise from vessel operations moving the jack-up rig to the project area, noise from pile driving operations, and installation of the gathering pipelines.

BlueCrest Energy Inc. has been given the approval to begin the development of the Cosmopolitan oil development project located approximately 6 miles north of Anchor Point on the Kenai Peninsula. BlueCrest proposes to drill one exploratory well at Cosmopolitan State #B-1 site during the 2015 open-water season, which is typically from April through October. Associated activities identified in their IHA that could result in a take of marine mammals include pipe driving, exploratory drilling, towing of the jack-up drill rig, and vertical seismic profiling. BlueCrest also intends to begin construction of the onshore development facilities, which includes the installation of a subsea seawater intake structure that will use up to 420,000 gallons per day of sea water to maintain pressure in the oil formation. The Alaska Department of Environmental Conservation (ADEC) permit schedule identifies that the individual permit for wastewater treatment and disposal will not be processed until 2016; however, some associated in-water work could be conducted in 2015.

SAE Exploration is planning to conduct up to 300 square miles of 3-D seismic survey in Cook Inlet in 2015, which likely includes Apache's multi-year seismic exploration in Cook Inlet. The Alaska Department of Natural Resources (ADNR, 2015) notes that since December 31, 2013, approximately 1,300 square miles of 3-D and 25,000 miles of 2-D seismic line surveys have been conducted in Cook Inlet.

4.3.1.1.4 Underwater Transmission Lines, Pipelines, and Other Submarine Installations

Currently in Cook Inlet, there are approximately 227 miles of undersea pipelines, which include 78 miles of oil pipelines and 149 miles of gas pipelines (ADNR, 2015).

In 2014, the Trans-Foreland Pipeline Co. LLC (owned by Tesoro Alaska) received approval from state, federal, and regional agencies to build a 29-mile long, 8-inch oil pipeline (Trans-Foreland Pipeline) from the west side of Cook Inlet to Tesoro refinery at Nikiski. The pipeline will be used by multiple oil producers in western Cook Inlet to replace oil transport by tanker from the Drift River Tank farm. The purpose of the Trans-Foreland Pipeline project is to transport oil across Cook Inlet originating at the Cook Inlet Energy Kustatan Production Facility to the Nikiski-Kenai Pipeline company tank farm on the east side of Cook Inlet. The pipeline will be buried in uplands and tidelands and anchored onto the seafloor across the inlet. Construction is expected to begin in 2015. Subsea pipeline installation will begin in May and be completed by the end of September, but most in-water work will be completed by June. A pipeline laying barge will be used for pipe welding and installation. Where possible, the pipeline may be buried using a subsea trenching jet sled that uses a high-pressure water jet to open a trench in the seabed underneath the pipeline after it has been laid on the seafloor. Horizontal directional drilling (HDD) will be used to install the pipeline at nearshore locations at the East and West Forelands. ADEC issued a wastewater discharge authorization in 2014 under a general permit for hydrostatic testing water. HDD drilling muds and cuttings are to be recovered and disposed of at existing grind and inject facilities at Kustatan and Nikiski. It is expected that some siltation will occur during pipeline laying operations. Any effect from reduced visibility would be short term due to the high tide velocities.

Effects on listed marine mammals can occur from underwater noise associated with underwater pipeline construction, including noise from the use of pipe laying barges, tugs, and support vessels, although NMFS does not regulate sound associated with maritime traffic and general vessel operation). Tug boats will position the lay barge and its anchor array. The subsea trenching jet sled used during construction operates with high-pressure water jets. No motors or compressors are located on the underwater jet sled. Hydraulic hoses, located on the deck of the barge, are connected to a gear box and underwater installation frame. Hydraulics are used to turn the anchor during installation. No motors or compressors are located in the water; thus, the underwater sound levels are expected to be lower than 120 dB. All noise associated with pipeline construction will be short term and localized. Few, if any, beluga whales are expected to be in the area during the in-water construction window.

As previously mentioned, Furie Operating Alaska LLC has been issued a right-of-way (ROW) lease to install a platform and two gathering lines in the Kitchen Lights Unit.

There are numerous communication cables lying on the bottom of Cook Inlet on the seafloor. While some of the cables are buried, there are locations that the cables lie on top of the seafloor and are weighted down. Existing fiber optic cable leases within the project area include the Kodiak-Kenai Cable Company fiber optic cable that runs a cable on the east side of Cook Inlet from Homer to Anchorage. Cook Inlet Energy has an approved fiber optic ROW that generally follows the Trans-Foreland pipeline route between Kustatan and Nikiski. Alaska Communications Systems Group, Inc. (ACS) installed a fiber optic cable in 2009 on the east side of Cook Inlet from Homer to Nikiski on the Kenai Peninsula to Point Woronzof in Anchorage. While these cables are already installed, maintenance activities can be expected to occur at any time when damaged. Repair operations include vessel deployment and diving crews. Potential effects from fiber optic cable maintenance include a temporary increase in vessel traffic and noise during cable repairs.

4.3.1.2 Ambient/Background Noise

Marine mammals rely heavily on sound to meet basic biological needs such as communicating, foraging, and navigating (Richardson 1995), especially in the turbid waters of Cook Inlet. In general, Cook Inlet is a noisy environment and noise has the potential to disrupt beluga whales' ability to meet these basic biological needs. Noise sources in Cook Inlet that could be found in the Action Area include ambient sound (e.g., flow noise, wind), large and small vessels, aircraft, oil and gas exploration and production, and construction activities (e.g., dredging and pile driving; NMFS, 2008a).

Ambient noise is environmental background noise that includes sources such as wind, waves, ice, current, and tidal flow, and biological factors such as shrimp (Richardson, 1995). Background noise includes anthropogenic noise factors that cannot be identified to a single source. Anthropogenic sound sources in Cook Inlet include: oil and gas exploration, vessels, aircraft, and coastal development projects.

Sound levels from ambient noise vary at different locations in Cook Inlet. Blackwell and Greene (2002) reported ambient levels, devoid of industrial sounds, at Birchwood of approximately 95 dB, to over 120 dB for locations off Elmendorf Air Force Base and north of Point Possession. At the mouth of Eagle River, they reported ambient levels of approximately 107.2 dB re 1 µPa. Blackwell (2005) reported background levels, not devoid of industrial sounds, without strong currents of 115 to 118 dB. Scientific Fishery Systems, Inc. (2009) indicated background levels at the Port of Anchorage ranged from 120 to 155 dB, depending heavily on wind speed and tide level. All of these studies indicate measured background levels are rarely below 125 dB, except in conditions of no wind and slack tide. However, all these studies were conducted in upper Cook Inlet where tidal bores associated with Turnagain Arm and Knik Arm occur. Farther south in Trading Bay, Illingworth & Rodkin (see Apache LOA Application 2014) found background noise levels at between only 90 and 100 dB. However, Illingworth & Rodkin (2014) also measured background noise associated with drilling activity in lower Cook Inlet (Cape Starichkof) and found background levels between 105 and 118 dB.

In general, ambient and background noise levels within the Action Area are assumed to be less than 120 dB whenever conditions are calm, and exceeding 120 dB during storm events and during passage of large vessels.

4.3.1.3 Water Quality and Water Pollution

The Conservation Plan for the Cook Inlet Beluga Whale (NMFS, 2008a) states contaminants are a concern for the sustained health of Cook Inlet beluga whales. The principal sources of pollution in the marine environment are: 1) discharges from industrial activities not entering municipal treatment systems; 2) discharges from municipal wastewater treatment systems; 3) runoff from urban, mining, and agricultural areas; and 4) accidental spills or discharges of petroleum and other products (Moore et al., 2000).

4.3.1.3.1 Contaminants Found in Belugas

Because Cook Inlet beluga whales congregate in nearshore environments, they can be exposed to higher concentrations of point and non-point pollution (URS, 2010). As contaminants can affect the overall health of beluga whales (Becker et al., 2000; Reiner et al., 2012), and elevated levels of contaminants derived from terrestrial sources has been found in in St. Lawrence estuary beluga populations (Beland et al., 1993), NMFS has identified contaminants as a risk factor relative to Cook Inlet beluga whale population recovery (NMFS, 2008a). However, there is very little information on the potentially deleterious effects of chemicals on the Cook Inlet beluga whale population (NMFS, 2008a; URS, 2010; Reiner et al., 2012).

Nonpoint pollution sources include land runoff, precipitation, atmospheric deposition, drainage, or seepage, that commonly originate from urban development, harbors and marinas, highways and roads, and agriculture (Norman, 2011). Point pollution sources generally relate to specific outfalls from industrial facilities or sewage treatment plants, or stormwater runoff entering marine waters from a discrete pipe (Norman, 2011). Persistent organic pollutants (POPs) of concern include industrial chemicals such as PCBs; pesticides such as DDT, Aldrin, Chlordane, and Dieldrin; and chemical byproducts from waste incineration such as dioxins. POPs are generally lipophilic and will concentrate in whale blubber where they have little health effects on the animal. However, during periods that blubber lipids are most needed, such as during lean food periods or reproduction/lactation, sensitive organs such as liver and kidneys can receive high doses of chemicals leading to health problems such as reproductive impairment and immune suppression. Inorganic pollutants include heavy metals such as mercury, lead, zinc, copper, and arsenic derived from car exhaust, land runoff, treatment plant discharges, and mining. Acute levels of heavy metals can lead to organ damage, especially damage to heart, lungs, kidneys, intestines, and the nervous system.

Since 1992, tissues from Cook Inlet beluga whales have been collected from subsistence harvested and dead stranded beluga whales, when possible, and analyzed for contaminants as part of the Alaska Marine Mammal Tissue Archival Program. These samples were compared to samples taken from beluga whales in two Arctic Alaska locations (Point Hope and Point Lay), Greenland, Arctic Canada, and the Saint Lawrence estuary in eastern Canada (Becker et al., 2000, 2001; Reiner et al., 2012). Cook Inlet beluga whales appear to have lower levels of contaminants stored in their bodies than do beluga whales from other populations, with the possible exception of copper (Becker et al., 2000). Copper is also acutely toxic to salmon (Chapman, 1978), a major Cook Inlet beluga whale prey item. However, both Becker et al. (2000) and Reiner et al. (2012) concluded that little is known about the role of chemical stressors in beluga whale health and that future research should continue to examine their interaction and effects on recruitment in declining populations.

4.3.1.3.2 Stormwater Runoff

Stormwater runoff has the potential to carry numerous pollutants from the Municipality of Anchorage (MOA), the Matanuska-Susitna Borough, and the Kenai Peninsula Borough into Cook Inlet. Runoff can include pollution coming from streets, construction and industrial areas, and airports. Runoff can also carry hazardous materials from spills and contaminated sites into Cook Inlet. The importance of stormwater as a potential pathogen source is further reinforced by a study conducted in 2003 regarding pathogen inputs at the watershed level for Anchorage (MOA, 2003) that identified significant contributors to creeks and streams that release to the Cook Inlet marine environment. Stormwater runoff in the MOA is separated from domestic waste and collected from an area of approximately 1,955 square miles that includes Eagle River, Girdwood, Chugiak, and Eklutna. The potential discharge volume and efficiency of the stormwater system in the MOA is unknown

ADEC records all reported spills to marine waters in Cook Inlet. Regulations require that any spill to marine water be reported. Oil spills in small amounts are not reported, but are documented in a company's oil discharge prevention and contingency plan. At present, any release to water is to be reported immediately, and any release to land in excess of 55 gallons is to be reported as soon as the discharge is known. Volumes of discharged oil from 1 to 10 gallons are documented on a monthly spill report log for each facility or vessel.

4.3.1.3.3 Wastewater Discharge

Ten communities currently discharge treated municipal wastes into Cook Inlet. Wastewaters entering these plants may contain a variety of organic and inorganic pollutants, metals, nutrients, sediments, bacteria and viruses, and other emerging pollutants of concern. Wastewater from the MOA, Nanwalek, Port Graham, Seldovia, and Tyonek receive primary treatment, wastewaters from Homer, Kenai, and Palmer receive secondary treatment, and wastewaters from Eagle River and Girdwood receive tertiary treatment. Primary treatment means that only materials easily collected from the raw wastewater (such as fats, oils, greases, sand, granular materials, rocks, floating objects, and human wastes) are removed, usually through mechanical means. The primary effluent is discharged directly into Cook Inlet, where it becomes diluted. Wastewater undergoing secondary treatment is further treated to substantially degrade the biological content of the sewage (such as in human and food wastes). Tertiary treatment plants use technology in addition to primary and secondary treatment to increase the quality of the effluent discharge.

The MOA's John M. Asplund Water Pollution Control Facility (WPCF) located at Point Woronzof handles approximately 58 million gallons of sewage a day for 220,000 people. The plant has only primary treatment capabilities and has operated on waivers since 1985 (waivers from meeting water quality standards) due to the extreme tidal flows in Cook Inlet. A recent study validated that because of the extreme tidal energy in the study area, the concentration of the WPCF discharge is reduced significantly within the zone of initial dilution (ZID) and continues to reduce rapidly as it moves away from the ZID. Vertical mixing of the discharge is complete throughout the inlet (AWWU Biological Evaluation, 2011).

4.3.1.3.4 Oil Spills

While construction of an oil/gas facility may temporarily result in habitat loss, a natural gas blowout or oil spill could severely affect the beluga whales and put the population at risk. According to the ADEC oil spills database, oil spills to marine waters are composed mostly of harbor and vessel spills, and platform and processing facilities, and the total amount of reported oil discharge in Cook Inlet area since July 1, 2013, was 126,259 gallons (from 79 spills) with the largest quantities from produced water, process water, diesel, drilling muds, and aviation fuel. The facility type that accounts for most of the discharged fluids are natural gas and oil production, air transportation, vessel discharges, and mining. The ADEC oil spill database reports that since, July 1, 2013, oil spills to water occur primarily from vessels and harbor activities and from exploration and production facilities. Most vessel and harbor releases are small in nature, with the largest being reported as 200 gallons of diesel at the North Star Terminal in Homer. Discharges from exploration rigs and activities were small in nature from 0.001 to 1.0 gallons composed of hydraulic fluids and engine lube oil. Similarly, production facilities and platform spills are usually small and composed of diesel, hydraulic fluids, drilling muds, ethylene glycol, and crude oil. The largest oil spill was 840 gallons of crude oil on the Granite Point Platform of which 714 gallons were contained.

4.3.1.4 Prey Reduction

Several fisheries occur in Cook Inlet waters and have varying likelihoods of competing with marine mammals for fish due to differences in gear type, species fished, timing, and location of the fisheries. Given that beluga whales concentrate in upper Cook Inlet during summer (Rugh et al., 2010), fisheries that occur in those waters during spring and summer could have a higher likelihood of interacting with beluga whales.

Fisheries may compete with beluga whales in Cook Inlet for salmon and other prey species. There is strong indication that these whales are dependent on access to relatively dense concentrations of high value prey throughout the summer months. A significant reduction in the amount of available prey may affect the energetics of Cook Inlet belugas and delay recovery.

4.3.1.4.1 Commercial Fisheries

Commercial fisheries in upper Cook Inlet begin at the end of June. ADF&G has management responsibility for most of the commercial fisheries in Cook Inlet, with the exception of halibut and a few federally managed fisheries in lower Cook Inlet. The state-managed fisheries in the upper and mid Cook Inlet include salmon (both set and drift gillnet), herring (gillnet), a recently reopened dip net fishery for eulachon (a.k.a. hooligan or smelt), and a razor clam (*Siliqua patula*) fishery. The largest fisheries in Cook Inlet, in terms of participant numbers and landed biomass, are the state-managed salmon drift and set gillnet fisheries concentrated in the Central and Northern Districts of upper Cook Inlet Management Area. Even though all five types of Pacific salmon are caught in the upper Cook Inlet, sockeye salmon (*Onchorhynchus nerka*) is the primary target of the salmon commercial fisheries. Times of operation change depending upon management requirements, but in general, the drift fishery operates from late June through August, and the set gillnet fishery during June through July. Salmon fishery effort varies between years, and within-year effort can be temporally and spatially directed through salmon management regulations.

Commercial fishing for halibut in Cook Inlet is managed by the International Pacific Halibut Commission (IPHC). The IPHC manages stocks of Pacific halibut within agreement waters of the United States and Canada. Cook Inlet falls in regulatory area 3A, which also includes a portion of the Gulf of Alaska. In Cook Inlet, this fishery primarily operates in mid and lower Inlet waters.

4.3.1.4.2 Recreational, Personal Use, and Subsistence Fisheries

Recreational fishing is a very popular sport in Alaska, as evidenced by the intensive fishing during salmon runs and the large number of charter fishing operations. There are numerous recreational fishing areas targeting primarily salmon, including the hundreds of drainages of the Susitna River, the Little Susitna River, the west Cook Inlet streams, the Kenai River, and areas around Anchorage, such as Ship Creek. Fish counts in recent years have led to reduced fishing openings, and closure of many harvest areas.

Cook Inlet is a non-subsistence area as defined by Alaska statutes (AS 16.05.258(c)) as "areas where dependence upon subsistence (customary and traditional uses of fish and wildlife) is not a principal characteristic of the economy, culture, and way of life," although personal-use fishery participants remain very possessive of their fishing rights.

Since 2003, Alaskans harvest between 130,000 and 540,000 sockeye salmon annually. Through the Kenai River Late-Run Sockeye Salmon Management Plan the ADF&G manages the upper Cook Inlet commercial fisheries to minimize the harvest of Northern District coho salmon (*Oncorhynchus kisutch*), late-run Kenai River king salmon, and Kenai River coho salmon to leave fish for personal use. This program includes the Kenai River personal use salmon dip-netting.

Kenai River king salmon and other king salmon stocks throughout Cook Inlet are experiencing a period of low productivity and, since 2009, below average strength. That trend is anticipated to continue during the 2015 season. The 2015 preseason forecast for early-run Kenai River king salmon is for a total run of approximately 5,200 fish in the Kenai River.

Recent concern regarding the volume of harvestable clams in the Ninilchik and Clam Gulch areas of Cook Inlet has resulted in a 2015 closure to clamming in the east side Cook Inlet beaches. The cause of the decline in razor clam abundance on eastside Cook Inlet beaches is unknown, but is thought to have resulted from poor recruitment.

Fishing for eulachon (commonly referred to as hooligan) is popular in Turnagain Arm, with no bag or possession limits. The two most significant areas where eulachon are harvested in personal use fisheries are the Twentymile River (and shore areas of Turnagain Arm near Twentymile River) and Kenai River. Personal-use eulachon fishing takes place in the spring by dip-net or drift gillnet. Currently, no subsistence records are kept for eulachon or herring harvests (ADF&G, 2014).

There is currently no annual sac roe harvest of herring in upper Cook Inlet.

4.3.1.5 Direct Mortality

This section summarizes the known and potential human and natural causes of direct mortality of Cook Inlet marine mammals.

4.3.1.5.1 Subsistence Harvest

Tyonek is the only tribal Village in upper Cook Inlet with a tradition of hunting beluga whales. However, a series of moratoriums have been placed on the Cook Inlet beluga subsistence harvest beginning in 1999, following severe harvest pressure in the mid-1990s that saw annual removals of 10 to 15 percent of the population (Mahoney and Shelden, 2000) and resulted in a population decline from an estimated 1,300 whales in 1979 (Calkins, 1989) to a recent estimate of 340 animals (Allen and Angliss, 2014). Tyonek subsistence hunters were not involved with the high harvest activity in the 1990s (this was largely conducted by Anchorage-based hunters), and their harvest numbers remained low (Stephen R. Braund & Associates and Huntington Consulting [SRBA and HC], 2011). Annual Village harvests between 1980 and 2000 generally averaged less than one beluga (Fall et al., 1984; SRBA and HC, 2011). Although only five whales have been harvested since 1999 (Hobbs et al., 2008; Allen and Angliss, 2014), the population has continued to decline. No future subsistence harvest is planned until after the five-year population average has grown to at least 350 whales and, thus, no beluga harvest is authorized for 2015 when the geotechnical and geophysical surveys would occur.

4.3.1.5.2 Stranding

Live stranding occurs when a marine mammal is found in waters too shallow to swim. Live stranding is very rare and not an issue of concern for humpback whales and Steller sea lions because the former forages in deeper waters and the latter is capable of walking. However, live strandings are not uncommon in beluga whales as they naturally inhabit shallow water environments. Strandings can be intentional (e.g., to avoid killer whale predation), accidental (e.g., chasing prey into shallows then trapped by receding tide), or a result of illness or injury (NMFS, 2008a). Cook Inlet beluga whales are probably predisposed to stranding because they breed, feed, and molt in the shallow waters of upper Cook Inlet, where extreme tidal fluctuations occur, especially in Turnagain Arm. Between 1988 and 2008, more than 700 whales have been stranded in upper Cook Inlet, with only 20 associated deaths (Vos and Shelden, 2005; NMFS, 2008a). Still, Hobbs et al. (2006) recognized that stranding was a constant threat to the Cook Inlet beluga whale recovery and determined this declining population could not easily recover from multiple mortalities that resulted from a mass stranding event. All these strandings occurred in Turnagain Arm, Knik Arm, Susitna River, or Kenai River outside the Action Area.

4.3.1.5.3 Predation

Killer whales occasionally enter Cook Inlet and prey upon beluga whales (Shelden et al., 2003). They can also cause beluga whales to strand, which in itself could result in mortality. Predation events, although rare, have been reported throughout Cook Inlet, and could occur within the Action Area. The annual average number of beluga whales killed by killer whales has been estimated at a low one per year (Shelden et al., 2003). However, given the small size of the Cook Inlet beluga whale population, killer whale predation could still significantly affect beluga whale recovery.

4.3.1.5.4 Ship Strikes

Humpback whales are large and ponderous, and rest at the surface, often within or near shipping lanes or in inland waters where fishing boats and recreational boats are common. Allen and Angliss (2014) estimated that the annual humpback mortality from vessel collisions in Alaskan waters is about two animals per year. Ship strikes from G&G vessels are not an issue with humpback whales since survey vessels would not exceed speeds of 4 to 5 knots. The jack-up barge would also be towed by a tug at speeds less than 10 knots. Most strikes of baleen whales occur when vessels are traveling at speeds exceeding 13 knots http://www.nmfs.noaa.gov/pr/pdfs/shipstrike/ss_speed.pdf). Also, humpback whale occurrence in the Action Area is uncommon? with the likelihood of a humpback whale vessel encounter to be discountable.

Cook Inlet beluga whales may be susceptible to ship strike mortality when they occur within commercial shipping lanes leading to POA or Port MacKenzie, although only one beluga whale death (in 2007) has been attributed to ship strike based on blunt force injuries (NMFS, 2008a). Beluga whales may likely be more susceptible to strikes from commercial and recreational fishing vessels given that all can occur where salmon congregate. A number of Cook Inlet beluga whales have been photographed with propeller scars (Burek, 1999a, b, c; Kaplan et al., 2009; McGuire et al., 2009, 2011), suggesting that small vessel ship strikes are not rare, but strikes are often survivable. Again, the support? vessels would not exceed 4 to 5 knots while surveying.

Ship strike has not been reported as a significant mortality factor for Steller sea lions in Alaska (Allen and Angliss, 2014). Sea lions are agile and can see long distances above water, both factors that may allow them to avoid ship strike.

5.0 EFFECTS OF THE PROPOSED ACTION

5.1 POTENTIAL EFFECTS

The following sections provide assessments of potential direct, indirect, and cumulative effects on the listed species and their habitats from the Project and non-jurisdictional actions resulting from development of the Project.

5.1.1 Types of Effects

General effects are described by species and avoidance and conservation measures are described in Section 2. The distinction between direct and indirect effects of specific activities can be difficult to distinguish. For the purposes of this assessment, the following actions are considered as resulting in potential direct and indirect effects on listed species and their occupied habitats.

Potential direct effects to listed species and their habitats include:

- Collision mortality;
- Acoustic injury or harassment and disturbance;
- Spills and Resultant Contamination; and
- Habitat loss or alteration.

Potential indirect effects may include:

- Habitat degradation;
- Prey reduction; and
- Altered human access.

Project facilities and activities potentially affecting the species or their habitats are introduced at the beginning of each species assessment.

Cumulative effects are defined in 50 C.F.R 402.02 as effects that are likely to occur as a result of future state or private activities, not involving federal activities, that are reasonably certain to occur within the action area. These have recently been described for listed species within Alaska and Alaska waters by the NMFS (NMFS, 2015c) and the USFWS (USFWS, 2015a) as:

- State-managed commercial, sport, subsistence, and tribal fisheries;
- Commercial or private marine or air traffic;
- Commercial or residential development;
- State-permitted wastewater or stormwater discharges; and
- Recreational and subsistence hunting.

Potential implications from increases in these projected cumulative effects are incorporated into the summary for each listed species.

5.1.2 Vessel Strikes

During operation of the Liquefaction Facility, Project LNGCs would visit the Marine Terminal at an expected rate of about 21 visits per month. This LNGC traffic would likely result in a long term increase in the traffic of large vessels in Cook Inlet. An analysis of the probable increase in vessel traffic from these operations and the potential resulting increase in the incidence of vessel-whale collisions is provided in Attachment A.

5.2 BELUGA WHALE, COOK INLET DPS

The range of the Cook Inlet beluga is restricted to Cook Inlet. Activities that could potentially affect the Cook Inlet beluga are limited to those that would occur within or have an effect on the Cook Inlet Basin. Proposed activities that could potentially affect Cook Inlet belugas include construction and operation of the proposed Liquefaction Facility (including the Marine Terminal) and construction of the proposed Mainline across Cook Inlet.

5.2.1 Direct Effects

Construction and operation of the Project may directly affect Cook Inlet beluga whales or critical habitat through:

- Construction of the Marine Terminal;
- HLV traffic to the Liquefaction Facility;
- Dredging and sediment disposal for the Marine Terminal;
- Trenching and pipelay for the Mainline across Cook Inlet;
- Barge traffic for delivery of materials, supplies to the Marine Terminal and Mainline MOF; and
- Potential fuel spills.

Potential direct effects on beluga whales and critical habitat could include:

- Disturbance and displacement from Marine Terminal, Mainline MOF, and Mainline pipe lay construction noise;
- Disturbance and displacement from Marine Terminal dredging and dredge disposal;
- Disturbance and displacement from HLV and LNGC docking noise;
- Vessel strikes; and
- Vessel groundings and potential oil spills.

5.2.1.1 Noise Associated with Construction

Underwater noise typically generated during construction and vessel docking operations summarized here is discussed in detail in the *Marine Mammal Protection Act Assessment* provided in Resource Report No. 3, Appendix F. Thresholds established for underwater sound to prevent Level B harassment or Level A injury to whales are 120 decibels root mean square (dB_{rms}) for disturbance from continuous sound, 160 dB_{rms} reference (re) 1 microPascal (µPa) for disturbance from impulsive sound, and 180 dB_{rms} re 1 µPa for injury. Underwater sound sources that could potentially affect Cook Inlet beluga whales include impact sheet pile driving, vibratory pile driving, pipelay vessel thrusters/anchor handling by tugs for the laybarge, and noise associated with the docking of HLVs and LNGCs. Exposure of marine mammals to sound above these threshold values has the potential to cause short term (temporary threshold shift [TTS]) or long-term (permanent threshold shift [PTT]) hearing loss; masking of vocal communications; or physiological stress that can lead to mortality. Most of the sound energy produced by these activities is at frequencies of less than 1 kHz. The primary hearing sensitivity of beluga whales is between 10 and 70 kHz, indicating that belugas have poor hearing at the frequencies of sound generated by pile driving hammers and vessel thrusters. These potential effects are described in more detail in Resource Report No. 3, Appendix F.

The areas potentially exposed to underwater sound above threshold values by Marine Terminal construction, Mainline MOF construction, Mainline pipelay, and HLV and LNGC docking are summarized in Table 13. The table provides noise exposure areas from pile-driving using several means of pile or sheet pile driving methods; the final determination of the type of noise source and level of exposure will be developed prior to construction. Potential exposure of Cook Inlet beluga whales to noise generated during construction would be avoided or minimized by applying for an IHA and using PSO to establish exclusion zones with the ability to shut down activities if belugas are sited within the exclusion zones. Summer densities of Cook Inlet beluga whales are estimated at: Marine Terminal – 0.00041 whales per square mile; Mainline Material Offload Facility – 0.0953 whales per square mile; and Mainline – 0.02774 whales per square mile.

TABLE 13

Underwater Noise Radii with Potential Zones of Influence (ZOI) for 160 dB Impulse, and 120 dB Continuous Sounds During Project Construction and Operation in Cook Inlet

Noise Source	**Underwater Noise Thresholds**			**Activity Duration by Construction Year (S) (days/events)**					
	Source Level (dBrms re 1 µPa at 1 m)	**Radius (mi)**	**ZOI (mi^2)**	**S1**	**S2**	**S3**	**S4**	**Total**	**Beluga [c,d,e] Exposures**
Impulse Noise (160 dB_{rms})									
Marine Terminal									
Impact [d] Pile Driving (pipe)	222 dB	2.17	7.42	114	190	182	0	486 days	2
Impact [d] Pile Driving (sheet)	199.7 dB	0.060	0.006						
Mainline MOF									
Impact Pile [d] Driving (pipe)	222 dB	2.17	7.42	45	0	0	0	45 days	32
Impact [d] Pile Driving (sheet)	199.7 dB	0.060	0.006						
Continuous Noise (120 dB_{rms})									
Marine Terminal									
Vibratory [d] Pile Driving (pipe)	199.1 dB	2.65	11.00	114	190	182	0	486 days	2
Vibratory[d] Pile Driving (sheet)	187 dB	0.74	0.86						
Tug and Barge (docking)	178.9 dB	2.64	10.95	#	#	#	#	190 events	1
LNG Carrier (docking) [e]	192.2 dB	2.54	10.09	NA	NA	NA	NA	300 [b] events / year	1
Mainline MOF									
Vibratory[d] Pile Driving (pipe)	199.1 dB	2.65	11.01	45	0	0	0	45 days	47
Vibratory[d] Pile Driving (sheet)	187 dB	0.74	0.86						
Tug and Barge (docking)	178.9 dB	2.64	10.95	#	#	#	#	39 events	36
Mainline									
Pipelay Vessel Operations	179.2 dB	0.567	1.01	25	84	#	#	109 days	99
Pipelay Tug (anchor handling)	194.3 dB	3.22	32.67	25	84	#	#	109 days	

Sources: Appendix F, Tables 13, 14, 15, 30, 31, 32, and 33

dB_{rms} = decibels root mean square; µPa = microPascal

TABLE 13

Underwater Noise Radii with Potential Zones of Influence (ZOI) for 160 dB Impulse, and 120 dB Continuous Sounds During Project Construction and Operation in Cook Inlet

Noise Source	Underwater Noise Thresholds			Activity Duration by Construction Year (S) (days/events)					
	Source Level (dBrms re 1 µPa at 1 m)	Radius (mi)	ZOI (mi²)	S1	S2	S3	S4	Total	Beluga [c,d,e] Exposures

[a] Measured at 39 feet (12 meters).

[b] LNG Carriers per year, based on 25 arrivals per month.

[c] Summer densities of Cook Inlet beluga whales used to estimate conservative potential exposures summarized in Table 5 were: Marine Terminal – 0.00041 whales/mi²; Pipeline Material Offload Facility – 0.0953 whales/mi²; and Mainline – 0.02774

[d] Impact or vibratory hammers would be used or a mix of the two, so the exposure estimates are not additive.

[e] Exposure estimates for construction are for the duration of construction (multiple years), the exposure estimate for LNGC docking is estimated annual exposures.

= missing data

Expected activity levels and estimated Zones of Influence (ZOI) indicate that some Cook Inlet belugas may be exposed to sounds exceeding NMFS threshold values for Level B incidental harassment (takes). Such takes are unlawful unless an incidental take authorization is first obtained by the project proponent. By statute and regulation, NMFS can only issue an incidental take authorization if it authorizes takes of small numbers of marine mammals, and if these small numbers of takes will have a negligible effect on the species or stock. NMFS will only issue up to 34 Level B takes per year for a proposed activity, as they have repeatedly found this number of takes represents a small number of Cook Inlet belugas taken and this number has been found to have negligible effect on the Cook Inlet beluga DPS. Conservation measures would be implemented to ensure Level A takes do not occur and to minimize the number of Level B takes. These measures would include the deployment of PSOs to clear safety zones of marine mammals prior to start-up and shut-downs if belugas approach the ensonified area.

5.2.1.2 Liquefaction Facility Construction

5.2.1.2.1 Dredging/Dredge Disposal and MOF Construction

Construction of the Marine Facilities would occur during the open water period from April through October, with new dredging completed during one construction season. Dredging and seabed preparation would use a combination of dredging barge (barge-mounted crane, clamshell) and hydraulic dredge in two dredging operation spreads. Dredging for the MOF would have a footprint of approximately 51 acres. An additional area offshore from the site would be covered by disposal of the dredged material. Maintenance dredging may be required in subsequent years to maintain dredge depths depending on the rate of sedimentation. Construction of the MOF would result in the loss of approximately 28 acres of seafloor and water column for the duration of its existence.

Substrates within these dredge areas are primarily medium dense sandy silt and sand overlying hard sandy clay. Cobbles and boulders of varying sizes are also present (Ch2MHILL, 2015). Seabed preparation would be completed by backfilling the dredged area with granular material and rock. Dredge materials would be discharged in deep water within 5 miles of the Marine Terminal.

Benthic habitats support biota that provide forage for fish and invertebrates that in turn provide prey for Cook Inlet beluga whales. Dredging activities early or late in the open water season may coincide with beluga whale movements between summer and winter habitats (Figure 10). Dredging and seabed preparation would increase water turbidity, which would potentially reduce habitat quality for beluga whale prey. Nearshore benthic habitats support biota that provide forage for fish and invertebrates that in turn provide prey for Cook Inlet beluga whales.

Construction of the Marine Facilities would occur during the open water period from April through October, with dredging and seabed preparation occurring during the first construction season. Dredging activities early or late in the open water season, may coincide with beluga whale movements between summer and winter habitats (Figure 9, 10). Dredging and seabed preparation would increase water turbidity which would potentially reduce habitat quality for beluga whale prey. Because of the high natural turbidity in upper Cook Inlet, it is unlikely that dredging and dredge disposal would exceed background water turbidity more than 7,200 feet from these activities. It is unlikely that dredging would result in more than minor loss of beluga whale forage opportunity and minor temporary increases in turbidity that could reduce forage fish habitat quality.

5.2.1.2.2 Marine Terminal Construction and Pile Driving

Underwater construction noise has the potential to harass marine mammals — impulsive noise that exceeds 160 dB_{rms} re 1 μPa (rms). Impulsive noise sources are limited to impact hammer noise associated with pile driving (Table 13). Vibratory sheet and pile driving also have the potential to harass marine mammals where generated noise exceeds 120 dB_{rms} re 1 μPa. Both impact and continuous vibratory noise are planned for construction of the MOF, and product loading facilities (PLF) trestle supports. This includes driving pipe piles, sheet piles, bent piles, and dolphin structures. Exposure to noise above threshold levels has the potential to damage beluga whale hearing, mask vocalizations, change vocal behaviors, or displace animals from habitats (NMFS, 2015b). PSOs would be used during construction and pile driving activities to prevent potential exposure of Cook Inlet belugas to potentially injurious sound levels (exceeding NMFS Level A thresholds). In addition, as discussed in the Project's EFH Assessment, impulse noise can result in fish injuries or mortalities (see Resource Report No. 3, Appendix D).

5.2.1.2.3 Vessel Activity

Vessels are a major source of noise in coastal environments. Cook Inlet has a naturally noisy acoustic environment with natural noise sources such as bottom substrate transport by high currents, sand and mud bars generating breaking waves during low tide/high current periods, river mouths that become rapids at low tide, and fast and pancake ice formed during winter months and that are under continuous stress and movements by high tide oscillations and currents (NMFS, 2015b). Although the magnitude of the effect of ambient noise on Cook Inlet belugas is unknown, the combined effect of anthropogenic noise and ambient noise that has the potential to affect beluga acoustic perception, communication, echolocation, and behavior such as foraging and movement patterns is considered a threat to the recovery of Cook Inlet beluga whales (NMFS, 2015b).

Noise generated by vessels includes propeller cavitation, engines, and depth sounders. Of these sources, noise associated with HLV tug and barge docking at the MOF and potentially at the Port of Anchorage could exceed threshold values (Table 13). This level is below the level determined by NMFS as likely to cause permanent hearing threshold shifts. The low frequency sounds generated by commercial shipping vessels can travel and be detected by marine mammals at considerable distances. Beluga whales are able to hear an unusually wide range of frequencies, covering most natural and man-made sounds. However, where their hearing is most sensitive (10 to 100 kHz) is above the frequency range of most industrial noise.

Anthropogenic noise may also indirectly affect the survival and reproductive success of Cook Inlet belugas by having negative effects on their prey (see Resource Report No. 3, Appendix D, EFH Assessment; NMFS, 2015b).

5.2.1.2.4 Vessel Strikes

Vessel strikes are a potential source of concern with increasing levels of vessel traffic associated with construction of the Project. Nielson et al. (2012) reviewed the record of whale vessel strikes in Alaskan waters from 1978 to 2011. Of 108 whale vessel encounters, only one was a beluga whale, and it was identified only as a possible vessel strike. Beluga whales are more likely at risk from high speed recreational fishing vessels in the vicinity of estuaries and river mouths in Cook Inlet than they would be from relatively slower moving HLVs and LNGCs, or barges, on a steady course to a moorage or to the Marine Terminal. In the Draft Cook Inlet Beluga Whale Conservation Plan (NMFS, 2015b), NMFS reported that larger commercial vessels are not expected to pose a significant threat to Cook Inlet beluga whales due to their slower speed and straight line movement. Vessels would use safe speeds that minimize noise and allow avoidance of collisions with marine mammals.

5.2.1.2.5 Traffic (Air)

Noise from aircraft overflights has the potential to disturb beluga whales. Most air traffic to support construction of the Liquefaction Facility would be for transport of Project personnel to the Kenai Municipal Airport and Ted Stevens Anchorage International Airport. Commercial aircraft would normally operate at altitudes over 1,500 feet above sea level when in flight and noise reaching water would be below threshold values. Routine Project-related air traffic to support construction of the Liquefaction Facility would not be expected to affect Cook Inlet beluga whales, and would be indistinguishable from current air traffic over Cook Inlet.

5.2.1.2.6 Potential Spills and Resultant Contamination

Marine oil spills are considered a potential threat to the recovery of Cook Inlet beluga whales (NMFS, 2015b). During construction, the most likely source of exposure to an oil spill would be from a grounded LNGC with a subsequent release of fuel, with the greatest chances for exposure during fall or winter on the west side of lower Cook Inlet. Most Cook Inlet beluga whales would be within upper Cook Inlet during open water periods. While vessel groundings do occur within the Cook Inlet beluga range, they are rare, and there is currently no indication that Cook Inlet beluga whales have been directly affected by any marine oil spills (NMFS, 2015b). Vessel grounding that results in a fuel spill or transmission of aquatic invasive organisms could result in long-term damage to the Cook Inlet beluga whale and critical habitat (Figure 7). Spill response plans would be implemented to reduce potential effects, and vessels would be required to comply with regulations that minimize potential introduction of aquatic invasive species.

5.2.1.3 Liquefaction Facility Operation

5.2.1.3.1 Vessel Traffic

Noise generated by vessels includes propeller cavitation, engines, and depth sounders. Of these sources, noise associated with LNGC docking at the PLF could exceed threshold values (Table 13). Sound pressure source levels from LNGCs were 192.2 dB_{rms} re 1 μPa with operation of bow thrusters during the short docking period. The onset of thruster noise is generally more sudden, and can cause a startle reaction in nearby marine mammals. This potential exposure level is near the threshold level of 180 dB_{rms} re 1 μPa determined by NMFS as likely to cause permanent hearing threshold shifts. The area potentially affected by this level of noise, however, would be limited to within about 16 to 23 feet from the source, would be active for about 20 minutes, and calculated potential exposure estimates would be much less than one beluga whale. The low frequency sounds generated by commercial shipping vessels can travel and be detected by marine mammals at considerable distances. Beluga whales are able to hear an unusually wide range of frequencies, covering most natural and man-made sounds. However, the range at which their hearing is most acute at (10 to 70100 kHz), is above the frequency range of most industrial noise (Wartzok and Ketten, 1999; Finneran et al., 2005).

Anthropogenic noise may also indirectly affect the survival and reproductive success of Cook Inlet belugas by having negative effects on their prey (NMFS, 2015b). Any such effects on fish (beluga prey) would minor, consisting primarily behavioral – temporary avoidance – and have no indirect effects on Cook Inlet belugas.

5.2.1.3.2 Vessel Strikes

Vessel strikes are a potential source of concern with increasing levels of vessel traffic associated with the Project. An analysis of the potential for whale vessel strikes over the 30-year Project life is provided in Attachment A. With implementation of the identified conservation measures, it would be unlikely that an LNGC would strike a beluga.

5.2.1.3.3 Traffic (Air)

No routine? air traffic would be planned for operation of the Marine Terminal. LNGC pilots would embark/disembark at Homer and Nikiski by vessels.

5.2.1.3.4 Cooling Water Discharge from LNGCs

LNGCs would use Cook Inlet water to cool engines while vessels are berthed at the PLF. Cooling water intake and discharge would typically occur for about 21 hours while the LNGC is docked. Uptake rates would be at a low velocity that would allow most juvenile fishes to avoid entrainment; however, larval marine fish and pink and chum salmon smolts under 44 mm could not avoid entrainment. No chemicals would be added to cooling water. Cooling water could potentially introduce thermal pollution, but with the level of water exchange in Cook Inlet, any temperature differential would likely be very short term and limited in extent and is not expected to affect beluga whales or their prey.

5.2.1.3.5 Potential Spills and Resultant Contamination

Marine oil spills are considered a potential threat to the recovery of Cook Inlet beluga whales (NMFS, 2015b). During operations, the most likely source of exposure to an oil spill would be from a grounded LNGC with a subsequent release of fuel, with the greatest chances for exposure of beluga whales during fall or winter on the west side of lower Cook Inlet. While vessel groundings do occur within the Cook Inlet beluga range, they are rare. There is currently no indication that Cook Inlet beluga whales have been directly affected by any spills (NMFS, 2015b). Vessel grounding that results in a fuel spill or transmission of aquatic invasive organisms could result in long-term damage to Cook Inlet beluga whale critical habitat (Figure 7). Spill response plans would be implemented to reduce potential effects, and vessels would be required to comply with regulations that minimize potential introduction of aquatic invasive species.

There has never been a major incident involving a large LNG spill or fire on water. Although unlikely, a spill of LNG could still be hazardous to aquatic organisms. A spill of LNG could occur from a tank rupture or valve failure during LNGC loading, during LNGC grounding, or due to an accident at an adjacent facility. LNG is not water soluble and would vaporize rapidly upon contact as the liquid heats up and becomes a gas. Methane is lighter than air and would quickly dissipate. Because LNG would not mix with water, no water contamination would occur. The greatest threat to aquatic organisms near an LNG spill would be from changes in water temperature as a result of the spill. The extremely cold LNG would rapidly cool the upper water layers nearest the spill as it begins to vaporize. Aquatic organisms, including beluga whales and their prey in close proximity could be exposed to freezing temperatures which could cause injury or mortality. Alternatively, vaporized LNG could ignite, resulting in a fire and localized heating of the surface water. Neither heating nor cooling would likely cause the overall water column to change temperature and effects would be limited to the surface layer. Belugas and fish would likely respond to spills by moving away from undesirable temperatures, but plankton would be unable to avoid negative effects.

5.2.1.4 Mainline Construction

5.2.1.4.1 Dredging and Dredge Disposal

The nearshore pipeline crossings would involve dredging / trenching and pipeline burial. Dredging and seabed preparation would increase water turbidity which would potentially reduce habitat quality for beluga whale prey. Dredging effects would be similar to the previous discussion for the Liquefaction Facility. It is unlikely that dredging would result in more than minor loss of beluga whale forage and minor temporary increases in turbidity that could reduce forage fish habitat quality.

5.2.1.4.2 Mainline MOF Construction and Pile Driving

Impulsive underwater construction noise has the potential to harass marine mammals where it exceeds 160 dB_{rms} re 1 μPa. Impulsive noise sources proposed for the construction phase of the Project include impact hammer noise associated with pile driving (Table 13). Pile driving is expected to occur with the construction of the Mainline MOF, with effects similar to those described previously for the Marine Terminal.

5.2.1.4.3 Trenching (shoreline and intertidal) and Pipe-Laying

Construction of the Mainline across Cook Inlet would occur over two seasons. The shoreline approaches would be trenched out to a depth of about -35 to -45 feet MLLW during the first season with the ends abandoned at depth for recovery by the pipe-lay barge for tie-in during the subsequent season. Construction activities would generate some sound, with the loudest sound produced by the tugs when they are pulling up to and repositioning the anchors for the pipe-lay barge (Table 13). The pipelay across Cook Inlet would occur near summer beluga concentration areas, but the sound generated is not expected to result in behavioral disturbances that rise to the level of a take under the MMPA. Trenching and post-lay burial methods would create a localized disturbance (around the pipeline) that would create a sediment plume that could reduce habitat quality for beluga prey. Any such effects on beluga prey would be brief and limited in scope.

5.2.1.4.4 Vessel Traffic

Tug and barge combinations would be used to transport pipeline delivered by vessels to a jointing and insulating facility near the Port of Seward 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 the tug propellers and thrusters (Table 13).

5.2.1.4.5 Traffic (Air)

Noise from aircraft overflights has the potential to disturb beluga whales. Most air traffic to support construction of the Mainline would be for transport of Project personnel to the Beluga Airport, Kenai Municipal Airport, and Ted Stevens Anchorage International Airport. Commercial and charter aircraft would normally operate at altitudes over 1,500 feet above sea level when in flight and noise reaching water would be below threshold values. Routine Project-related air traffic to support construction of the Mainline would not be expected to affect Cook Inlet beluga whales, and would be indistinguishable from current air traffic over Cook Inlet.

5.2.1.4.6 Hydrostatic Testing

Prior to commissioning, the offshore portion of the pipeline would be flooded with filtered seawater and hydrostatically tested. Test water would be discharged to Cook Inlet. Only approved additives such as oxygen scavengers, biocides, or preservatives would be used as necessary to meet discharge specifications. Discharges of hydrostatic test waters must be permitted under the Alaska Pollutant Discharge Elimination System by ADEC.

5.2.1.4.7 Potential Spills and Resultant Contamination

Marine oil spills are considered a potential threat to the recovery of Cook Inlet beluga whales (NMFS, 2015b). The most likely source of exposure to an oil spill during construction of the Mainline would be from transport of fuel across Cook Inlet to the Mainline MOF. Most Cook Inlet beluga whales would be within upper Cook Inlet during open water periods.

Another potential source of potential spill exposure could occur from a grounded vessel with a subsequent release of fuel, with the greatest chances for exposure during fall or winter on the west side of lower Cook Inlet. While vessel groundings do occur within the Cook Inlet beluga range, they are rare. There is currently no indication that Cook Inlet beluga whales have been directly affected by any spills (NMFS, 2015b). Vessel grounding that results in a fuel spill or transmission of aquatic invasive organisms could result in long-term damage to Cook Inlet beluga whale critical habitat (Figure 7).

5.2.1.5 Mainline Operation

5.2.1.5.1 Traffic (Air)

Noise from aircraft overflights has the potential to disturb beluga whales. Mainline operations would include aerial surveillance of the ROW. Aircraft completing pipeline monitoring would go up to a minimum altitude of at least 1,500 feet above sea level when crossing Cook Inlet. Noise reaching the water from these flights would be below threshold values and would be unlikely to disturb beluga whales. Routine Project-related air traffic to support the Mainline would not be expected to affect Cook Inlet beluga whales, and would be indistinguishable from current air traffic over Cook Inlet.

5.2.2 Indirect Effects

The Project may indirectly affect beluga whale critical habitat by reducing or altering prey availability or abundance through:

- Changes in prey abundance or distribution from Marine Terminal construction and operation, and Mainline construction across Cook Inlet;
- Potential transport of aquatic invasive organisms from HLVs and LNGCs.

5.2.2.1 Prey Effects

Stream crossings for Mainline constructed through Cook Inlet Basin anadromous streams that support Pacific salmon and eulachon spawning could also indirectly affect PCE 2 of Cook Inlet beluga whale critical habitat.

Proposed activities that could potentially result in indirect effects on Cook Inlet belugas include construction and operation of the proposed Liquefaction Facility (including the Marine Terminal) and construction of the proposed Mainline across Cook Inlet. Potential indirect effects on Cook Inlet beluga whales could occur through construction and operation-related reductions or displacement of anadromous prey from the Marine Terminal area. Anadromous prey are a PCE of critical habitat; and potential Project-related effects and mitigation to EFH are discussed in more detail in the EFH Assessment Report included as Resource Report No. 3, Appendix D. The EFH Assessment Report concludes that the potential direct and indirect effects of construction and operation on marine EFH and EFH species would be minor. Specific mechanisms for effects on beluga prey are discussed under Direct Effects.

5.2.2.2 Vessel Ballast Water Handling

Potential degradation of beluga whale critical habitat from HLV and LNGC traffic could occur through the introduction of aquatic invasive organisms. Vectors for introducing aquatic invasive organisms from ship traffic include ballast-water discharge, fouled ship hulls, and equipment placed overboard (e.g., anchors). Modules carried on barges could be sourced in Asia and could potentially transport non-native tunicates, green crab (*Carcinus maenas*), and Chinese mitten crab (*Eriocheir sinensis*) (ADF&G, 2002), all of which affect food webs and can outcompete native invertebrates, resulting in habitat degradation.

HLVs would plan to ballast loads with cargo rather than water ballast and use minimal amounts of freshwater for ballast. Use of freshwater ballast would reduce the likelihood of transporting marine aquatic invasive organisms. Invasive aquatic organisms on or in semisubmersible vessels, barges, and tugs would be controlled by ballast water regulations (33 C.F.R. Part 151), which require a ship-specific Ballast Water Management Plan, a ballast water record book, ballast water exchange, an approved ballast water treatment system, and an International Ballast Water Management Certificate. HLVs would wash down before entering Alaskan coastal waters and exchange ballast at sea to ensure a clean water discharge to minimize introduction of aquatic invasive organisms. All HLV operations would comply with USCG and EPA regulations for ballast water discharge.

All vessels brought into the State of Alaska or federal waters are subject to USCG 33 C.F.R. 151 regulations, which are intended to reduce the transfer of aquatic invasive organisms. Management of ballast water discharge is regulated by federal regulations (33 C.F.R. 151.2025) that prohibit discharge of untreated ballast water into the waters of the U.S. unless the ballast water has been subject to a mid-ocean ballast water exchange (at least 200 nautical miles offshore). Vessel operators are also required to remove “fouling organisms from hull, piping, and tanks on a regular basis and dispose of any removed substances in accordance with local, state, and federal regulations” (33 C.F.R. 151.2035(a)(6). Adherence to the USCG 33 C.F.R. 151 regulations would minimize the likelihood of project-related vessel traffic introducing aquatic invasive species.

5.2.3 Effects from Non-Jurisdictional Facilities

No effects on Cook Inlet belugas whales or critical habitat from non-jurisdictional facilities have been identified.

5.2.4 Cumulative Effects

The proposed draft recovery plan identifies 10 potential threats to Cook Inlet beluga whales scaled from high to low relative concern: high – catastrophic events (natural disasters, spills, mass strandings), cumulative and synergistic effects of multiple stressors, and noise; medium – disease agents (pathogens, parasites, harmful algal blooms), habitat loss or degradation, reduction in prey, unauthorized take; and low – subsistence hunting, pollution, and predation (NMFS, 2015b). Cook Inlet belugas were listed as endangered because of population declines caused by overharvest during the mid-1990s. The Cook Inlet beluga whale population continues to decline despite cessation of harvest for reasons that are not well understood. The Project would contribute to incremental noise and disturbance within Critical Habitat Area 2. With implementation of BMPs and conservation measures, potential effects would be avoided and minimized to the greatest extent practicable. It is not expected that the Project would increase the overall effects to a level that would jeopardize Cook Inlet beluga whales or adversely modify critical habitat.

5.2.5 Summary of Effects

5.2.5.1 Summary of Effects on Critical Habitat

When establishing critical habitat for the Cook Inlet beluga whale, NMFS identified the following as the Primary Constituent Elements; an analysis of the potential effects of the survey program on these elements follows.

5.2.5.1.1 Intertidal and Subtidal Waters of Cook Inlet with Depths <30 feet (9.1 m) MLLW and Within 5 Miles (8.0 km) of High and Medium Flow Accumulation Anadromous Fish Streams

Marine Terminal and Mainline construction areas include waters of Cook Inlet that are <30 feet in depth and within 5.0 miles of anadromous streams. Several anadromous streams (Three-mile Creek, Indian Creek, and two unnamed streams) enter Cook Inlet in the vicinity of the Mainline crossing. Marine Terminal and Mainline construction would not prevent beluga from accessing the mouths of these streams. Marine Terminal dredging and construction and Mainline construction would result in short-term and long-term loss or alteration of intertidal or subtidal waters that are <30 feet in depth and within 5.0 miles of anadromous streams. Minor seafloor effects would occur in these areas from dredging, turbidity for dredged material, and pipeline trenching. There would be minor effects on this Primary Constituent Element.

5.2.5.1.2 Primary Prey Species – Pacific Salmon, Pacific Eulachon, Pacific Cod, Saffron Cod, Yellowfin Sole

Belugas' primary prey could be affected by sound generated by Marine Terminal and Mainline construction, physical habitat disturbance, seawater intake, and discharges associated with vessels or dredged materials.

As discussed in Resource Report No. 3, Appendix D acoustical effects to marine mammal prey resources, are limited and would be minor, should they occur. The effects of pile driving on fish, fish larvae and eggs, and benthic invertebrates have been studied and have been found to be minor. Based on the EFH Assessment, there would be no or minor effects on eggs or larval fish of these primary prey species or any other marine mammal prey resource.

Direct physical disturbance of the benthic habitats is expected to total about 1,076 square feet, representing a small portion of the benthic habitat available in the nearly 8,108 square mile Cook Inlet. Indirect effects on benthic and water-column habitats would also occur from trenching, dredging, and the discharge of dredged materials. Preliminary modeling of the discharges indicates that most of the discharged materials would be deposited within a short distance of the discharge location. Turbidity would extend further and would normalize within minutes of cessation of the discharge. Physical evidence of the direct and indirect benthic effects would be expected to be ameliorated naturally in a relatively short time in the high energy environment of Cook Inlet. The Project areas are not known to contain any especially important spawning areas for these species. Salmon and eulachon are anadromous and spawn in freshwater; only adult Pacific cod are found in the upper Cook Inlet. Given the small area affected, the temporary nature of most effects, and the high energy environment of Cook Inlet, there would be minor effects on this Primary Constituent Element.

5.2.5.1.3 The Absence of Toxins or Other Agents of a Type or Amount Harmful to Beluga Whales

No toxins would be discharged or otherwise introduced into waters of Cook Inlet by the Project. All construction and operations discharges would be permitted and regulated. While spill effects to EFH can be serious, effects can be minimized by implementation of SWPPPs and BMPs. There would be minor effects on this Primary Constituent Element.

5.2.5.1.4 Unrestricted Passage within or between the Critical Habitat Areas

Belugas may avoid areas ensonified by the construction and operation activities that generate sound with frequencies within the beluga hearing range and at levels above threshold values. This includes the pile and sheet driving, pipelay operations, and vessel docking (Table 13). These activities would be conducted in relatively open areas of Cook Inlet within Critical Habitat Area 2. Given the size and openness of Cook Inlet in the Project areas, and the relatively small area and mobile/temporary nature of the zones of ensonification, the generation of sound by Project activities would not be expected to result in any restriction of passage of belugas within or between critical habitat areas. There would be no effect on this Primary Constituent Element.

5.2.5.1.5 The Absence of In-water Noise at Levels Resulting in the Abandonment of Habitat by Cook Inlet Beluga Whales

Construction and operation activities generate sound with frequencies within the beluga hearing range and at levels above threshold values, and may result in temporary displacement of belugas. This includes the pile and sheet driving, pipelay operations, and vessel docking (Table 13). These activities would be conducted in relatively open areas of Cook Inlet within Critical Habitat Area 2. Any displacement of belugas would likely be short-term and temporary. No abandonment of the habitat by belugas would be expected. The Project would not be expected to affect this Primary Constituent Element.

In 2011, subsequent to designation of critical habitat for Cook Inlet beluga whales, NMFS issued a BO (NMFS, 2011) analyzing the effects of the Port of Anchorage MTRP on critical habitat. Although the Port of Anchorage was excluded from the critical habitat designation pursuant to section 4(b)(2) of the ESA, the action area for the MTRP extended beyond the exclusion into areas that are designated. Despite the exclusion, NMFS analyzed the effect of the MTRP on the PCE values of habitat in the excluded area as well. NMFS found the values of shallow water foraging habitat, prey species abundance and availability, absence of toxins and other harmful agents, and unrestricted passage within and between areas were not likely to be affected by dredging, filling, or construction activities in the action area (including the excluded port areas). NMFS determined only the value “absence of in-water noise at levels resulting in the abandonment of habitat (PCE 5)” had the potential to adversely affect Cook Inlet belugas. In assessing the effect of the action on that value, NMFS determined that construction and operation of the expanded Port would introduce significant sound in the waters of Knik Arm. After review of available information on sources of noise, intensity and duration, and beluga responses, NMFS concluded: “It is unlikely that belugas would alter their behavior in a way that prevents them from entering and/or transiting through Knik Arm causing abandonment of critical habitat.” Further, NMFS’s BO concluded that the action, as proposed, is not likely to destroy or adversely modify Cook Inlet beluga whale critical habitat. Although PCE 5 may indicate that the habitat is adversely affected, it is NMFS’s opinion that critical habitat will remain functional and able to serve its intended conservation role for Cook Inlet beluga whales.

The Marine Terminal and Mainline would be located in Area 2 of the Beluga whale critical habitat. This is the area in which beluga whales expand their spring-summer distribution during the late fall and winter months, and the area into which the beluga whale population will expand as it recovers. As discussed previously, the Project may affect critical habitat by introducing noise and additional vessel traffic. However, these effects are not likely to diminish the value of the primary constituent elements of the critical habitat for the conservation of Cook Inlet beluga whales. Whale movements between and among habitat areas are not likely to be impeded and the quantity and quality of prey are unlikely to be diminished. Water quality may occasionally be affected by small infrequent spills at the Marine Terminal that would have only minor and transitory effects on water quality, and larger spills associated with a catastrophic release of fuel oil or other contaminants are so unlikely as to be discountable. Therefore, the critical habitat for the Cook Inlet beluga whale is not likely to be adversely modified.

5.2.5.2 Summary of Effects on Cook Inlet Beluga Whales

The Project components may adversely affect beluga whales during construction and placement of pipeline across Cook Inlet; construction activities at the LNG Terminal and by vessel traffic may adversely affect beluga whales through Level B harassment, which is likely to result in temporary changes in behavior with little consequence on the fitness of the individual whales exposed. Implementation of the conservation measures for monitoring marine mammal occurrence near in-water construction activities in Cook Inlet described previously, as well as stopping activities before marine mammals are exposed to potentially harmful levels of sound, should minimize potential for injury to the whales' ability to hear. Nevertheless, the possibility of an adverse effect to some individual beluga whales exists.

5.3 BLUE WHALE

Blue whales use the Gulf of Alaska, Aleutian Islands and Bering Sea as summer feeding grounds. Activities that could potentially affect the blue whales are limited to Project-related vessel traffic that would occur through these waters in support of construction of the Liquefaction Facility, Mainline, and GTP.

5.3.1 Direct Effects

The primary direct effect of Project-related vessel traffic on blue whales is the potential for collision mortality. Ship strikes were implicated in the deaths of nine blue whales between 2007 and 2011 (Carretta et al., 2014). Monnahan et al. (2014) investigated the effects of ship strikes on blue whales using a population modeling approach and concluded habitat density dependence, not ship strikes, was the key factor in the lack of increase for the population and that future ship strikes were likely have a minimal effect (Monnahan et al., 2014). Blue whale mortality and injuries attributed to ship strikes in California waters averaged 1.9 per year during 2007-2011. No blue whale ship strikes were documented in Alaskan waters during 1978 to 2011 (Neilson et al., 2012). Given the distribution and abundance of blue whales and implementation of these conservation measures, it is unlikely that an LNGC would strike a blue whale. While there is a potential for ship strikes in Project LNGC and HLV shipping routes (see Section 2.1), the risk of potential strikes is considering low because of the intermittent occurrence and dispersed distribution of blue whales in Alaskan waters.

5.3.2 Indirect Effects

Project-related vessel traffic could indirectly affect blue whales through potential habitat degradation cause by increased shipping noise. Vessels would use safe speeds that minimize noise and allow avoidance of collisions with marine mammals.

5.3.3 Cumulative Effects

Projected increases in shipping traffic related to opening of the Northwest Passage as a result of reduced ice cover from global climate change would increase the potential for cumulative effects on blue whales from collision mortality and habitat degradation from increased shipping noise in Alaskan waters. Climate change may also result in changes in blue whale prey availability.

5.3.4 Summary of Effects

Blue whales were listed as endangered primarily due to overexploitation in commercial fisheries. Current risk factors for blue whales include ship strikes and degradation of their acoustic habitat. Blue whales would not be expected to be affected, although, there would be a low risk of vessel strikes.

5.4 BOWHEAD WHALE

Construction and operation of the Liquefaction Facility in and adjacent to Cook Inlet would have no direct or indirect effects on bowhead whales, which in Alaska are found only in the Bering, Chukchi, and Beaufort Seas. Construction of Interdependent and Interrelated Project Facilities, specifically GTP, could potentially affect bowhead whales. Operation and maintenance of the GTP, Mainline, and PTTL would have no effect on bowhead whales because of their onshore location, and because they would involve no routine offshore vessel or aircraft traffic. Alternatives (to trucking) being considered for transporting pipe, camps, materials, equipment, fuel, supplies, include the barging to existing docks at Badami, East Dock, Kuparuk and Endicott. Selection of these alternatives would result in a temporary increase in barge traffic over a short period of time?, which may result in effects on bowhead whales.

5.4.1 Direct Effects

The Project may directly affect bowhead whales through:

- Noise from construction modifications to West Dock – Dock Head 4;
- Noise from dock landing at the barge bridge;
- HLV traffic to West Dock for delivery of the GTP modules;
- Coastal barge traffic for delivery of materials, supplies to West Dock, Badami, and Point Thomson; and
- Potential fuel spills.

. Bowhead whales generally occur well offshore of West Dock during April through October. Potential effects on bowhead whales could include:

- Disturbance and displacement from West Dock construction noise;
- Disturbance and displacement from HLV docking noise;
- Vessel strikes; and
- Vessel groundings and potential oil spills.

Underwater noise typically generated during construction and during vessel docking operations summarized here is discussed in detail in the *Marine Mammal Protection Act Assessment* provided in Resource Report No. 3, Appendix F. Thresholds established for underwater noise to prevent Level B harassment or Level A injury to whales are 120 dB dB_{rms} root mean square (rms) for disturbance from continuous noise; 160 dB dB_{rms} re 1 µPa rms for disturbance from impulsive noise; and 180 dB dB_{rms} re 1 µPa rms for injury. Underwater noise sources that could potentially affect bowhead whales include: impact sheet pile driving, vibratory pile driving, and HLV noise associated with docking. Exposure of marine mammals to noise above these threshold values has the potential to cause short term TTS or long-term PTT hearing loss; masking of vocal communications; or physiological stress that can lead to mortality. These potential effects are described in more detail in Resource Report No. 3, Appendix F.

The Beaufort Sea bowhead whale density used to estimate the potential exposures in Table 14 is 0.0127 whales per square mile. The areas potentially exposed to underwater noise by West Dock construction and HLV docking are summarized in Table 14.

TABLE 14

Estimated Noise Radii, ZOI, and Bowhead Whale Exposures during West Dock Construction and Operations

Noise Source	Source Level (dB_{rms} re 1 µPa at 1 m)	Ensonified to Threshold		Activity Duration by Construction Season (S)					
		Radius (mi)	ZOI (mi^2)	S1	S2	S3	S4	Total	Potential Bowhead Exposures
Impulse Noise (160 dB_{rms})									
Impact Pile Driving (pipe)	222 dB	2.17	7.42	57	0	0	0	57 days	0
Impact Pile Driving (sheet)	199.7 dB	0.060	0.006						

TABLE 14

Estimated Noise Radii, ZOI, and Bowhead Whale Exposures during West Dock Construction and Operations

Noise Source	Source Level (dB$_{rms}$ re 1 µPa at 1 m)	Ensonified to Threshold		Activity Duration by Construction Season (S)					
		Radius (mi)	ZOI (mi^2)	S1	S2	S3	S4	Total	Potential Bowhead Exposures
Continuous Noise (120 dB$_{rms}$)									
Vibratory Pile Driving (pipe)	199.1 dB	2.65	11.00	57	0	0	0	57 days	0 [a]
Vibratory Pile Driving (sheet)	187 dB	0.74	0.86						
Tug and Barge (docking)	178.9 dB	2.64	10.95	23	18	10	10	61 events	8

[a] Pile and sheet driving would be completed during winter is not expected to reach ringed seal wintering habitat.

Sources: Appendix F, Tables 13, 14, 15, and 16

Expected activity levels and estimated ZOI indicate that some bowhead whales may be exposed to docking sounds exceeding NMFS threshold values for Level B incidental harassment (takes). Such takes are unlawful unless an incidental take authorization is first obtained by the project proponent. By statute and regulation, NMFS can only issue an incidental take authorization if it authorizes takes of small numbers of marine mammals, and if these small numbers of takes will have a negligible effect on the species or stock. Conservation measures would be implemented to ensure Level A takes do not occur and to minimize the number of Level B takes. These measures would include the deployment of PSOs to clear safety zones of marine mammals prior to start-up and shut-downs if marine mammals approach the ensonified area.

5.4.1.1 GTP

5.4.1.1.1 Dock Head Modifications and Pile Driving

Impact or vibratory sheet and pile installation would occur at West Dock during the winter when bowhead whales are not present in the Beaufort Sea. Therefore, no effects on bowhead whales are expected as a result of dock head modifications pile driving.

5.4.1.1.2 Traffic (Air)

Air traffic related to construction at the GTP and West Dock modifications would likely occur over land and would not affect bowhead whales.

5.4.1.1.3 Potential Spills and Resultant Contamination

Oil spills that reach bowhead whales could result in eye irritation, baleen fouling, ingestion of oil, respiratory distress from hydrocarbon vapors, contamination of prey, and displacement from feeding areas. Bowhead whales could be exposed to an oil spill from a grounded HLV with a subsequent release of fuel. Few spills have been reported in Beaufort or Chukchi sea waters (NMFS, 2015a), and most spills associated with groundings would occur in nearshore habitats, making potential exposure of bowhead whales very unlikely. Potential fuel spills as a result of fuel transfers at West Dock could potentially reach nearshore waters during transfers at West Dock. These potential spills would likely be small, and be contained on the granular surface. Most of these small spills would be recovered. Spill response plans would be implemented to reduce potential effects.

5.4.1.2 PTTL

5.4.1.2.1 Vessel Traffic

Coastal barge traffic for delivery of pipeline and materials to Badami would follow routes that are typically within the barrier islands and few if any bowhead whales are likely to be exposed (NMFS, 2012c).

5.4.1.2.2 Traffic (Air)

Air traffic associated with construction and operation of the PTTL would generally occur over land and would not affect bowhead whales.

5.4.1.2.3 Potential Spills and Resultant Contamination

The most likely source of exposure to an oil spill would be from a barge grounding with a subsequent release of fuel. Few spills have been reported in Beaufort or Chukchi sea waters (NMFS, 2015a), and most spills associated with groundings would occur in nearshore habitats, making potential exposure of bowhead whales very unlikely. Spill response plans would be implemented to reduce potential effects.

5.4.2 Indirect Effects

The Project may indirectly affect bowhead whales by reducing or altering prey availability or abundance through:

- Marine habitat degradation from shipping noise; and
- Potential transport of aquatic invasive organisms from HLVs.

Project-related vessel traffic could indirectly affect bowhead whales through potential habitat degradation cause by increased shipping noise. Vessels would use safe speeds that minimize noise and allow avoidance of collisions with marine mammals.

5.4.2.1 Effects of Vessel Ballast Water Handling on Bowhead Whale Habitat

HLVs would anchor in Stefansson Sound inside of Reindeer Island to await offload. Ship hulls, ballast, and equipment lowered into the water may serve to transport invasive aquatic organisms that could degrade coastal marine habitats by displacing or transmit diseases to native aquatic organisms. HLVs would plan to ballast loads with cargo rather than water ballast and use minimal amounts of freshwater for ballast. Use of freshwater ballast would allow for removal of ballast without transporting marine aquatic invasive organisms. Invasive aquatic organisms on or in semi-submersible vessels, barges, and tugs would be controlled by ballast water regulations, which require a ship-specific Ballast Water Management Plan, a ballast water record book, ballast water exchange, an approved ballast water treatment system, and an International Ballast Water Management Certificate. HLVs would wash down before entering Alaskan coastal waters and exchange ballast at sea to ensure a clean water discharge to minimize introduction of aquatic invasive organisms.

All vessels brought into the State of Alaska or federal waters are subject to USCG 33 C.F.R. 151 regulations, which are intended to reduce the transfer of aquatic invasive organisms. Management of ballast water discharge is regulated by federal regulations (33 C.F.R. 151.2025) that prohibit discharge of untreated ballast water into Waters of the U.S. unless the ballast water has been subject to a mid-ocean ballast water exchange (at least 200 nautical miles offshore). Vessel operators are also required to remove "fouling organisms from hull, piping, and tanks on a regular basis and dispose of any removed substances in accordance with local, state, and federal regulations" (33 C.F.R. 151.2035(a)(6). Adherence to the USCG 33 C.F.R. 151 regulations would minimize the likelihood of Project-related vessel traffic introducing aquatic invasive species. Currently, no aquatic invasive organisms have become established at Prudhoe Bay and little is known about the environmental tolerance of species that could be released (McGee et al., 2006).

5.4.3 Cumulative Effects

Projected increases in shipping traffic related to opening of the Northwest Passage as a result of reduced ice cover from global climate change would increase the potential for cumulative effects on bowhead whales from collision mortality and habitat degradation from increased shipping noise in Alaskan waters. Climate change may also result in changes in bowhead whale prey distribution and abundance and timing of spring and fall migrations. Although bowhead whales are exposed to a number of stressors, they are currently experiencing increasing population levels under current stressor regimes (NMFS, 2015c). With incorporation of conservation measures, activities associated with the Project are not expected to increase the overall effects to a level that would jeopardize bowhead whales.

5.4.4 Summary of Effects

5.4.4.1 Summary of Effects on Critical Habitat

No critical habitat has been designated for the bowhead whale.

5.4.4.2 Summary of Effects on Bowhead Whales

The Project could adversely affect bowhead whales during construction activities at West Dock and by vessel traffic primarily through potential acoustic effects. Most construction would occur during winter when bowhead whales are not present near West Dock. Noise from barge traffic associated with the Project would be near ambient noise levels and would be less than the level for potential acoustic harassment. With implementation of the conservation measures outlined previously, Bowhead whales would be unlikely to be affected.

5.5 FIN WHALE

Fin whales range in U.S. waters from the North Pacific south to Hawaii, entering into the Bering Sea during ice-free summer months. Activities that could potentially affect fin whales are limited to Project-related vessel traffic that would occur through these waters in support of construction of the Liquefaction Facility, Mainline, and GTP.

5.5.1 Direct Effects

The primary direct effect of Project-related vessel traffic on fin whales is the potential for collision mortality. Two ship strike mortalities of fin whales occurred in Alaska waters between 2008 and 2012, one in 2009 and one in 2010 (Allen and Angliss, 2015). Given the distribution and abundance of fin whales and implementation of these conservation measures, it is unlikely that an LNGC would strike a fin whale. While there is a potential for ship strikes in Project LNGC and HLV shipping routes (see Section 2.1), the risk of potential strikes is considered low because of the intermittent occurrence and dispersed distribution of fin whales in Alaskan waters.

5.5.2 Indirect Effects

Project-related vessel traffic could indirectly affect fin whales through potential habitat degradation cause by increased shipping traffic vessel noise. Vessels would use safe speeds that minimize noise and allow avoidance of collisions with marine mammals.

5.5.3 Cumulative Effects

Projected increases in shipping traffic related to opening of the Northwest Passage as a result of reduced ice cover from global climate change would increase the potential for cumulative effects on fin whales from collision mortality and habitat degradation from increased shipping noise in Alaskan waters. Possible changes in fin whale habitat from climate change include changes in prey distribution as well as increased shipping traffic and range expansion associated with reduced ice coverage (Allen and Angliss, 2015).

5.5.4 Summary of Effects on Fin Whales

Fin whales were listed as endangered primarily due to overexploitation in commercial fisheries. Current risk factors for fin whales include ship strikes, fishing gear entanglement, and degradation of their habitat from climate change and oil and gas activities in the Chukchi and Beaufort Seas (Allen and Angliss, 2015). Fin whales would not be expected to be affected, although there would be a low risk of vessel strikes.

5.6 GRAY WHALE – WESTERN NORTH PACIFIC DPS

The distribution and migration patterns of WNP gray whales are poorly known and overlap with ENP gray whales. WNP gray whales may occur in the Gulf of Alaska, Aleutian Islands, and southern Bering Sea. Activities that could potentially affect WNP gray whales are limited to Project-related vessel traffic that would occur through these waters in support of construction of the Liquefaction Facility, Mainline, and GTP.

5.6.1 Direct Effects

The primary direct effect of Project-related vessel traffic on WNP gray whales is the potential for collision mortality. Project-related HLV traffic is unlikely to encounter WNP gray whales, which would be expected to occur west of shipping routes through the Bering Sea. Because the fall/winter migration route for the portion of the WNP gray whales that winter along the West Coast of North America has not been characterized, the risk of potential ship strikes is unknown. While a potential exists for ship strikes in Project LNGC and HLV shipping routes (see Section 2.1), the risk of strikes is unknown, but is expected to be low. Most gray whales encountered by vessels in these areas likely belong to the ENP gray whale population.

5.6.2 Indirect Effects

Project-related vessel traffic could indirectly affect WNP gray whales through potential habitat degradation cause by increased shipping traffic vessel noise. Vessels would use safe speeds that minimize noise and allow avoidance of collisions with marine mammals.

5.6.3 Cumulative Effects

Projected increases in shipping traffic related to opening of the Northwest Passage as a result of reduced ice cover from global climate change would increase the potential for cumulative effects on WNP gray whales from collision mortality and habitat degradation from increased shipping noise in Alaskan waters. Possible changes in WNP gray whale habitat from climate change include changes in prey distribution, as well as increased shipping traffic and range expansion associated with reduced ice coverage.

5.6.4 Summary of Effects on WNP Gray Whales

Gray whales were listed as endangered primarily due to overexploitation in commercial fisheries. Current risk factors for WNP gray whales include large-scale oil and gas development programs off Sakhalin Island, poaching, entanglement in fishing gear, industrialization and shipping congestion throughout the migratory corridor, pollution, possible illegal whaling or resumed legal whaling at unsustainable levels, and ship strikes (Weller et al., 2004). WNP gray whales would not be expected to be affected, although there would be a low risk of vessel strikes.

5.7 HUMPBACK WHALE – WESTERN NORTH PACIFIC DPS

Humpback whales that occur in Alaska waters include members of three DPSs: the Hawaii DPS – now delisted, the Mexico DPS – now delisted, and the Western North Pacific DPS – listing as endangered. Humpback whales may occur in lower Cook Inlet, Prince William Sound, the Gulf of Alaska, Aleutian Islands, Bering, Chukchi, and Beaufort seas. Humpback whales that venture into Cook Inlet are most likely to belong to either the Hawaii or Mexico DPSs, which have been de-listed. Occasional sightings of humpback whales in the Beaufort Sea are assumed to represent vagrants from the either the Hawaii DPS (Allen and Angliss, 2015) or the Western North Pacific DPS (Hashagen et al., 2009). Activities that could potentially affect WNP humpback whales are limited to Project-related vessel traffic that would occur through these waters in support of construction of the Liquefaction Facility, Mainline, and GTP.

5.7.1 Direct Effects

The primary direct effect of Project-related vessel traffic on WNP humpback whales is the potential for collision mortality. Most of the 108 verified vessel strikes, 86 percent, in Alaska waters between 1978 and 2011 were humpback whales (Neilson et al., 2012). Annual ship strike mortality from 2008 to 2014 for the Western North Pacific DPS (stock) averaged 0.45 whales per year (Allen and Angliss, 2015). Ship strikes may be more likely to occur within feeding areas where vessel traffic and humpback whale concentrate from June through September around the Aleutian Islands, southern Bering Sea, Kodiak Island, and the Shumigan Islands (Ferguson et al., 2015a, b). Given the distribution and abundance of humpback whales and implementation of these conservation measures, it is unlikely that an LNGC would strike a humpback whale.

Most humpback whales encountered by vessels in these regions likely belong to the Hawaii or Mexico humpback whale DPSs. While a potential exists for ship strikes in Project LNGC and HLV shipping routes (see Section 2.1), the risk of strikes is considered low. No humpback whales are expected to be affected by the Project.

5.7.2 Indirect Effects

Project-related vessel traffic could indirectly affect WNP humpback whales through potential habitat degradation caused by increased shipping traffic vessel noise. Vessels would use safe speeds that minimize noise and allow avoidance of collisions with marine mammals.

5.7.3 Cumulative Effects

Projected increases in shipping traffic related to opening of the Northwest Passage as a result of reduced ice cover from global climate change would increase the potential for cumulative effects on WNP humpback whales from collision mortality and habitat degradation from increased shipping noise in Alaskan waters. Possible changes in WNP humpback whale habitat from climate change include changes in prey distribution, as well as increased shipping traffic and range expansion associated with reduced ice coverage.

5.7.4 Summary of Effects on WNP Humpback Whales

Humpback whales were listed as endangered primarily due to overexploitation in commercial fisheries. Current risks for WNP humpback whales include energy development, whaling, competition with fisheries, fishing gear entanglement, entanglement in unknown marine debris, and vessel collisions (80 FR 22304). The Project is not expected to affect WNP humpback whales, although there is a low risk of vessel strikes.

5.8 NORTH PACIFIC RIGHT WHALE

North Pacific right whales remain in the southeastern Bering Sea from May through December with peak calling rates in August, September, and December (Munger et al., 2008; Stafford and Mellinger, 2009). Activities that could potentially affect the North Pacific right whale are limited to Project-related vessel traffic that would occur through these waters in support of construction and operation of the Liquefaction Facility, Mainline, and GTP.

5.8.1 Direct Effects

The primary direct effect of Project-related vessel traffic on right whales is the potential for collision mortality. Ship strikes are significant sources of mortality for the North Atlantic stock of right whales, and North Pacific right whales are also likely vulnerable to ship strikes. Because of their rare occurrence and scattered distribution, however, the threat of ship strikes to the North Pacific stock of right whales is unknown. No North Pacific right whales are expected to be affected by the Project. While a potential exists for ship strikes in Project LNGC and HLV shipping routes (see Section 2.1), the risk of strikes is considered extremely low because of their rare occurrence and scattered distribution.

5.8.2 Indirect Effects

Project-related vessel traffic could indirectly affect North Pacific right whales and their designated critical habitat through potential habitat degradation cause by increased shipping traffic noise. Vessel traffic would not cross or approach critical habitat in the Bering Sea or on the south side of Kodiak Island and would have no effect on the zooplankton prey of North Pacific right whales or the designated critical habitat area. Ballast water exchange would comply with U.S. Coast Guard regulations and would occur outside of U.S. waters, and would not affect North Pacific right whale critical habitat. Vessels would use safe speeds that minimize noise and allow avoidance of collisions with marine mammals.

5.8.3 Cumulative Effects

Projected increases in shipping traffic related to opening of the Northwest Passage as a result of reduced ice cover from global climate change would increase the potential for cumulative effects on right whales from collision mortality and habitat degradation from increased shipping noise in Alaska waters. Possible changes in right whale habitat from climate change include changes in prey distribution as well as increased shipping traffic.

5.8.4 Summary of Effects on North Pacific Right Whales

Right whales were listed as endangered primarily due to overexploitation in commercial fisheries. The North Pacific right whale is considered one of the most endangered whales in the world, numbering fewer than 500 individuals. Current risk factors for right whales include ship strikes, fishing gear entanglement, and degradation of their acoustic habitat. North Pacific right whales would not be expected to be affected, although there would be a very low risk of vessel strikes.

5.9 SEI WHALE

Sei whales feed in Gulf of Alaska waters during the summer months. Activities that could potentially affect the fin whales are limited to Project-related vessel traffic that would occur through these waters in support of construction and operation of the Liquefaction Facility, Mainline, and GTP.

5.9.1 Direct Effects

The primary direct effect of Project-related vessel traffic on sei whales is the potential for collision mortality. One sei whale death was attributed to collision with a vessel in the North Pacific Ocean in 2003 (NMFS, 2012b). The average observed ship strike mortality for sei whales in the North Pacific during 2004 to 2008 was 0 whales (Carretta et al., 2014). No sei whales would be expected to be affected by the Project.

Given the distribution and abundance of sei whales and implementation of these conservation measures, it is unlikely that an LNGC would strike a humpback whale. While a potential exists for ship strikes in Project LNGC and HLV shipping routes (see Section 2.1), the risk of strikes is considered low.

5.9.2 Indirect Effects

Project-related vessel traffic could indirectly affect sei whales through potential habitat degradation caused by increased shipping traffic noise. Vessels would use safe speeds that minimize noise and allow avoidance of collisions with marine mammals.

5.9.3 Cumulative Effects

Projected increases in shipping traffic related to opening of the Northwest Passage as a result of reduced ice cover from global climate change would increase the potential for cumulative effects on sei whales from collision mortality and habitat degradation from increased shipping noise in Alaskan waters. Possible changes in sei whale habitat from climate change include changes in prey distribution as well as increased shipping traffic.

5.9.4 Summary of Effects on Sei Whales

Sei whales were listed as endangered primarily due to overexploitation in commercial fisheries. Current risks to sei whales include ship strikes and entanglement in fishing gear. Sei whales would not be expected to be affected, although there would be a low risk of vessel strikes.

5.10 SPERM WHALE

Sperm whales appear to be nomadic, showing widespread movements between areas of concentration (Mizroch and Rice, 2012); although, they have been detected year round in the Gulf of Alaska (Mellinger et al., 2004). Sperm whales are found most frequently in coastal waters around the central and western Aleutian Islands (Allen and Angliss, 2015). Activities that could potentially affect sperm whales are limited to Project-related vessel traffic that would occur through these waters in support of construction and operation of the Liquefaction Facility, Mainline, and GTP.

5.10.1 Direct Effects

The primary direct effect of Project-related vessel traffic on sperm whales is the potential for collision mortality. From 2006-2010, 11 sperm whale mortalities were reported; although, human interaction for these mortalities could not be determined (Allen and Angliss, 2015). A single sperm whale vessel collision mortality was reported in Alaskan waters during 1978 to 2011, south of Prince William Sound in the Gulf of Alaska (Neilson et al. 2012). No sperm whales would be expected to be affected by the Project. While a potential exists for ship strikes in Project LNGC and HLV shipping routes (see Section 2.1), the risk of strikes is considered low.

5.10.2 Indirect Effects

Project-related vessel traffic could indirectly affect sperm whales through potential habitat degradation caused by increased shipping traffic noise. Vessels would use safe speeds that minimize noise and allow avoidance of collisions with marine mammals.

5.10.3 Cumulative Effects

Projected increases in shipping traffic related to opening of the Northwest Passage as a result of reduced ice cover from global climate change would increase the potential for cumulative effects on sperm whales from collision mortality and habitat degradation from increased shipping noise in Alaska waters. Possible changes in sperm whale habitat from climate change include changes in prey distribution as well as increased shipping traffic.

5.10.4 Summary of Effects on Sperm Whales

Sperm whales were listed as endangered primarily due to overexploitation in commercial fisheries. Current risk factors for sperm whales include ship strikes, fishing gear entanglement, and degradation of their acoustic habitat. Sperm whales would not be expected to be affected, although there would be a very low risk of vessel strikes.

5.11 ARCTIC RINGED SEAL

Construction and operation of the Liquefaction Facility in and adjacent to Cook Inlet would have no direct or indirect effects on ringed seals, which in Alaska are found in the Bering, Chukchi, and Beaufort Seas. Construction of Interdependent and Interrelated Project Facilities on Alaska's North Slope, specifically the GTP and PTTL, could potentially affect ringed seals and proposed critical habitat. Operation and maintenance of the GTP, Mainline, and PTTL would have no effect on ringed seals because of their onshore location, and because they would involve no routine offshore vessel or aircraft traffic. Alternatives (to trucking) being considered for transporting pipe, camps, materials, equipment, fuel, supplies, include the barging to existing docks at Badami, East Dock, Kuparuk and Endic which could have effects on ringed seals.

5.11.1 Direct Effects

Construction and operation of the Project may directly affect ringed seals or proposed critical habitat through:

- Construction of modifications to West Dock – Dock Head 4;
- HLV traffic to West Dock for delivery of the GTP modules;
- Coastal barge traffic for delivery of materials, supplies to West Dock, Badami, and Point Thomson; and
- Potential fuel spills.

The GTP and associated facilities are onshore and would not affect ringed seals. Construction of the coastal facilities at Prudhoe Bay would occur primarily during winter with operations primarily during the open water season. HLV traffic would occur during summer. Ringed seals could occur in the West Dock area year-round. Potential direct effects on ringed seals and proposed critical habitat could include:

- Disturbance and displacement from West Dock construction noise;
- Disturbance and displacement from HLV docking noise;
- Vessel strikes; and

- Vessel groundings and potential oil spills.

Underwater noise typically generated during construction and during vessel docking operations summarized here (Table 15) is discussed in detail in the Marine Mammal Protection Act Assessment provided in Resource Report No. 3, Appendix F. Thresholds established for underwater noise to prevent Level B harassment or Level A injury to seals are 120 dB root mean square (rms) for disturbance from continuous noise; 160 dB re 1 µPa$_{rms}$ for disturbance from impulsive noise; and 190 dB re 1 µPa$_{rms}$ for injury. Underwater noise sources that could potentially affect ringed seals include: impact sheet pile driving, vibratory pile driving, and HLV noise associated with docking. Exposure of marine mammals to noise above these threshold values has the potential to cause short term TTS or long-term PTT hearing loss; masking of vocal communications; or physiological stress that can lead to mortality. These potential effects are described in more detail in Resource Report No. 3, Appendix F.

TABLE 15

Estimated Noise Radii, ZOI, and Ringed Seal Exposures during West Dock Construction and Operations

Noise Source	Source Level (dB$_{rms}$ re 1 µPa at 1 m)	Ensonified to Threshold		Activity Duration by Construction Season (S)					Potential Ringed Seal Exposures
		Radius (mi)	ZOI (mi^2)	S1	S2	S3	S4	Total	
Impulse Noise (160 dB$_{rms}$)									
Impact Pile Driving (pipe)	222 dB	2.17	7.42	57	0	0	0	57 days	0 [a]
Impact Pile Driving (sheet)	199.7 dB	0.060	0.006						
Continuous Noise (120 dB$_{rms}$)									
Vibratory Pile Driving (pipe)	199.1 dB	2.65	11.00	57	0	0	0	57 days	0 [a]
Vibratory Pile Driving (sheet)	187 dB	0.74	0.86						
Tug and Barge (docking)	178.9 dB	2.64	10.95	23	18	10	10	61 events	845

Sources: Appendix F, Tables 13, 14, 15, 16, and 34

[a] Pile and sheet driving would be completed during winter is not expected to reach ringed seal wintering habitat.

Expected activity levels and estimated ZOI indicate that some ringed seals may be exposed to docking sounds exceeding NMFS threshold values for Level B incidental harassment (takes). Such takes are unlawful unless an incidental take authorization is first obtained by the project proponent. By statute and regulation, NMFS can only issue an incidental take authorization if it authorizes takes of small numbers of marine mammals, and if these small numbers of takes will have a negligible effect on the species or stock. Conservation measures would be implemented to ensure Level A takes do not occur and to minimize the number of Level B takes. These measures would include the deployment of PSOs to clear safety zones of marine mammals prior to start-up and shut-downs if marine mammals approach the ensonified area.

5.11.1.1 Effects of Dock Head Modifications and Pile Driving on Ringed Seals

Dock Head 4 construction would require installation of sheet piles, H-piles, and pipe piles, most of which would be placed using an impact hammer in winter. The Level B harassment threshold for airborne noise of 100 dB$_{rms}$ for seals is not expected to exceed 0.6 miles, regardless of hammer type or pile size. Underwater noise would attenuate to 120 dB within about 0.76 miles. NMFS does not consider sea ice within water depths ranging from 0 to 10 feet as used by ringed seals during winter and early spring because ice thickness leaves the area of open water area between the bottom of the ice and the top of the substrate insufficient for seal use (NMFS, 2012c). Because previous measurement of pile driving noise indicates that the noise attenuates within about 0.76 mile under sea ice, and grounded ice should extend to about 1.02 miles (5-m isobaths) from West Dock wintering ringed seals are not expected to be exposed to pile driving noise (Appendix F).

The Project would avoid and minimize and potential exposure of marine mammals to noise generated during construction by applying for an IHA, establish exclusion zones and using PSOs with the ability to shut down activities if marine mammals are sited within the exclusion zones.

5.11.1.2 Effects of Dock Head Modifications and Pile Driving on Ringed Seal Habitat

Dock Head 4 construction would cover about 31 acres of benthic habitat with granular materials. This area of marine and benthic habitat that could be used by ringed seals for foraging would be lost (permanent impact). Effects on habitat quality from increased turbidity during construction would be temporary and not dissimilar with turbidity generated during spring break up or summer/fall storms; fish and invertebrate communities would be expected to return to the area.

5.11.1.3 Effects of Vessel Activity on Ringed Seal

HLVs for delivery of modules to West Dock would follow shipping routes through the Bering, Chukchi, and Beaufort seas. The slow speeds and straight-line movement of HLVs combined with the long period of daylight enable captains and crew to see and avoid striking marine mammals. Seals are less susceptible to vessel strikes than whales, likely because they can see both above and below the water and they can move quickly.

Vessel traffic would be expected to have only temporary and minor behavioral effects on ringed seals. Although some ringed seals may be found in Prudhoe Bay, the West Dock area is not heavily utilized. Barge / HLV traffic along the Chukchi Sea and Beaufort Sea coast would; however, likely come within proximity to a number of ringed seals. Green and Negri (2006) monitored ringed seal occurrence and reaction to barge traffic in the Beaufort Sea between Cape Simpson and West Dock. During 15 barge trips (approximately 4,500 miles), 1,020 ringed seals were observed within about 1,000 feet of the vessel. About 48 percent showed no reaction to the barge, 37 percent (381) appeared to react mildly, and 15 percent (148) reacted more strongly. The stronger reactions consisted of a rapid dive often accompanied by a loud splash. Most of these recorded reactions, however occurred with seals that were observed within 100 feet of the vessels.

Selection of barging pipeline construction materials for the Mainline, PBTL, and PTTL, as an alternative method for transportation, would result in a substantial increase in barge traffic associated with the Project. Coastal barge traffic for delivery of pipeline and materials to Badami, Kuparuk, Endicott, or East Dock, would follow routes that are typically within the barrier islands, so few ringed seals would be exposed to noise and vessel collisions with ringed seals would be unlikely to occur (NMFS, 2012c).

5.11.1.4 Effects of Potential Spills and Resultant Contamination on Ringed Seals

The potential for exposure to fuel storage or transfer spills would be low as most spills would be contained on granular workspaces, spilled product would be recovered, and any unrecoverable product that reaches water would likely be sufficiently diluted to a nonhazardous level.

The most likely source of exposure to an oil spill would be from a potential barge grounding with a subsequent release of fuel. Few spills have been reported in Beaufort or Chukchi sea waters (NMFS, 2015a). Potential effects of oil on seals could include skin and eye irritation from contact, systemic effects from ingestion of oil from the water or contaminated prey, and respiratory damage from inhalation of hydrocarbon vapors.

5.11.2 Indirect Effects

The Project may indirectly affect ringed seal critical habitat by reducing or altering prey availability or abundance through:

- Changes in prey abundance from dock construction;
- Potential transport of aquatic invasive organisms from HLVs.

5.11.2.1 Prey Effects

Potential indirect effects on ringed seals could occur through construction and operation-related reductions or displacement of ringed seal prey, including marine invertebrates, and Arctic and saffron cod from the West Dock area. Primary prey resources defined as Arctic cod, saffron cod, shrimps, and amphipods, are a PCE of ringed seal critical habitat. Potential Project-related effects and mitigation to EFH are discussed in more detail in the EFH Assessment Report included as Resource Report No. 3, Appendix D. The EFH Assessment Report concludes that the potential direct and indirect effects of the Project construction and operation on marine EFH and EFH species would be minor. Specific mechanisms for effects to ringed seal prey are discussed under direct effects above.

5.11.2.2 Effects of Vessel Ballast Water Handling on Ringed Seal Habitat

HLVs would anchor in Stefansson Sound inside of Reindeer Island to await offload. Ship hulls, ballast, and equipment lowered into the water may serve to transport invasive aquatic organisms that can degrade coastal marine habitats by displacing or transmitting diseases to native aquatic organisms. HLVs would plan to ballast loads with cargo rather than water ballast and use minimal amounts of freshwater for ballast. Use of freshwater ballast would allow for removal of ballast without transporting marine aquatic invasive organisms. Invasive aquatic organisms on or in semi-submersible vessels, barges, and tugs would be controlled by ballast water regulations which require a ship-specific Ballast Water Management Plan, a ballast water record book, ballast water exchange, an approved ballast water treatment system, and an International Ballast Water Management Certificate. HLVs would wash down before entering Alaskan coastal waters and exchange ballast at sea to ensure a clean water discharge to minimize introduction of aquatic invasive organisms.

All vessels brought into the State of Alaska or federal waters are subject to USCG 33 C.F.R. 151 regulations, which are intended to reduce the transfer of aquatic invasive organisms. Management of ballast water discharge is regulated by federal regulations (33 C.F.R. 151.2025) that prohibit discharge of untreated ballast water into the Waters of the U.S. unless the ballast water has been subject to a mid-ocean ballast water exchange (at least 200 nautical miles offshore). Vessel operators are also required to remove “fouling organisms from hull, piping, and tanks on a regular basis and dispose of any removed substances in accordance with local, state, and federal regulations” (33 C.F.R. 151.2035(a)(6). Adherence to the USCG 33 C.F.R. 151 regulations would minimize the likelihood of project-related vessel traffic introducing aquatic invasive species. Currently, no aquatic invasive organisms have become established at Prudhoe Bay and little is known about the environmental tolerance of species that could be released (McGee et al., 2006).

5.11.2.3 Effects from Non-Jurisdictional Facilities

Expansion of the Point Thomson facility related to production of natural gas would include modifications to the dock and HLV traffic that could potentially affect ringed seals.

5.11.3 Cumulative Effects

Concerns for ringed seals are tied to the likelihood that their sea-ice and snow habitats have been modified by the warming climate, and that changes in ocean temperature, acidification, and ice cover threaten prey communities on which ringed seals depend (NMFS, 2015c). Other concerns include the potential effects from oil and gas exploration activities, particularly in the outer continental shelf leasing areas, such as harm and harassment from vessel traffic, seismic exploration noise, or the potential for oil spills (NMFS, 2015c). Although ringed seals are exposed to a number of stressors, they are currently experiencing stable population levels under current stressor regimes (NMFS, 2015c). With incorporation of conservation measures, activities associated with the Project are not expected to increase the overall effects to a level that would jeopardize ringed seals.

5.11.4 Summary of Effects

5.11.4.1 Summary of Effects on Critical Habitat

Critical habitat was proposed for the Arctic ringed seal before the listing rule for the seal was vacated by the courts, but none currently exists. The Project would result in the short term disturbance of the berthing basin and using a barge bride, and the permanent loss of about 31 acres for dockhead expansion and barge bridge preparation and emplacement temporary and minor. The would be longer term but would affect a negligible proportion of potential forage species habitat within the proposed critical habitat area. Water depths in the area where the dockhead expansion would take place are too shallow for use by ringed seals in the winter for pupping or foraging, thus essential features of ringed seal habitat would not be impacted.

5.11.4.2 Summary of Effects on Ringed Seals

The Project may adversely affect a few Arctic ringed seals during construction activities at West Dock primarily through potential acoustic effects, but also potentially through injury or mortality from on-ice construction. With implementation of conservation measures for identifying and monitoring marine mammal occurrence near these activities and stopping activities when marine mammals could be affected; however, adverse effects are unlikely. No ringed seals were estimated to be exposed to harassing or injurious levels of impact or vibratory pile driving noise. Seals are generally tolerant of industrial noise and they are less sensitive to lower frequency noises, such that noise generated during HLV docking is unlikely to harass ringed seals. With implementation of conservation measures, the Project is unlikely to affect more than a few ringed seals during on-ice construction.

5.12 BEARDED SEAL – BERINGIA DPS

Construction and operation of the Liquefaction Facility in and adjacent to Cook Inlet would have no direct or indirect effects on the bearded seal, which in Alaska is found in the Bering, Chukchi, and Beaufort Seas. Construction of Interdependent and Interrelated Project Facilities, specifically the GTP, could potentially affect bearded seals. Operation and maintenance of the GTP, Mainline, and PTTL would have no effect on bearded seals because of their onshore location, and because they would involve no routine offshore vessel or aircraft traffic. Alternatives (to trucking) being considered for transporting pipe, camps, materials, equipment, fuel, supplies, include the barging to existing docks at Badami, East Dock, Kuparuk, and Endicott.

5.12.1 Direct Effects

The GTP and associated facilities are onshore and would not affect bearded seals. Construction of the coastal facilities at Prudhoe Bay would occur primarily during winter with vessel operations primarily during the open water season. HLV traffic would occur during summer. Bearded seals could occur in the West Dock area during the open-water season. Potential direct effects on bearded seals could include:

- Construction of modifications to West Dock – Dock Head 4;
- Noise generated by construction of the dockhead expansion and vessel docking;
- Disturbance and displacement from HLV docking noise;
- HLV traffic to West Dock for delivery of the GTP modules;
- Coastal barge traffic for delivery of materials, supplies to West Dock, Badami, and Point Thomson; and
- Vessel strikes; and
- Vessel groundings and potential oil spills.

Underwater noise typically generated during construction and during vessel docking operations summarized here is discussed in detail in the *Marine Mammal Protection Act Assessment* provided in Resource Report No. 3, Appendix F. Thresholds established for underwater noise to prevent Level B harassment or Level A injury to seals are 120 dB root mean square (rms) for disturbance from continuous noise; 160 dB re 1 µPa rms for disturbance from impulsive noise; and 190 dB re 1 µPa rms for injury. Underwater noise sources that could potentially affect bearded seals include: HLV noise associated with docking. Bearded seals are not present in the Prudhoe Bay region during winter when sheet and pile driving would occur. Exposure of marine mammals to noise above these threshold values has the potential to cause short term TTS or long-term PTT hearing loss; masking of vocal communications; or physiological stress that can lead to mortality. These potential effects are described in more detail in Resource Report No. 3, Appendix F.

The areas and numbers of bearded seals potentially exposed to underwater noise by West Dock construction and HLV docking are summarized in Table 16. Density of bearded seals during summer in the Beaufort Sea used to estimate potential exposures summarized in Table 15 was 0.06320 seals per square mile.

TABLE 16

Estimated Noise Radii, ZOI, and Bearded Seal Exposures during West Dock Construction and Operations

Noise Source	Underwater Noise Thresholds			Activity Duration by Season (S)					Potential Bearded Seal Exposures
	Source Level (dB_{rms} re 1 µPa at 1 m)	Radius (mi)	ZOI (mi^2)	S1	S2	S3	S4	Total	
Continuous Noise (120 dB_{rms})									
Tug and Barge (docking)	178.9 dB	2.64	10.95	23	18	10	10	61 events	42

Sources: Appendix F, Tables 13, 14, 15, and 34

Expected activity levels and estimated ZOI indicate that some bearded seals may be exposed to docking sounds exceeding NMFS threshold values for Level B incidental harassment (takes). Such takes are unlawful unless an incidental take authorization is first obtained by the project proponent.

By statute and regulation, NMFS can only issue an incidental take authorization if it authorizes takes of small numbers of marine mammals, and if these small numbers of takes will have a negligible effect on the species or stock. Conservation measures would be implemented to ensure Level A takes do not occur and to minimize the number of Level B takes. These measures would include the deployment of PSOs to clear safety zones of marine mammals prior to start-up and shut-downs if marine mammals approach the ensonified area.

5.12.1.1 Effects of Dock Head Modifications and Pile Driving on Bearded Seals

Dock Head 4 pile and sheet driving would occur during winter when bearded seals are not present in the Prudhoe Bay area.

5.12.1.2 Effects of Dock Head Modifications and Pile Driving on Bearded Seal Habitat

Dock Head 4 construction would cover about 31 acres of benthic habitat with granular material. This area of marine and benthic habitat that could be used by bearded seals for foraging would be lost. Effects on habitat quality from increased turbidity during construction would be temporary and not dissimilar with turbidity generated during spring break up or summer/fall storms; fish and invertebrate communities would be expected to return to the area.

5.12.1.3 Effects of Vessel Activity on Bearded Seals

HLVs for delivery of modules to West Dock would follow shipping routes through the Bering, Chukchi, and Beaufort seas. The slow speeds and straight-line movement of HLVs combined with the long period of daylight enable captains and crew to see and avoid striking marine mammals. During the open-water shipping season, most bearded seals would be associated with sea ice and shipping traffic usually avoids ice. Ships could collide with bearded seals; however, it would be highly unlikely. Seals are less susceptible to vessel strikes than whales, likely because they can see both above and below the water and they can move quickly.

Vessel traffic would be expected to have only temporary and minor behavioral effects on bearded seals. Although a few bearded seals may be found in Prudhoe Bay, the West Dock area is not heavily utilized. Barge / HLV traffic along the Chukchi Sea and Beaufort Sea coast would; however, likely come within proximity some bearded seals. Green and Negri (2006) monitored bearded seal occurrence and reaction to barge traffic in the Beaufort Sea between Cape Simpson and West Dock. During 15 barge trips (approximately 4,500 miles), 28 bearded seals were observed within about 1,000 feet of the vessel, and only two of the observed seals exhibited reactions described as stronger – consisting of a rapid dive often accompanied by a loud splash.

Selection of barging pipeline construction materials for the Mainline, PBTL, and PTTL, as an alternative method for transportation, would result in a substantial increase in barge traffic associated with the Project. Coastal barge traffic for delivery of pipeline and materials to Badami, Kuparuk, Endicott, or East Dock, would follow routes that are typically within the barrier islands so few ringed seals would be exposed to noise and vessel collisions with ringed seals would be unlikely to occur (NMFS, 2012c).

5.12.1.4 Effects of Potential Spills and Resultant Contamination on Bearded Seals

The potential for exposure to fuel storage or transfer spills would be low as most spills would be contained on granular workspaces, spilled product would be recovered, and any unrecoverable product that reaches marine water would likely be sufficiently diluted to a nonhazardous level.

Coastal barge traffic for delivery of pipeline and materials to Badami would follow routes that are typically within the barrier islands and few bearded seals are likely to be exposed to noise and vessel collisions with bearded seals are unlikely to occur (NMFS, 2012c).

All fuel and hazardous liquid storage tanks and containers would be located onshore and constructed with secondary containment. Any potential spills are not likely to reach marine water habitats of bearded seals. Because the GTP handles primarily natural gas, no chance of a large oil spill exists.

5.12.2 Indirect Effects

The Project may indirectly affect bearded seals by reducing or altering prey availability or abundance through:

- Changes in prey abundance from dock construction;
- Potential transport of aquatic invasive organisms from HLVs.

5.12.2.1 Prey Effects

Potential indirect effects on bearded seals could occur through construction and operation-related reductions or displacement of bearded seal prey, including benthic invertebrates and fish from the West Dock area. Potential Project-related effects and mitigation to EFH are discussed in more detail in the draft EFH Assessment Report included as Resource Report No. 3, Appendix D. The draft EFH Assessment Report concludes that the potential direct and indirect effects of the Project construction and operation on marine EFH and EFH species would be minor. Specific mechanisms for effects on bearded seal prey are discussed under direct effects above.

5.12.2.2 Effects of Vessel Ballast Water Handling on Bearded Seals

HLVs would anchor in Stefansson Sound inside of Reindeer Island to await offload. Ship hulls, ballast, and equipment lowered into the water may serve to transport invasive aquatic organisms that can degrade coastal marine habitats by displacing or transmit diseases to native aquatic organisms. HLVs would plan to ballast loads with cargo rather than water ballast and use minimal amounts of freshwater for ballast. Use of freshwater ballast would allow for removal of ballast without transporting marine aquatic invasive organisms. Invasive aquatic organisms on or in semi-submersible vessels, barges, and tugs would be controlled by ballast water regulations, which require a ship-specific Ballast Water Management Plan, a ballast water record book, ballast water exchange, an approved ballast water treatment system, and an International Ballast Water Management Certificate. HLVs would wash down before entering Alaska coastal waters and exchange ballast at sea to ensure a clean water discharge to minimize introduction of aquatic invasive organisms.

All vessels brought into the State of Alaska or federal waters are subject to USCG 33 C.F.R. 151 regulations, which are intended to reduce the transfer of aquatic invasive organisms. Management of ballast water discharge is regulated by federal regulations (33 C.F.R. 151.2025) that prohibit discharge of untreated ballast water into the Waters of the U.S. unless the ballast water has been subject to a mid-ocean ballast water exchange (at least 200 nautical miles offshore). Vessel operators are also required to remove “fouling organisms from hull, piping, and tanks on a regular basis and dispose of any removed substances in accordance with local, state, and federal regulations” (33 C.F.R. 151.2035(a)(6). Adherence to the USCG 33 C.F.R. 151 regulations would minimize the likelihood of project-related vessel traffic introducing aquatic invasive species. Currently no aquatic invasive organisms have become established at Prudhoe Bay and little is known about the environmental tolerance of species that could be released (McGee et al., 2006).

5.12.2.3 Effects from Non-Jurisdictional Facilities

Expansion of the Point Thomson facility related to production of natural gas would include modifications to the dock and HLV traffic that could potentially affect bearded seals.

5.12.3 Cumulative Effects

Concern for bearded seals are tied to the likelihood that their sea-ice and snow habitats have been modified by the warming climate, and that changes in ocean temperature, acidification, and ice cover threaten prey communities on which they depend (NMFS, 2015c). Other concerns include the potential effects from oil and gas exploration activities, particularly in the outer continental shelf leasing areas, such as harm and harassment from vessel traffic, seismic exploration noise, or the potential for oil spills (NMFS, 2015c). Although bearded seals are exposed to a number of stressors, they are currently experiencing stable population levels under current stressor regimes (NMFS, 2015c). With incorporation of conservation measures, activities associated with the Project are not expected to increase the overall effects to a level that would jeopardize bearded seals.

5.12.4 Summary of Effects

5.12.4.1 Summary of Effects on Critical Habitat

No critical habitat has been designated for bearded seals.

5.12.4.2 Summary of Effects on Bearded Seals

The Project may affect a few individual bearded seals during summer and HLV docking at West Dock primarily through potential acoustic effects. With implementation of conservation measures to monitor marine mammal occurrence near construction activities and stopping activities when marine mammals could be exposed to potential acoustic effects, adverse effects would be unlikely. Seals are generally tolerant of industrial noise, and they are less sensitive to lower frequency noise such that noise from HLV docking is unlikely to harass bearded seals. With implementation of conservation measures, the Project may affect a few bearded seals.

5.13 STELLER SEA LION – WESTERN DPS

The range of the western DPS of the Steller sea lion extends from the outer Aleutian Islands to Prince William Sound. Activities that could potentially affect the western DPS Steller sea lions are limited to Project-related construction and operation vessel traffic through the Aleutian Islands, Gulf of Alaska, lower Cook Inlet, and Resurrection Bay.

5.13.1 Direct Effects

The Project could potentially directly affect western DPS Steller sea lions and critical habitat through:

- LNGC and HLV traffic during construction and operation in the Aleutian Islands, lower Cook Inlet, Shelikof Strait, and Resurrection Bay.

Construction of the facilities in Cook Inlet would occur during open water with operations year-round. Steller sea lions are unlikely to occur in the vicinity of the Marine Terminal or Mainline route through upper Cook Inlet. Potential direct effects on wester DPS Steller sea lions and critical habitat related to vessel traffic could include:

- Vessel strikes.
- Vessel groundings and potential oil spills.

5.13.1.1 Effects of Construction Vessel Activity on Steller Sea Lions

Effects of HLV traffic could include disturbance associated with vessel noise, vessel strikes, and spills resulting from vessel grounding. The low frequency sounds generated by commercial shipping vessels can travel and be detected by marine mammals at considerable distances, although much of the sound produced by large cargo carriers is at frequencies below the hearing sensitivity of Steller sea lions (Kastelein et al., 2005). Vessel strikes are not likely to occur as sea lions are able to detect and avoid vessels.

Non pup counts for the western DPS Steller sea lions in Alaska increased at an annual rate of 2.1 percent between 2000 and 2014 (Table 17; Fritz et al., 2015; Fritz et al., 2013; Johnson and Fritz, 2014; NMFS, 2014). Differences in abundance trends occur across Steller sea lion range in Alaska; however, with increasing trends east of Samalga Pass and decreasing trends to the west (Table 15; Fritz et al., 2015; Fritz et al., 2013; Johnson and Fritz, 2014). NMFS uses six sub-regions within the western DPS in Alaska for trend and status monitoring; three (eastern, central, and western) within the Aleutian Islands and three within the Gulf of Alaska (NMFS, 2008).

Vessel transit associated with this action would be likely to encounter sea lions from the eastern Aleutian, and the western and central Gulf of Alaska, where population increases have been documented (Table 17). According to NMFS recovery plan the primary factors affecting recovery are environmental variability, competition with commercial fisheries and killer whale predation (NMFS, 2008). The relative potential effect of vessel traffic on Steller sea lion recovery was judged to be low (NMFS, 2008). The effects of increased vessel traffic associated with the Project that could potentially disturb a small number of Steller sea lions would be indistinguishable from other commercial vessel traffic and is not expected to alter any of these trends.

TABLE 17

Annual Rates of Change in Non-Pup and Pup Counts of Western DPS Steller Sea Lions by Region, 2000 to 2014

Region	Longitude Range	Non Pups			Pups		
		Trend	-95%	+95%	Trend	-95%	+95%
Western DPS in Alaska	144°W-172°E	2.17	1.54	2.76	1.76	1.16	2.31
East of Samalga Pass	144-170°W	3.41	2.59	4.15	3.18	2.44	3.91
Eastern Gulf of Alaska	144-150°W	5.22	2.48	8.06	4.44	2.36	6.42
Central Gulf of Alaska	150-158°W	2.61	1.46	3.76	2.14	0.45	3.61
E-C Gulf of Alaska	144-158°W	3.67	2.36	5.08	2.83	1.58	4.07
Western Gulf of Alaska	158-163°W	4.09	2.77	5.33	3.27	1.86	4.72
Eastern Aleutian Islands	163-170°W	2.30	0.98	3.67	3.55	2.43	4.62
W Gulf and E Aleutians	158-170°W	-1.22	-2.02	-0.4	-1.66	-2.46	-0.86
West of Samalga Pass	170°W-172°E	-0.27	-1.17	0.61	-0.64	-1.56	0.23
Central Aleutian Islands	170°W-177°E	-7.10	-8.66	-5.57	-8.92	-10.14	-7.53
Western Aleutian Islands	177°E - 172°E	2.17	1.54	2.76	1.76	1.16	2.31

Source: Fritz et al., 2015; NMFS, 2014b

Shaded cells indicate western DPS Steller sea lion trend and status monitoring sub-regions (NMFS, 2008).

5.13.1.2 Effects of Potential Spills from Construction Vessel Traffic on Steller Sea Lions

Effects of HLV traffic could include spills resulting from vessel grounding. Vessel groundings that result in oil spills are rare events and, when they do occur, effects tend to be localized. The total number of accidents and the total risk of a bunker oil spill in the Aleutian Islands region are predicted to increase in the future with increasing vessel traffic (DNV and ERM, 2010; Nuka, 2015b). To reduce the likelihood of ship groundings, the International Maritime Organization (IMO, 2016) recently adopted the Aleutian Islands ATBA, which recommends ships 400 gross tonnages and above on international voyages through the Aleutian Island region, use the Northern and Southern

Great Circle routes (Figure 1). Adherence to established shipping lanes, sailing on routes well offshore of the Aleutian Islands whenever possible, and avoidance of the ATBA by vessel traffic would reduce the likelihood of ship strikes and vessel groundings that could potentially injure Steller sea lions or damage critical habitat (NCSR, 2014; Aleutian Islands Risk Assessment Project Management Team, 2011; Huntington et al., 2015).

5.13.1.3 Effects of Operational Vessel Traffic on Steller Sea Lions

Effects of LNGC traffic could include disturbance associated with vessel noise, vessel strikes, and spills resulting from vessel grounding. The low frequency sounds generated by commercial shipping vessels can travel and be detected by marine mammals at considerable distances, although much of the sound produced by large cargo carriers is at frequencies below the hearing sensitivity of Steller sea lions (Kastelein et al., 2005). Vessel strikes are not likely to occur as sea lions are able to detect and avoid vessels.

5.13.1.4 Effects of Potential Spills from Operational Vessel Traffic on Steller Sea Lions

Effects of LNGC traffic could include spills resulting from vessel grounding. Vessel groundings that result in oil spills are rare events, and when they do occur, effects tend to be localized. The total number of accidents and the total risk of a bunker oil spill in the Aleutian Islands region are predicted to increase in the future with increasing vessel traffic (DNV and ERM, 2010; Nuka, 2015b). To reduce the likelihood of ship groundings, the IMO (2016) recently adopted the Aleutian Islands ATBA, requiring ships of 400 gross tonnages and above on international voyages through the Aleutian Island region to use the Northern and Southern Great Circle routes (Figure 1). Adherence to established shipping lanes, sailing on routes well offshore of the Aleutian Islands whenever possible, and avoidance of the ATBA by vessel traffic would reduce the likelihood of vessel groundings that could potentially injure Steller sea lions or damage critical habitat (NCSR, 2014; Aleutian Islands Risk Assessment Project Management Team, 2011; Huntington et al., 2015).

5.13.2 Indirect Effects

The Project may indirectly affect Steller sea lions by reducing or altering prey availability or abundance through:

- Potential transport of aquatic invasive organisms from HLVs and LNGCs.

5.13.2.1 Effects of Construction Vessel Ballast Water Handling on Steller Sea Lions

HLVs would cross through critical habitat within the 20-nautical-mile buffer around rookies and haulouts at the entrance to Cook Inlet, at Unimak Pass, and through foraging areas in Shelikof Strait and north of Unimak Pass. Potential degradation of Steller sea lion critical habitat from vessel traffic could occur through the introduction of aquatic invasive organisms. Vectors for introducing aquatic invasive organisms from ship traffic include ballast-water discharge, fouled ship hulls, and equipment placed overboard (e.g., anchors). Construction HLV traffic could potentially transport non-native tunicates, green crab (*Carcinus maenas*) and Chinese mitten crab (*Eriocheir sinensis*) (ADF&G, 2002) which affect food webs and can outcompete native invertebrates, resulting in habitat degradation.

HLVs would plan to ballast loads with cargo rather than water ballast and use minimal amounts of freshwater for ballast. Use of freshwater ballast would allow for removal of ballast within transporting marine aquatic invasive organisms. Invasive aquatic organisms on or in semi-submersible vessels, barges, and tugs would be controlled by ballast water regulations which require a ship-specific Ballast Water Management Plan, a ballast water record book, ballast water exchange, an approved ballast water treatment system, and an International Ballast Water Management Certificate. HLVs would wash down before entering Alaska coastal waters and exchange ballast at sea to ensure a clean water discharge to minimize introduction of aquatic invasive organisms. All HLV operations would comply with USCG regulations.

All vessels brought into the State of Alaska or federal waters are subject to USCG 33 C.F.R. 151 regulations, which are intended to reduce the transfer of aquatic invasive organisms. Management of ballast water discharge is regulated by federal regulations (33 C.F.R. 151.2025) that prohibit discharge of untreated ballast water into the waters of the U.S. unless the ballast water has been subject to a mid-ocean ballast water exchange (at least 200 nautical miles offshore). Vessel operators are also required to remove "fouling organisms from hull, piping, and tanks on a regular basis and dispose of any removed substances in accordance with local, state, and federal regulations" (33 C.F.R. 151.2035(a)(6). Adherence to the USCG 33 C.F.R. 151 regulations would minimize the likelihood of Project-related vessel traffic introducing aquatic invasive species.

5.13.2.2 Effects of Operational Vessel Ballast Water Handling on Steller Sea Lions

LNGCs would cross through critical habitat within the 20-nautical-mile buffer around rookies and haulouts at the entrance to Cook Inlet, at Unimak Pass, and through foraging areas in Shelikof Strait and north of Unimak Pass. Potential degradation of Steller sea lion critical habitat from vessel traffic could occur through the introduction of aquatic invasive organisms. Vectors for introducing aquatic invasive organisms from ship traffic include ballast-water discharge, fouled ship hulls, and equipment placed overboard (e.g., anchors). Operation LNGC traffic could potentially transport non-native tunicates, green crab (*Carcinus maenas*) and Chinese mitten crab (*Eriocheir sinensis*) (ADF&G, 2002) which affect food webs and can outcompete native invertebrates resulting in habitat degradation.

All vessels brought into the State of Alaska or federal waters are subject to USCG 33 C.F.R. 151 regulations, which are intended to reduce the transfer of aquatic invasive organisms. Management of ballast water discharge is regulated by federal regulations (33 C.F.R. 151.2025) that prohibit discharge of untreated ballast water into the waters of the U.S. unless the ballast water has been subject to a mid-ocean ballast water exchange (at least 200 nautical miles offshore). Vessel operators are also required to remove "fouling organisms from hull, piping, and tanks on a regular basis and dispose of any removed substances in accordance with local, state, and federal regulations" (33 C.F.R. 151.2035(a)(6). Adherence to the USCG 33 C.F.R. 151 regulations would minimize the likelihood of project-related vessel traffic introducing aquatic invasive species.

5.13.3 Cumulative Effects

Concern for western DPS Steller sea lions are tied to significant population declines that were potentially caused by marine habitat regime change that lowered the carrying capacity of the environment; competition for prey with other predators and commercial fisheries; and predation by sharks and killer whales. Reduced prey from competition with commercial fisheries or environmental change, predation by killer whales, and environmental variability have been identified as stressors potentially affecting recovery of Steller sea lion populations (NMFS, 2015c). Although Steller sea lions are exposed to a number of stressors, the population as a whole is increasing despite declines of western DPS Steller sea lions in the western Aleutian Islands (NMFS, 2015c). With incorporation of conservation measures, activities associated with the Project are not expected to increase the overall effects to a level that would jeopardize western DPS Steller sea lions.

5.13.4 Summary of Effects

5.13.4.1 Summary of Effects on Critical Habitat

Normal construction and operation of the Project with associated vessel traffic would not result in adverse modification of designated Steller sea lion critical habitat. An oil spill associated with a vessel grounding could result in localized diminishment of forage fish, but such an event is improbable and would become even less likely to occur with compliance of the HLV and LNGC traffic with the Aleutian Islands ATBA. Spill prevention and response planning would be implemented, and vessels would be subject to USCG 33 C.F.R. 151 regulations to prevent the introduction of aquatic invasive organisms.

5.13.4.2 Summary of Effects on Western DPS Steller Sea Lions

The Project could result disturbance of individual Steller sea lions as a result of vessel traffic. These effects are likely to minor and transitory having little effect on the fitness of exposed individuals and would be indistinguishable from normal shipping traffic. Ship strikes from vessels associated with construction or operations could occur; however, the probability of such an event is low. An oil spill from a vessel grounding could be injurious or lethal to exposed animals. However, the probability of such an event is low and would be minimized through implementation of oil spill prevention and response plans. With implementation of conservation measures, western DPS Steller sea lions would not be expected to be affected.

5.14 PACIFIC WALRUS

Construction and operation of the Liquefaction Facility in and adjacent to Cook Inlet would have no direct or indirect effects on the Pacific Walrus, which in Alaska is found in the Bering, Chukchi, and Beaufort Seas. Pacific walruses are also extralimital over most of the Beaufort Sea, including Prudhoe Bay where construction of the GTP associated facilities (at West Dock) would take place (Figure 17). While walrus have been occasionally observed in the Prudhoe Bay area, such observations are rare and their presence would not be expected during construction of the Project. Walruses could potentially be affected by barge / HLV traffic associated with GTP construction through the Chukchi Sea.

5.14.1 Direct Effects

The Project may directly affect Pacific walruses through:

- Construction of modifications to West Dock – Dock Head 4;
- HLV traffic to West Dock for delivery of the GTP modules;
- Coastal barge traffic for delivery of materials, supplies to West Dock, Badami, and Point Thomson; and
- Vessel strikes; and
- Vessel groundings and potential oil spills.

The GTP and associated facilities are onshore and would not affect Pacific walruses. Construction of the coastal facilities at Prudhoe Bay would occur primarily during winter with vessel operations primarily during the open water season. Pacific walruses could potentially occur in the West Dock area during the open-water season, but I is unlikely and no effects would be expected.

Beaufort Sea is not a primary foraging habitat for walruses (USFWS, 2011a).

5.14.1.1 Dock Head Modifications and Pile Driving on Pacific Walruses

Pacific walruses are not present in the Prudhoe Bay region during winter when sheet and pile driving would occur. Pacific walruses are occasionally observed in Prudhoe Bay, but they are not considered regular inhabitants of this region. Walruses could be attracted to and haul out on West Dock (USFWS, 2011a). A few walruses have been observed at Northstar Island, the Saltwater Treatment Plant, and the Endicott Causeway (USFWS, 2011a). Walruses that haulout in work areas may become either a walrus or human safety issue, and they may need to be hazed from the area. Regulations allow the use of deterrent actions for intentional take of Pacific walrus with the intention of 1) moving walruses away from certain areas during human activities, 2) discouraging walruses from entering specific areas, and 3) preventing walruses from becoming injured during human activities (USFWS, 2014b). Walruses are not present in the Prudhoe Bay area in winter when pile driving is planned to occur. The Project would avoid and minimize and potential exposure of marine mammals to noise generated during construction by applying for an IHA, establish exclusion zones and using PSOs with the ability to shut down activities if marine mammals are sited within the exclusion zones.

5.14.1.2 Dock Head Modifications and Pile Driving on Pacific Walrus Habitat

Dock Head 4 construction would cover about 31 acres of benthic habitat with granular material. However, the area is well outside the range of the Pacific walrus. Walrus have been observed rarely in the region but are not known to forage in this area, so there would be no effect on walrus habitat.

5.14.1.3 Effects of Vessel Activity on Pacific Walruses

HLVs for delivery of modules to West Dock would follow shipping routes through the Bering, Chukchi, and Beaufort seas. The slow speeds and straight-line movement of HLVs combined with the long period of daylight enable captains and crew to see and avoid striking marine mammals. During the open-water shipping season, most Pacific walruses occur along the edge of the pack ice, and most HLVs and barges avoid large ice floes or land where walruses are likely to be found. Vessel disturbance could cause short-term interruption of walrus movements or could displace some animals as vessels pass through an area (USFWS, 2011a). Ships could collide with walruses; however, collisions would most likely be rare. Walruses are less susceptible to vessel strikes than whales, likely because they can see both above and below the water and they can move quickly.

Green and Negri (2006) monitored marine mammal occurrence and reaction to barge traffic in the Beaufort Sea between Cape Simpson and West Dock. During 15 barge trips (approximately 4,500 miles) in August-September, no walruses were observed. Walruses would be more likely to occur in proximity to the vessel traffic as the vessels pass through the Chukchi Sea.

Coastal barge traffic for delivery of pipeline and materials to Badami would follow routes that are typically within the barrier islands and few Pacific walruses would likely to be exposed to noise; vessel collisions with Pacific walruses would be unlikely to occur (NMFS, 2012c).

5.14.1.4 Effects of Potential Spills and Resultant Contamination on Pacific Walruses

Fuel transfer and refueling spills that could reach nearshore open waters or shorefast ice could potentially occur during dock modifications and construction of the staging area near West Dock. The potential for exposure to fuel storage or transfer spills would be low as most spills would be contained on granular workspaces or on ice, spilled product would be recovered, and any unrecoverable product that reaches marine water would likely be sufficiently diluted to a nonhazardous level.

The most likely source of exposure to an oil spill would be from a barge grounding with a subsequent release of fuel. Few spills have been reported in Beaufort or Chukchi sea waters (NMFS, 2015a). Potential oil effects on seals could include skin and eye irritation from contact, systemic effects from ingestion of oil from the water or contaminated prey, respiratory damage from inhalation of hydrocarbon vapors.

All fuel and hazardous liquid storage tanks and containers would be located onshore and constructed with secondary containment. Any potential spills are not likely to reach marine water habitats of bearded seals. Because the GTP handles primarily natural gas, no chance of a large oil spill exists.

5.14.2 Indirect Effects

The Project may indirectly affect Pacific walruses by reducing or altering prey availability or abundance through:

- Loss or alteration of marine benthic habitat from dock construction; and
- Potential transport of aquatic invasive organisms from HLVs.

5.14.2.1 Prey Effects

Potential indirect effects on walruses could occur through construction and operation-related reductions in benthic invertebrate prey from the West Dock area. Potential Project-related effects and mitigation to EFH are discussed in more detail in the EFH Assessment Report included as Resource Report No. 3, Appendix D. The EFH Assessment Report concludes that the potential direct and indirect effects of the Project construction and operation on marine EFH and EFH species would be minor. Specific mechanisms for effects on walrus prey are discussed under direct effects above.

5.14.2.2 Effects of Vessel Ballast Water Handling on Pacific Walrus Habitat

HLVs would anchor in Stefansson Sound inside of Reindeer Island to await offload. Ship hulls, ballast, and equipment lowered into the water may serve to transport invasive aquatic organisms that can degrade coastal marine habitats by displacing or transmit diseases to native aquatic organisms. HLVs would plan to ballast loads with cargo rather than water ballast and use minimal amounts of freshwater for ballast. Use of freshwater ballast would allow for removal of ballast without transporting marine aquatic invasive organisms. Invasive aquatic organisms on or in semi-submersible vessels, barges, and tugs would be controlled by ballast water regulations which require a ship-specific Ballast Water Management Plan, a ballast water record book, ballast water exchange, an approved ballast water treatment system, and an International Ballast Water Management Certificate. HLVs would wash down before entering Alaska coastal waters and exchange ballast at sea to ensure a clean water discharge to minimize introduction of aquatic invasive organisms.

All vessels brought into the State of Alaska or federal waters are subject to USCG 33 C.F.R. 151 regulations, which are intended to reduce the transfer of aquatic invasive organisms. Management of ballast water discharge is regulated by federal regulations (33 C.F.R. 151.2025) that prohibit discharge of untreated ballast water into the Waters of the U.S. unless the ballast water has been subject to a mid-ocean ballast water exchange (at least 200 nautical miles offshore). Vessel operators are also required to remove "fouling organisms from hull, piping, and tanks on a regular basis and dispose of any removed substances in accordance with local, state, and federal regulations" (33 C.F.R. 151.2035(a)(6). Adherence to the USCG 33 C.F.R. 151 regulations would minimize the likelihood of project-related vessel traffic introducing aquatic invasive species. Currently no aquatic invasive organisms have become established at Prudhoe Bay and little is known about the environmental tolerance of species that could be released (McGee et al., 2006).

5.14.2.3 Effects from Non-Jurisdictional Facilities

Expansion of the Point Thomson facility related to production of natural gas would include modifications to the dock and HLV traffic that could potentially affect Pacific walruses.

5.14.3 Cumulative Effects

Concern for walruses are tied to the likelihood that their sea-ice habitats have been modified by the warming climate, and that changes in ocean temperature, acidification, and ice cover threaten prey communities on which they depend (USFWS, 2015a). The disappearance of sea ice over the continental shelf likely caused walruses to haul out on shore in large numbers (USFWS, 2015a).

Other concerns include the potential effects from oil and gas exploration activities, particularly in the outer continental shelf leasing areas, such as harm and harassment from vessel and aircraft traffic, seismic exploration noise, or the potential for oil spills. Although Pacific walruses are exposed to a number of stressors, their recent population trend is unknown, but is thought to have declined since the 1970s and 1980s under current stressor regimes (USFWS, 2015a). With incorporation of conservation measures, activities associated with the Project would not be expected to increase the overall effects to a level that would jeopardize Pacific walruses.

5.14.4 Summary of Effects

5.14.4.1 Summary of Effects on Critical Habitat

No critical habitat has been designated for Pacific walruses.

5.14.4.2 Summary of Effects on Pacific Walrus

The Project may affect a few individual Pacific walruses during construction activities at West Dock primarily through potential acoustic effects. With implementation of conservation measures to monitor marine mammal occurrence near these activities and stopping activities when marine mammals could be affected, however, adverse effects would be unlikely. Shipping activities would follow established shipping lanes, would not be located near coastal or sea-ice habitats, and would be unlikely to disturb walruses. With implementation of conservation measures, the Project would not be expected to affect more than a few Pacific walrus.

5.15 NORTHERN SEA OTTER – SOUTHWEST ALASKA DPS

The range of the southwest Alaska DPS of the northern sea otter extends from the outer Aleutian Islands to the eastern Alaska Peninsula. Activities that could potentially affect the southwestern Alaska DPS northern sea otter are limited to Project-related construction and operation vessel traffic through the Aleutian Islands, Gulf of Alaska, and lower Cook Inlet.

5.15.1 Direct Effects

The Project could potentially affect southwest Alaska DPS northern sea otters and critical habitat through:

- LNGC and HLV traffic during construction and operation in lower Cook Inlet, and through the Aleutian Islands

Construction of the facilities in Cook Inlet would occur during open water with operations year-round. Northern sea otter may occur in the vicinity of the Marine Terminal primarily during summer, although they are not expected to be common in the area, and the northern sea otters occurring along the eastern shoreline of Cook Inlet belong to the non-ESA listed southcentral Alaska stock. Potential direct and indirect effects on southwest Alaska DPS northern sea otters could include:

- Vessel strikes; and
- Vessel groundings and potential oil spills.

5.15.1.1 Effects of Vessel Traffic on Northern Sea Otters

Southwest Alaska DPS northern sea otters could be exposed to vessel traffic during construction primarily in the Aleutian Islands and Shelikof Strait and boat strikes could occur or sea otters could exhibit behavioral or physiological responses to disturbance caused by vessels (USFWS, 2014c). Each year, thousands of commercial vessels cross the marine shipping route between Seattle and Asia, generally passing through the Aleutian Islands twice; once through Unimak Pass to the east and then near Buldir Island to the west. Boat strike is a recurring cause of death in the southwest Alaska stock of sea otters (USFWS, 2014c). Although, necropsies of most sea otters from ship strikes indicate that a contributing factor, such as disease or biotoxin exposure, likely made sea otters more vulnerable to boat strikes (USFWS, 2014c). Shipping traffic is predicted to increase in the future in this region (Aleutians Islands Risk Assessment Project Management Team, 2015; Nuka, 2015b).

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 heavy boat traffic, but 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. There is, however, no evidence that other effects (such as disturbance) associated with routine oil and gas development and transportation have had a direct effect on the southwest Alaska sea otter stock (USFWS, 2014c).

5.15.1.2 Effects of Potential Spills and Resultant Contamination on Northern Sea Otters

Sea otters are dependent on their fur for thermoregulation. Oiled fur loses its ability to insulate, which results in sea otters becoming hypothermic. Sea otters ingest oil while grooming oiled fur which can result in toxic effects including damage to internal organs. The most likely source of exposure to an oil spill would be from a grounded vessel with a subsequent release of fuel. While vessel groundings do occur within the sea otters range, they are rare, and there is currently no indication that small-scale spills have had an effect on southwest DPS of northern sea otters (USFWS, 2014c). Vessel grounding that results in a fuel spill or transmission of aquatic invasive organisms could result in long-term damage to sea otter critical habitat (Figure 1).

To reduce the likelihood of ship groundings, the IMO (2016) recently adopted the Aleutian Islands ATBA, which recommends that ships 400 gross tonnages and above on international voyages through the Aleutian Island region, use the Northern and Southern Great Circle routes (Figure 1). Adherence to established shipping lanes, sailing on routes well offshore of the Aleutian Islands whenever possible, and avoidance of the proposed ATBA by vessel traffic would reduce the likelihood of vessel groundings that could potentially damage critical habitat for sea otters (NCSR, 2014; Aleutian Islands Risk Assessment Project Management Team, 2011; Huntington et al., 2015).

5.15.1.3 Effects of Operational Vessel Traffic on Northern Sea Otters

Coastal shipping through the eastern Aleutian Islands, Kodiak, Kamishak, and Alaska Peninsula is identified as a moderate risk factor in the recovery of the southwest DPS northern sea otter because of proximity to ocean passes in the eastern Aleutian Islands and the shipping route into Cook Inlet, and the increased risk of potential oil or fuel spills (USFWS, 2013b). Southwest DPS northern sea otters could be exposed to LNGC traffic during operations and boat strikes could occur or sea otters could exhibit behavioral or physiological responses to disturbance caused by vessels (USFWS, 2014c). Boat strike is a recurring cause of death in the southwest DPS of northern sea otters (USFWS, 2014c), although healthy sea otters are likely capable of avoiding boat strikes.

5.15.1.4 Effects of Potential Spills and Resultant Contamination on Northern Sea Otters

The most likely source of exposure to an oil spill during operations would be from a grounded LNGC with a subsequent release of fuel. While vessel groundings do occur within the sea otters range, they are rare, and there is currently no indication that small-scale spills have had an effect on southwest DPS of northern sea otters (USFWS, 2014c). Vessel grounding that results in a fuel spill or transmission of aquatic invasive organisms could result in long-term damage to sea otter critical habitat (Figure 1, 18).

To reduce the likelihood of ship groundings, the IMO (2016) recently adopted the establishment of the Aleutian Islands ATBA, which recommends that ships 400 gross tonnages and above on international voyages through the Aleutian Island region, use the Northern and Southern Great Circle routes (Figure 1). Adherence to established shipping lanes, sailing on routes well offshore of the Aleutian Islands whenever possible, and avoidance of the proposed ATBA by vessel traffic would reduce the likelihood of vessel groundings that could potentially damage critical habitat for sea otters (NCSR, 2014; Aleutian Islands Risk Assessment Project Management Team, 2011; Huntington et al., 2015).

5.15.2 Indirect Effects

The Project may indirectly affect southwest Alaska northern sea otters by reducing or altering prey availability or abundance through:

- Potential transport of aquatic invasive organisms from HLVs and LNGCs.

5.15.2.1 Effects of Construction Vessel Ballast Water Handling on Northern Sea Otters

Potential degradation of southwest Alaska DPS northern sea otter critical habitat from vessel traffic could also occur through the introduction of aquatic invasive organisms. Vectors for introducing aquatic invasive organisms from ship traffic include ballast-water discharge, fouled ship hulls, and equipment placed overboard (e.g., anchors). Construction vessel traffic would arrive from Asia and could potentially transport non-native tunicates, green crab (*Carcinus maenas*) and Chinese mitten crab (*Eriocheir sinensis*) (ADF&G, 2002) which affect food webs and can outcompete native invertebrates, resulting in habitat degradation.

HLVs would plan to ballast loads with cargo rather than water ballast and use minimal amounts of freshwater for ballast. Use of freshwater ballast would allow for removal of ballast within transporting marine aquatic invasive organisms. Invasive aquatic organisms on or in semi-submersible vessels, barges, and tugs would be controlled by ballast water regulations, which require a ship-specific Ballast Water Management Plan, a ballast water record book, ballast water exchange, an approved ballast water treatment system, and an International Ballast Water Management Certificate (see *GTP Project Pre-FEED Logistics Plan*). HLVs would wash down before entering Alaska coastal waters and exchange ballast at sea to ensure a clean water discharge to minimize introduction of aquatic invasive organisms. All HLV operations would comply with USCG regulations.

All vessels brought into the State of Alaska or federal waters are subject to USCG 33 C.F.R. 151 regulations, which are intended to reduce the transfer of aquatic invasive organisms. Management of ballast water discharge is regulated by federal regulations (33 C.F.R. 151.2025) that prohibit discharge of untreated ballast water into the Waters of the U.S. unless the ballast water has been subject to a mid-ocean ballast water exchange (at least 200 nautical miles offshore). Vessel operators are also required to remove "fouling organisms from hull, piping, and tanks on a regular basis and dispose of any removed substances in accordance with local, state, and federal regulations" (33 C.F.R. 151.2035(a)(6). Adherence to the USCG 33 C.F.R. 151 regulations would minimize the likelihood of project-related vessel traffic introducing aquatic invasive species.

5.15.2.2 Effects of Operations Vessel Ballast Water Handling on Northern Sea Otters

Potential degradation of sea otter critical habitat from vessel traffic could occur through the introduction of aquatic invasive organisms. Vectors for introducing aquatic invasive organisms from ship traffic include ballast-water discharge, fouled ship hulls, and equipment placed overboard (e.g., anchors). LNGCs traveling between Asia and Alaska could potentially transport non-native tunicates, green crab (*Carcinus maenas*) and Chinese mitten crab (*Eriocheir sinensis*) (ADF&G, 2002), which can affect food webs and outcompete native invertebrates, resulting in habitat degradation. Adherence to the USCG 33 C.F.R. 151 regulations would minimize the likelihood of Project-related vessel traffic introducing aquatic invasive organisms.

5.15.3 Cumulative Effects

Concerns for southwest Alaska northern sea otters are tied to significant population declines that were potentially cause by increased predation by killer whales. Other threats to northern sea otters include infectious disease, biotoxins, contaminants, oil spills, food limitations, bycatch in commercial fisheries, subsistence harvest, loss of habitat, and illegal take (USFWS, 2013b). Although northern sea otters are exposed to a number of stressors, the current population has a widespread distribution and a stabilizing population trend (NMFS, 2015c). With incorporation of conservation measures, activities associated with the Project are not expected to increase the overall effects to a level that would jeopardize southwest Alaska DPS northern sea otters.

5.15.4 Summary of Effects

5.15.4.1 Summary of Effects on Critical Habitat

Normal construction and operation of the Project with associated vessel traffic would not affect sea otter critical habitat. An oil spill associated with a vessel grounding could result in localized diminishment of forage and kelp cover, but such an event is improbable and would become even less likely to occur with compliance of the HLV and LNGC traffic with the Aleutian Islands ATBA. Spill prevention and response planning would be implemented, and vessels would be subject to USCG 33 C.F.R. 151 regulations to prevent the introduction of aquatic invasive organisms.

5.15.4.1.1 Summary of Effects on Southwest Alaska DPS Northern Sea Otters

The Project could result in disturbance of individual sea otters as a result of vessel traffic. These effects are likely to be minor and transitory, having little effect on the fitness of exposed individuals and would be indistinguishable from normal shipping traffic. Ship strikes from vessels associated with construction or operations could occur; however, the probability of such an event is low. An oil spill from a vessel grounding could be injurious or lethal to exposed animals. However, the probability of such an event is low and would be minimized through implementation of oil spill prevention and response plans. With incorporation of conservation measures described previously, southwest Alaska DPS northern sea otters would not be affected.

5.16 POLAR BEARS

Construction and operation of the Liquefaction Facility in and adjacent to Cook Inlet would have no direct or indirect effects on polar bears, which in Alaska are found in the Bering, Chukchi, and Beaufort Seas and the Arctic Coastal Plain. Construction of Interdependent and Interrelated Project Facilities, specifically the GTP, Mainline, and PTTL, could potentially affect polar bears. Operation and maintenance of the GTP, Mainline, and PTTL could also affect polar bears that may occur along shorelines and inland along the Beaufort Sea coast. Alternatives (to trucking) being considered for transporting pipe, camps, materials, equipment, fuel, supplies, include the barging to existing docks at Badami, East Dock, Kuparuk, and Endicott.

5.16.1 Direct Effects

The Project components on Alaska BCP could potentially affect polar bears and their habitats through:

- Construction and operation of the GTP, including West Dock modifications, berthing basin, module laydown area, process and potable water source and pipeline, and borrow sites;
- HLV traffic to West Dock for delivery of the GTP modules;
- Construction and operation of the PTTL (entire route); and
- Construction and operation of the Mainline (MP 0 to approximate MP 14).

Construction and operation of these facilities would occur year-round; although, initial excavation and placement of granular materials or ice on tundra habitats would occur primarily during winter. Polar bears may occur in the vicinity of the Project during any time of year, but are more likely to occur during fall through spring.

Potential direct effects on polar bears could include:

- Potential injury and/or mortality from:
  - Vehicle collision;
  - Hazing, or human defense;
  - Cub mortality through natal den disturbance that causes den abandonment or mother-cub separation;
  - Exposure to hazardous materials and fuel spills or leaks;
  - Temporary or permanent loss or alteration of terrestrial denning habitat;
  - Disturbance from noise or visual stimuli such as production facilities, vessels, or air traffic; and
  - Altered productivity or survival.

5.16.1.1 Vehicle Collisions

Vehicle and machinery traffic on granular and ice roads could collide with polar bears and cause injury or mortality, although such an event is considered very unlikely. 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 used for construction of the PTTL increasing the chance for collisions. Adherence to current safety practices, which include speed limits, reduces the likelihood of collisions; to date no injury or deaths of polar bears have occurred at industry facilities from vehicle-bear collisions. Vehicle horns, sirens, lights, spot lights, and the vehicle are sometimes used to deter bears from remaining at or near a worksite (USFWS, 2011a).

5.16.1.2 Hazing or Human Defense

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 the vehicle are sometimes used to deter bears from remaining at or near a worksite (USFWS, 2011a). All workers would follow measures in the polar bear interaction plan to avoid and minimize any potential harm to workers and polar bears. Since ITRs went into effect in 1993, no known instances of a bear being killed or industry personnel being injured by a bear as a result of industry activities (USFWS, 2011a) have occurred; although, Johnson et al. (2011) reported that a female polar bear was killed from injury sustained during hazing in late August 2011.

5.16.1.2.1 GTP

Because the GTP would be located within an industrialized area, and because it would not be located on the coast, few polar bears would be expected to occur near the facility during construction (Figure 19). Bears would be most likely to occur near the facility in fall or winter, but could occur in the Prudhoe Bay region year-round.

5.16.1.2.2 Mainline

The Mainline would be located within a relatively remote area that contains potentially suitable den habitat. Construction would occur primarily during winter when pregnant female polar bears would be in dens. Few polar bears would be expected to occur within this region during pipeline construction (Figure 19, Figure 20). Polar bears may be most likely to occur near the Mainline in fall or winter, but could occur in the region year-round.

No human interaction is expected during pipeline operation. If ground-based work on the pipeline during operations is required for maintenance, polar bears may be encountered.

5.16.1.2.3 PTTL

The PTTL would be located within a relatively remote area that contains documented polar bear den sites and suitable den habitat. Construction would occur primarily during winter when pregnant female polar bears would be in dens and male polar bears may transit the region. Multiple polar bears would be expected to occur within this region during pipeline construction (Figure 19, Figure 20). Polar bears may be most likely to occur near the facility in fall or winter, but could occur in the region year-round.

No human interaction is expected during pipeline operation. If ground-based work on the pipeline during operations is required for maintenance, polar bears may be encountered.

5.16.1.3 Natal Den Disturbance

Construction in Arctic tundra is typically accomplished during the winter on frozen soils. When the active layer above the permafrost is thawed in spring to early fall, the soils generally will not support the weight of construction equipment. Winter construction; however, increases the likelihood that female polar bears that hibernate and give birth in dens from late fall through late winter could be disturbed. Denning polar bears could be disturbed. Noise or vibratory disturbances occurring close to the den site could result in wakening and den abandonment (Amstrup, 1993; Durner et al., 2006; Linnell et al., 2000). Den abandonment would result in mortality of the cub if it remains alone in the den and would likely cause reduced survival if the cub emerges from the den site prematurely. Polar bear dens around industry activities may be discovered opportunistically or from planned surveys and are routinely monitored by the USFWS; although, the known den sites represent a small percentage of the total active polar bear dens for the SBS stock in any given year (USFWS, 2011a). Industry polar bear interaction plans, developed in consultation with USFWS for issuance of a LOA, stipulate procedures to be followed when a polar bear or a bear with cubs are encountered (USFWS, 2011a).

5.16.1.4 Potential Spills and Resultant Contamination

Polar bears have been known to ingest toxic substances such as glycol (Amstrup, 2000); however, current management practices require the proper use, storage, and disposal of hazardous materials, which minimizes potential exposure (USFWS, 2011a). Fuel storage and transport for machinery and vehicles would be required, but because the pipeline and facilities handle natural gas, no chance of a large oil spill exists. It is unlikely that polar bears would be exposed to any fuel storage or transfer spills.

5.16.1.5 Habitat Loss or Alteration

Development of construction work surfaces, granular material and ice transportation corridors, aboveground facilities, and water/ice withdrawal activities would result in temporary and permanent loss or alteration of potential den habitat. Potential den habitat within the region is mapped as the linear features (units are presented in miles) that accumulate snow drifts suitable for polar bear maternity den construction (Durner et al., 2001, 2003, 2006). A summary of direct loss of potential den habitat on the BCP through placement of granular fill, excavation of the water reservoir or material sites, and pipeline trench construction and restoration is summarized in Table 18. Both buried pipelines and pipelines elevated on VSMs would alter potential denning habitat. Trenching for buried pipelines would eliminate bluffs that accumulate snow drifts. Elevated pipelines alter snow drift patterns through the snow fence effect. Because these habitat alterations would be permanent, they are included with granular fill and excavation areas in Table 18.

Habitat loss and some habitat alteration initiated during construction would continue through Project operations. The loss of 0.94 mile of potential den habitat represents a small proportion, 0.03 percent, of the total 3,140.81 miles of available den habitat in the region (Table 18). The loss of 0.84 miles of den habitat within designated critical habitat represents 0.04 percent of the available 2,339.02 miles of den habitat (Table 18). Temporary ice effects on 1.58 miles of den habitat represents 0.05 percent of total mapped den habitat, with 1.34 miles or 0.06 percent within critical habitat (Table 18).

TABLE 18

Potentially Suitable Polar Bear Den Habitat Affected During Project Construction and Operations

	Potential Polar Bear Den Habitat (miles)					
	Granular Fill or Excavation		Ice Pads or Roads		Total	
Facility Name	**Within Proposed Critical Habitat**	**Outside Proposed Critical Habitat**	**Within Proposed Critical Habitat**	**Outside Proposed Critical Habitat**	**Within Proposed Critical Habitat**	**Outside Proposed Critical Habitat**
GTP						
GTP Pad	0	0	0	0	0	0
Operations Center Pad	0	0	0	0	0	0
GTP Associated Infrastructure						
Module Staging Area	0.16	0	0	0	0.16	0
Access Roads	0.08	0	0	0	0.08	0
Reservoir Pipeline ROW	0.02	0	0	0	0.02	0
ATWS	0.01	0	0	0	0.01	0
GTP Subtotal	***0..27***	***0***	***0***	***0***	***0.27***	***0***
Pipelines						
Mainline	0.10	0.03	0	0	0.10	0.03
PTTL	0.51	0.05	0.93	0.21	1.44	0.25
PBTL	0	0	0	0	0	0
Mainline Associated Infrastructure						
ATWS	0.00	0.01	0.00	0.00	0.00	0.01
Access Roads	0.00	0.04	0.00	0.00	0.00	0.04
PTTL Associated Infrastructure						
ATWS	0.00	0.00	0.06	0.04	0.06	0.04
Access Roads/Work Pads	0.00	0.00	0.15	0.05	0.15	0.05
Pipeline Subtotal	***0.61***	***0.08***	***0.93***	***0.21***	***1.54***	***0.28***
Granular Material Total	0.92	0.08	1.13	0.30	2.06	0.37

TABLE 18

Potentially Suitable Polar Bear Den Habitat Affected During Project Construction and Operations

	Potential Polar Bear Den Habitat (miles)					
	Granular Fill or Excavation		Ice Pads or Roads		Total	
Facility Name	Within Proposed Critical Habitat	Outside Proposed Critical Habitat	Within Proposed Critical Habitat	Outside Proposed Critical Habitat	Within Proposed Critical Habitat	Outside Proposed Critical Habitat

Sources: Durner et al., 2001, 2003, 2006; CONST_MS_PTTL_FAC_ACS_ROW_PolarBearDenHabitat_intersect.shp

[a] Granular footprint, excavation, pipeline right-of-way (ROW) [material field blank for ROW or granular material]

[b] Ice footprint – temporary (single season) habitat effect [material field ice, some infrastructure that would likely be ice was blank for material moved to ice or granular material]

5.16.1.5.1 GTP

Polar bears use terrestrial habitats primarily for females to construct dens for hibernation and giving birth, and for males and females to travel and rest during open water periods. No potentially suitable den habitat would be lost due to construction of the GTP and little habitat would be lost or altered due to construction of associated infrastructure (Table 18, Figure 20). No polar bear den sites have been documented within 1 mile of the GTP (Table 18, Figure 20). Polar bears may travel along the shoreline around Prudhoe Bay, and may occur near the construction area, especially during October (Figure 19).

Polar bears traveling near the GTP would be subject to background noise levels from the Central Gas Facility (CGF) and other surrounding facilities. The additional contribution of noise from the GTP could increase background levels. Operation of the GTP 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. There is some indication, however, that polar bears may acclimate to routine industrial noises (Smith et al., 2007).

The CGF, east of the GTP, contributes to the ambient noise levels in this region which were on the order of an Leq of 52 dBA prior to operation of the Gas Handling Expansion Phase 1 (GHX-1) (Anderson et al., 1992). Noise would be expected to dissipate to background levels within 1 mile of the facility, but could contribute to degradation of an estimated 2.50 miles or 0.10 percent of available den habitat (Table 18); although there is no indication that this habitat has been used for denning by polar bears (Figure 20).

5.16.1.5.2 Mainline

Potentially suitable den habitat would be lost or altered due to construction of the Mainline and associated facilities are summarized in Table 18 and shown in Figure 20. Most of the habitat effects would be due to pipeline trenching from ice pads, access roads or material sites used to construct the Mainline. Some of these impacts would be short-term, others would be permanent if the contours are altered such that snow would not accumulate sufficiently at the location. No polar bear dens have been documented within 1 mile of the Mainline or associated facilities (Figure 20). Blasting may be required for preparation of the pipeline trench between MP 0 and MP 14, which could potentially disturb denning polar bears.

5.16.1.5.3 PTTL

Potentially suitable den habitat would be lost or altered due to construction of the PTTL and associated facilities, as summarized in Table 18 and shown in Figure 20. Most of the habitat effects would be temporary from ice pads or roads used to construct the PTTL. Four polar bear dens have been documented within 1 mile of the PTTL (Table 17, Figure 20). 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 construction area (Figure 19, Figure 20).

Winter construction increases the likelihood that female polar bears that hibernate and give birth in dens from late fall through late winter could be disturbed or dens could be destroyed. Denning polar bears could be disturbed by noise or vibrations from heavy equipment occurring close to the den site that could result in the bear wakening and abandoning the den and cub (Amstrup, 1993; Durner et al., 2006; Linnell et al., 2000). Den abandonment would result in mortality of the cub, if it remains alone in the den, and would likely cause reduced survival if the cub emerges from the den site prematurely. FLIR surveys would be conducted prior to winter construction to avoid disturbance to denning female polar bears.

5.16.1.6 Habitat Disturbance

5.16.1.6.1 Construction Disturbance

Polar bears could be disturbed by construction activity and noise, including intentional hazing away from active construction sites, as discussed previously. Polar bears commonly occur along the Beaufort Sea coast during late winter/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/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, with initiation of multiple marine-based projects near barrier islands, and with increased compliance and monitoring of industry projects (Schliebe et al., 2008; USFWS, 2011a), which increases the likelihood of human-bear encounters.

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, 2011a). 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.

GTP – West Dock Modifications

Pile driving noise for the Dock Head 4 construction may disturb and displace a few polar bears from the vicinity of the activity. Displacement is more likely during fall through early spring when polar bears may be more likely to occur in the vicinity of West Dock.

Vehicle and equipment traffic on ice would also increase the chance for vehicle collisions with polar bears. Adherence to current safety practices, which include speed limits, reduces the likelihood of collisions; and to date, no injury or deaths of polar bears have occurred at industry facilities from vehicle-bear collisions.

5.16.1.6.2 Den Disturbance

Occupied dens may be disturbed, which would be most likely in areas where suitable den habitat is present within 1 mile of access roads, facility construction sites, and the portions of the Point Thomson and Alaska Mainline pipelines in the Northern region (Table 17). The 116.47 miles of den habitat that could be disturbed represents 3.7 percent of the total 3,140.81 miles of available den habitat in the region (Table 19). The 100.49 miles of den habitat that could be disturbed within designated critical habitat represents 4.3 percent of the available 2,339.02 miles of den habitat (Table 19). These habitats have been used by denning polar bears; four polar bear den sites have been documented within 1 mile of the PTTL construction area (Table 20). Den surveys would be conducted over the area within 1.0 mile or more of all planned work areas in polar bear critical habitat before initiation of construction within a 1-mile buffer surrounding potential winter Project activities in polar bear denning habitat. Den surveys typically use forward-looking infrared sensors or trained dogs (York et al., 2004). If dens are detected, avoidance measures would be implemented as approved by the USFWS.

TABLE 19

Potentially Suitable Polar Bear Den Habitat Within 1 Mile of Project Winter Construction

Facility Name	Potential Polar Bear Den Habitat (miles)		
	Within Critical Habitat	Outside Critical Habitat	Total
GTP			
GTP Pad/Operations Center	4.66	0	4.66
GTP Associated Infrastructure	17.80	0	17.80
GTP Subtotal	***22.47***	***0***	***22.47***
Pipelines			
Mainline and Associated Facilities	20.22	4.10	24.33
PTTL and Associated Facilities	93.52	12.69	106.20
PTTL Aboveground Facilities	0.53	0.00	0.53
Pipeline Subtotal	***114.27***	***16.79***	***131.06***
Total	**99.76** [c]	**12.55** [c]	**112.31** [c]

Sources: Durner et al., 2001, 2003, 2006; CONST_MS_PTTL_FAC_ACS_ROW_PolarBearDenHabitat_1milebuffer_notdissolved_111615.shp

[a] Granular footprint, excavation, pipeline right-of-way (ROW) [material field blank for ROW or granular material]

[b] Ice footprint – temporary (single season) habitat effect [material field ice, some infrastructure that would likely be ice was blank for material moved to ice or granular material]

[c] Project totals remove duplication across multiple facilities

TABLE 20

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

Facility Name	Closest Mile Post	Distance (miles)	Year
PTTL			
Construction ROW	MP 9.3	0.67	2000-2001
Construction ROW	MP 14.9	0.35	2002-2003
Snow Storage Area	MP 26.7	0.42	1998-1999
Construction ROW	MP 336.4	0.97	2003-2004

Sources: USGS, 2010; TRL_Polar_Bear_Dens_within_1milebuffer_prj.shp

5.16.1.6.3 Operations Disturbance

While the level of activity during operations would be reduced from the levels during construction, the potential for disturbance would remain during project operations. Workers would continue to come and go from the facilities and pipeline ROW monitoring and maintenance procedures would adhere to any incidental take and polar bear interaction plan requirements identified by the USFWS. Polar bears emerging from dens located near routine industrial noise and human activity may habituate, or become accustom and less wary to activity (Smith et al., 2007; USFWS, 2011a). Habituation to stimulus, such as vehicle traffic and noise, is generally considered to be positive because polar bears may experience less stress; however, habituation may increase the risk of human-bear encounters (USFWS, 2011a).

Aerial pipeline inspections would be a potential source of operations disturbance, as would potential trench remediation and monitoring surveys. Polar bears may run from aircraft, especially helicopters that approach at low-altitude (USFWS, 2011a). 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, 2011a). During warm spring or summer days, however, even a short run may be sufficient to overheat a polar bear (USFWS, 2011a).

5.16.1.6.4 Traffic Disturbance

Polar bears may run from sources of noise and the sight of icebreakers, other vessels, and aircraft, especially helicopters. Helicopters are routinely used by research biologists to tranquilize and capture polar bears. Polar bears may respond by running, trotting, or walking away from the source or by jumping into the water if available (USFWS, 2011a).

Disturbance of nearshore/offshore transient or hunting polar bears would likely result in small-scale alterations of bear movements to avoid the vessel (USFWS, 2011a). Swimming bears would be minimally affected by underwater sounds, such as barge engines, because sound in open water would be attenuated, sounds would be masked by ambient noise, and polar bears normally swim with their heads above the surface, where noises produced underwater are weak (USFWS, 2011a). An encounter between a vessel and a swimming polar would most likely result in the bear changing its direction or temporarily swimming faster as the vessel passes (USFWS, 2011a).

Polar bears may run from sources of noise and the sight of aircraft, especially helicopters; responding by running, trotting, or walking away from the source or by jumping into the water if available (USFWS, 2011a). Polar bears fleeing from vehicles are likely to experience minimal effects when the event is temporary, the weather is cool, mothers and cubs are not separated, and the animal is otherwise unstressed (USFWS, 2011a). 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, 2011a).

GTP

Disturbance from vessel traffic during the summer is possible, although unlikely. Barge traffic is scheduled for the ice free period of 15 July to 25 August, when most polar bears would be associated with pack ice. HLV traffic would occur over 4 years with arrival/departure of 9 to 12 barges per year during the open water season. The HLV traffic would avoid ice floes and the multiyear ice edge where polar bears are most likely to occur. As polar bears have only rarely been documented swimming in open-water miles from the ice edge or ice floes vessel traffic it is expected that polar bears rarely encounter sea-lift vessels traveling through the Bering, Chukchi, and Beaufort seas.

No vessel traffic associated with GTP operations has been identified. Materials and supplies for operation of the GTP would be transported by ground or air.

Air traffic associated with construction and operation of the GTP would use existing facilities at the Deadhorse airport or local helipads within the Prudhoe Bay Oilfield. The potentially increased levels of air traffic are unlikely to cause any increased disturbance to polar bears, as few polar bears are expected to occur near the Deadhorse airport, and air traffic would generally not be necessary for access to the GTP (Figure 19). Most construction-related traffic associated with the GTP would use existing roads or ice roads during construction (Figure 19).

Air traffic associated with operation of the GTP would use existing facilities at the Deadhorse airport. The potentially increased levels of air traffic are unlikely to cause any increased disturbance to polar bears, as few polar bears are expected to occur near the Deadhorse airport, and air traffic would generally not be necessary for access to the GTP. Most operation-related traffic for movement of personnel and transport of materials and supplies associated with the GTP would use existing roads and would be reduced from construction traffic levels.

Mainline

Pipeline and materials would be transported to the construction site by truck. No vessel traffic to West Dock has been identified to support Mainline construction.

Vehicle and machinery traffic on ice roads could disturb polar bears. The use of FLIR surveys in coordination with USFWS, ice road pioneering, and prepacking of ice roads would minimize impacts to potential denning bears. Helicopters would likely be used to transport survey crews. Few polar bears are expected to occur near the Mainline route during summer, and no polar bears have been documented denning in habitats near the Mainline (Figure 420).

Routine pipeline inspections would likely be completed using a helicopter, which could create some disturbance across the Mainline ROW. A few polar bears could be disturbed by these overflights. Disturbance would be most likely during landing and takeoff from the helipads at MP 18.9 and MP 35.

PTTL

A portion of the pipe and materials for constructing the PTTL would be delivered by coastal barge to the Badami Dock and staged in a pipe storage yard south of the Badami Development and airstrip. Barge traffic is scheduled for the ice-free period of 15 July to 25 August, when most polar bears would be associated with pack ice.

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 used for construction of the PTTL increasing the chance disturbance and potential collisions. Helicopters and airplanes would most likely be used to support survey crews and to transport crews to Point Thomson and Badami prior to completion of the ice roads.

Routine pipeline inspections would likely be completed using a helicopter, which could create some disturbance across the PTTL ROW. A few polar bears could be disturbed by these overflights. Some pipeline inspection disturbance would also be expected for the existing Point Thomson and Badami oil pipelines.

5.16.1.6.5 Waste

GTP

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. The GTP and camp facilities would implement waste management plans that avoid and minimize potential access to food wastes. The GTP and associated facilities would be located in a low density polar bear area; no polar bear dens have been documented in the vicinity and few polar bears are anticipated to be attracted to the area (Figure 20).

Mainline

Polar bears may be attracted to camp facilities and 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. The construction camps would implement waste management plans that avoid and minimize potential access to food wastes. The Mainline and associated facilities would be constructed during winter through potentially suitable denning habitat between MP 0 and MP 14 (Table 19); although, no polar bear dens have been documented near the Mainline route (Figure 20). Workers would follow the measure in the polar bear interaction plan to minimize attraction of bears to the construction site.

PTTL

Polar bears may be attracted to construction camps 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. The construction camps would implement waste management plans that avoid and minimize potential access to food wastes. The PTTL and associated facilities would be constructed during winter through previous denning areas; polar bears have been documented near the Point Thomson Development and polar bears are likely to occur in the vicinity of the Badami Camp and could be attracted to the area. Workers would follow the measure in the polar bear interaction plan to minimize attraction of bears to the construction site.

5.16.1.7 Altered Productivity or Survival

Construction in Arctic tundra is typically accomplished during the winter on frozen soils. When the active layer above the permafrost is thawed in spring to early fall, the soils generally will not support the weight of construction equipment. Winter construction, however, increases the likelihood that female polar bears that hibernate and give birth in dens from late fall through late winter could be disturbed. Denning polar bears could be disturbed. Noise or vibratory disturbances occurring close to the den site could result in wakening and den abandonment (Amstrup, 1993; Durner et al., 2006; Linnell et al., 2000). Den abandonment would result in mortality of the cub if it remains alone in the den and would likely cause reduced survival if the cub emerges from the den site prematurely. Polar bear dens around industry activities may be discovered opportunistically or from planned surveys and are routinely monitored by the USFWS; although, the known den sites represent a small percentage of the total active polar bear dens for the SBS stock in any given year (USFWS, 2011a). Industry polar bear interaction plans, developed in consultation with USFWS for issuance of a LOA, stipulate procedures to be followed when a polar bear or a bear with cubs are encountered (USFWS, 2011a).

Polar bears have been known to ingest toxic substances such as glycol (Amstrup, 2000); however, current management practices require the proper use, storage, and disposal of hazardous materials, which minimizes potential exposure (USFWS, 2011a). Fuel storage and transport for machinery and vehicles would be required, but because the pipeline and facilities handle natural gas, no chance of a large oil spill exists. It is unlikely that polar bears would be exposed to any fuel storage or transfer spills.

5.16.2 Indirect Effects

The Project may indirectly affect polar bears by reducing or altering ringed seal availability or abundance through:

- Disturbance and displacement from West Dock construction noise;
- Disturbance and displacement from HLV docking noise;

- Vessel strikes; and
- Vessel groundings and potential oil spills.

Ringed seal are the primary prey of polar bears and potential Project-related effects on ringed seals are described previously. Disturbance and displacement of ringed seals during winter construction would be most likely to have a potential indirect effect on polar bears. The Project may adversely affect a few Arctic ringed seals during construction activities at West Dock primarily through potential acoustic effects, but also potentially through injury or mortality from on-ice construction. With implementation of conservation measures for identifying and monitoring marine mammal occurrence near these activities and stopping activities when marine mammals could be affected; however, adverse effects are unlikely. No ringed seals were estimated to be exposed to harassing or injurious levels of impact or vibratory pile driving noise. Seals are generally tolerant of industrial noise and are less sensitive to lower frequency noises, such that noise generated during HLV docking is unlikely to harass ringed seals. With implementation of conservation measures, it would be unlikely that more than a few ringed seals would be affected during on-ice construction.

5.16.3 Effects from Non-Jurisdictional Facilities on Polar Bears

The proposed PTU Expansion project would include construction and operation of new facilities that could potentially affect polar bears. Expansion within Prudhoe Bay would include construction of new aboveground pipelines, some of which would cross polar bear critical habitat.

These activities are in the same geographic area and are of the same type and magnitude as the activities assessed in the USFWS (2012) BO for the Point Thomson Project. USFWS (2012) found that the proposed Point Thomson Project activities may adversely affect polar bears through habitat loss, disturbance, and an increase in polar bear-human interactions. They concluded that the effects would be minor, with only a small number of polar bears adversely affected through disturbance and no lethal impacts, and that the continued existence, survival, or recovery of the polar would not be jeopardized.

5.16.4 Cumulative Effects on Polar Bears

USFWS's concern for polar bears is tied to the decline in their principal habitat, sea ice, and the projected decline that is expected to continue for the foreseeable future. Loss of their sea ice habitat threatens the polar bear throughout all of its range (73 FR 28212). The two main stressors for polar bears in Alaska are loss of sea ice resulting from climate change and subsistence hunting (USFWS, 2015a). Other concerns include the potential effects from oil and gas exploration and development, oil spills and environmental contaminants, research activities, and polar bear viewing at Village whale bone piles (USFWS, 2015a). The polar bear population is considered to be declining under the current stressor regimes (USFWS, 2015a). With incorporation of conservation measures, activities associated with the Project are not expected to increase the overall cumulative effects to a level that would jeopardize polar bears.

5.16.5 Summary of Effects

5.16.5.1 Summary of Effects on Critical Habitat

Small amounts of potentially suitable den habitat would be permanently affected as a result of facility construction and would temporarily affect an area of potentially suitable den habitat through ice road and pad construction. The GTP may alter habitat suitability for a small area around the facility as a result of noise generated during operation. Winter construction activities would temporarily reduce potentially suitable den habitat.

5.16.5.2 Summary of Effects on Polar Bears

The Project may cause some disturbance to a few polar bears primarily during construction, with a low level of continued potential for disturbance during operations. With development and implementation of LOAs and appropriate conservation measures, however, these activities would be unlikely to affect more than a few polar bears.

5.17 WOOD BISON

The ADF&G reintroduced wood bison into the lower Innoko/Yukon River release site in 2015. Currently, no Project activities coincide with this release site. The Mainline would cross through the defined NEP area and one of the unused reintroduction sites, Minto Flats. There are currently no plans or schedules for reintroduction to Minto Flats. Because it is not expected that wood bison from the lower Innoko/Yukon River reintroduction site would range into the Project area, the Project is not expected to affect wood bison.

5.18 ESKIMO CURLEW

The Eskimo curlew formerly migrated through eastern and northwestern Canada from wintering areas in South America to nest on the Arctic tundra in Alaska and northwestern Canada. The Eskimo curlew is believed to no longer occur within Alaska or the Project action area; as a result, the Eskimo curlew would not be affected, and a detailed analysis of effects was not conducted.

5.19 SHORT-TAILED ALBATROSS

Activities that could potentially affect short-tailed albatrosses are limited to Project-related vessel traffic that would occur through Alaska waters in support of construction and operation of the Liquefaction Facility, Mainline, and GTP. The areas that are most heavily used by short-tailed albatross include 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., 2007a; Tickell, 2000; USFWS, 2009a).

5.19.1 Direct Effects

The Project could potentially affect short-tailed albatross and their habitat through:

- LNGC and HLV traffic during construction and operation in the Gulf of Alaska, and through the Aleutian Islands.

Potential direct effects on short-tailed albatross could include:

- Vessel disturbance; and
- Vessel groundings and potential oil spills.

5.19.1.1 Effects of Vessel Traffic on Short-tailed Albatross

While a potential exists for vessel disturbance from the Project during LNGC traffic in the Gulf of Alaska and through the Aleutian Islands, and HLV traffic through the Gulf of Alaska, Aleutian Islands, and Bering Sea; due to the widespread distribution of short-tailed albatross, the risk of disturbance is expected to be low. The Aleutians and Bering Sea may be especially important during molting (USFWS, 2015a). 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 (Figure 22; USFWS, 2015a).

5.19.1.2 Effects of Vessel Spills and Resultant Contamination

Molting short-tailed albatross in the Aleutian Islands may be vulnerable to oil spills or vessel collisions (USFWS, 2014d). Project-related LNGC and HLV traffic would occur within the nonbreeding range of the short-tailed albatross, and shipping is a major source of spills in the Aleutian Islands and Bering Sea. 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 (DNV and ERM, 2010; USFWS, 2015a). Albatross molting in these areas may be less mobile and more sensitive to oil spills (USFWS, 2014d).

Aleutian Islands vessel routing measures that establish five Areas to Be Avoided (ATBAs) went into effect on January 1, 2016 for vessels making transoceanic voyages through the Bering Sea and North Pacific Ocean (Nuka, 2015a). Compliance with the Aleutian Islands ATBAs and recommended short-tailed albatross avoidance areas by Project-related vessel traffic would reduce the potential for effects from possible vessel grounding and associated releases on short-tailed albatross (DNV and ERM, 2011; Nuka, 2015b; USFWS, 2015a).

5.19.2 Indirect Effects

Project-related vessel traffic is not expected to indirectly affect short-tailed albatross foraging habitat.

5.19.3 Cumulative Effects

Projected increases in shipping traffic related to opening of the Northwest Passage as a result of reduced ice cover from global climate change would increase the potential for cumulative effects on short-tailed albatross from potential spills in Alaska waters. Possible changes in short-tailed albatross habitat from climate change include changes in prey distribution as well as increased shipping traffic.

5.19.4 Summary of Effects on Short-tailed Albatross

Short-tailed albatross were listed as endangered primarily due to overexploitation by feather hunters that almost drove the species to extinction. Current risk factors for short-tailed albatross include catastrophic events at their nesting islands, climate change and ocean regime shift, mortality from fisheries, contaminants, and oil spills. Short-tailed albatross would not be expected to be affected, although there would be a low risk of vessel traffic disturbance.

5.20 SPECTACLED EIDER

Construction and operation of the Liquefaction Facility in and adjacent to Cook Inlet would have no direct or indirect effects on spectacled eiders, which in Alaska are found in the Bering, Chukchi, and Beaufort Seas and the Arctic Coastal Plain. Construction of Interdependent and Interrelated Project Facilities, specifically the GTP, Mainline, and PTTL, could potentially affect spectacled eiders. Operation of the GTP, Mainline, and PTTL could also affect spectacled eiders which may be present on the BCP during spring through fall. Alternatives (to trucking) being considered for transporting pipe, camps, materials, equipment, fuel, supplies, include the barging to existing docks at Badami, East Dock, Kuparuk, and Endicott.

5.20.1 Direct Effects

The Project components that could potentially affect spectacled eiders and their habitats include:

- Construction and operation of the GTP, including West Dock modifications module laydown area, process and potable water source and pipeline, flare stack, lighting, communication towers, and borrow sites;
- HLV traffic to West Dock for delivery of the GTP modules;
- Construction and operation of the PBTL (entire route);
- Construction and operation of the PTTL (entire route);
- Construction and operation of the Mainline (MP 0 to approximate MP 62); and
- Construction and operation of access roads.

Construction and operation of these facilities would occur year-round; although, initial excavation and placement of granular materials or ice on tundra habitats would occur prior to nesting of spectacled eiders on the BCP. Spectacled eiders are present on the BCP during spring through fall. Potential direct effects on spectacled eiders could include:

- Potential collision or exposure injury and/or mortality from:
  - Marine vessels;
  - Vehicles and equipment;
  - Buildings, flares, and communication towers; and
  - Spills or leaks of toxic materials.
- Potential habitat loss and disturbance including:
  - Physical changes resulting in loss of habitat;
  - Displacement from or attraction to altered habitats; and
  - Disturbance from noise or visual stimuli.

5.20.1.1 Vessel Collisions

During poor weather and poor visibility conditions, low-flying spectacled eiders could collide with the modules on HLVs in transit to West Dock through the Chukchi and Beaufort seas. HLVs would anchor in Stefansson Sound inside of Reindeer Island to await offload, where they could present a collision hazard, especially late in the season when fall migrating spectacled eiders transit nearshore areas at average altitudes of 19.7 feet ± 29.2 feet Standard Error and relatively high rates of speed at about 45 miles per hour (Day et al. 2015; USFWS, 2010a).

Vessels would transit the Chukchi Sea and the Beaufort Sea. Spectacled eider / ship collision rates are unknown, but occur (Lovvorn, et al. 2003). USFWS (2010a) estimated possible collision mortality rates for offshore structures based upon observed strikes of common eiders at Northstar Island. They calculated an estimated strike rate of 0.44 spectacled eider per year per structure in the Chukchi Sea; no estimate was provided for the Beaufort Sea but they indicated that it would be significantly lower and decreasing eastward (USFWS, 2010a). Strike rates for vessels are likely considerably lower as they are much smaller than an offshore structure.

Minimizing lighting on anchored HLVs to illuminate on-deck work areas during periods of darkness or inclement weather would minimize attraction of birds to the HLVs, thereby minimizing the potential for collisions.

No vessel traffic associated with GTP operations has been identified. Materials and supplies for operation of the GTP would be transported by ground or air.

5.20.1.2 Vehicle Collisions

Air traffic associated with construction and operation of the GTP would use existing facilities at the Deadhorse airport or local helipads within the Prudhoe Bay Oilfield. The potentially increased levels of air traffic are unlikely to affect spectacled eiders, as few eiders have been documented nesting near the Deadhorse airport, and air traffic would generally not be necessary for access to the GTP (Figure 24).

Brood-rearing eiders are susceptible to vehicle collisions as they cross roadways. Brood-rearing eiders move extensively within the Prudhoe Bay regions, crossing over roads and under pipelines (TERA, 1995). Most construction-related traffic associated with the GTP would use existing roads or ice roads during construction. Recent density estimates, as well as 1992 to 2010 sightings (ALCC, 2012), indicate that few spectacled eiders currently use the area surrounding the airport, access roads near the GTP or between the GTP and West Dock (Figure 24). Driver awareness and vehicle speed limits would reduce risk for injury or mortality to spectacled eider broods.

5.20.1.2.1 Traffic (Air, Land)

Vehicle traffic for movement of personnel and transport of materials and supplies would be reduced from construction traffic levels. Some potential disturbance and collision mortality risk would continue to occur that may reduce habitat suitability near the GTP.

5.20.1.3 Facility Collisions

5.20.1.3.1 GTP

During poor weather and visibility conditions, low-flying spectacled eiders could collide with GTP facilities, towers, cranes or construction equipment at West Dock or sealift vessels. The estimated collision mortality rate for a stationary structure in the Chukchi Sea was 0.44 spectacled eider per year, with a significantly lower estimate for structures in the Beaufort Sea and decreasing farther east (USFWS, 2010a). The potential for eider collisions with facilities are further reduced at inland location as eiders typically migrate over water along shorelines (Day et al., 2005). Communication towers or overhead power lines have an increased collision risk because of their reduced visibility. Most collisions would be expected during periods of poor visibility, such as fog or low clouds, during fall migration. Overall, the probability of spectacled eider collisions with the GTP and pipelines would be low because facilities would be located inland from Prudhoe Bay and most spectacled eiders would be expected to migrate offshore (Figure 23). Communications towers would be designed without guy wires, which reduces their collision risk to birds. Downward shielded facility lighting may also to reduce the risk of spectacled eider collisions with the GTP and pipelines.

During poor weather and visibility conditions, low-flying spectacled eiders could collide with GTP modules, buildings, and communication towers. The Waste Heat Recovery Units and Stacks would be about 240 feet tall, and would likely be the tallest structure at the GTP. The potential for eider collisions with the GTP are likely reduced by its inland location as eiders typically migrate over water along shorelines (Day et al., 2005). Facility modules would range from about 25 to 180 feet high. These structures would be visible to eiders under normal conditions. Communication towers or overhead power lines have an increased collision risk because of their reduced visibility. The communication tower at the GTP would be about 150 feet tall. The proposed plans provide power onsite at the GTP and no overhead power lines would be used. Most collisions would be expected during periods of poor visibility such as fog or low clouds during fall migration. Outdoor lighting can attract birds to facilities especially during periods of low visibility potentially increasing collision risk. Overall, the probability of spectacled eider collisions with GTP facilities would be low because facilities would be located inland from Prudhoe Bay and most spectacled eiders would be expected to migrate offshore (Figure 23). Communications towers designed without guy wires would reduce their collision risk to birds. Lighting directed only where needed and use of downward shielded light fixtures would minimize potential attraction of birds to the facility during periods of impaired visibility.

The flare stacks for the GTP would be located on a granular pad that extends into a basin wetland complex that has been used by spectacled eiders (TERA, 1996; Larned et al., 2005). Eiders using this basin complex may be at an increased risk for collision with the flare stacks. The height of the flare would generally preclude an incineration hazard for nesting birds. The bright light emitted during flare events may attract migrating eiders, and could present a collision and incineration hazard for migrating spectacled eiders; although, most eiders would be expected to migrate offshore and at mean altitudes well below the flare height (Day et al., 2015). The flare stacks would be equipped with aviation obstruction lighting.

5.20.1.4 Potential Spills and Resultant Contamination

Eiders exposed to fuels would lose the ability to thermo-regulate and would ingest the substance during preening. The potential for exposure to fuel storage or transfer spills would be low as most spills would be contained on granular workspaces, spilled product would be recovered, and any unrecoverable product that reaches water would likely be sufficiently diluted to a nonhazardous level. Flashers and deterrents would be used around spills that reach ponds or lakes to prevent exposure to waterfowl, including eiders.

Any fuel spills and oil drips from vehicles during summer staging or winter construction would be contained and cleanup. Fuel storage at remote locations to support construction would use BMPs and secondary containments. Vessel traffic for delivery of the pipeline to Badami would present a potential for a coastal fuel spill, which could affect spectacled eiders, although spectacled eider density is expected to be low east of the Sagavanirktok River. Trucks for delivery of pipeline and fuel along the Mainline construction spread potential for fuel spills, which could affect spectacled eiders, although spectacled eiders are not expected to occur south of about MP 33.

Snow management could push contaminated snow into the lake basin north of the GTP or east of the Operations Center Pad. This basin habitat may be suitable for spectacled eider nesting; snow management that pushes snow into this basin could increase the risk of exposure of spectacled eiders to contaminants. Flashers and deterrents would be used around spills that reach ponds or lakes to prevent exposure to waterfowl, including eiders.

5.20.1.5 Disturbance

Summer activities such as surveys, GTP construction activities, pipeline construction, erosion control and rehabilitation work, HLV traffic, and vehicle traffic, would increase disturbance levels. Summer use of workspaces, staging areas, and roads would also increase during construction and could disturb eiders nesting near these activities. Potential effects of disturbance on breeding eiders could range from temporary displacement of individuals to abandonment of nests, loss of eggs or young exposed to predators and inclement weather, and indirect loss of nesting and brood-rearing habitat. Studies of the effects of construction and operation of a remote drilling site and airstrip revealed that spectacled eiders were not displaced, did not change habitat use, and breeding productivity was not altered near the drill site during 3 years of construction and operations at the site (Johnson et al., 2008). Several pairs of spectacled eiders would be expected to use habitats within the Project vicinity and could potentially be exposed to construction disturbance.

Potential disturbance from vehicles and equipment during operations would be reduced from construction; although, some spectacled eiders may avoid the area around the GTP due to noise from the facility. Some potential vehicle traffic disturbance would continue to occur that may reduce habitat suitability near the GTP. Several studies have suggested that eiders may tolerate or become habituated to human presence, established facilities, and relatively high levels of noise, such as that produced by low-level aircraft (Johnson et al., 2008). Inspections of the pipeline segment not paralleling the road by workers on the tundra during the nesting season could disturb eiders. If ground-based work on the PTTL during operations is required, a few spectacled eiders could be disturbed.

The Mainline would be buried through potential spectacled eider nesting habitat from MP 0 to MP 62. Routine maintenance would not affect spectacled eiders. Potential erosion control measures and rehabilitation activities during summer could potentially disturb spectacled eiders. Required materials and supplies would be transported primarily by the existing road system and operation of the pipeline may increase the overall traffic on the Dalton Highway into Deadhorse and to the GTP where the Mainline originates. No compressor stations would be located within spectacled eider nesting habitat on the BCP. No spectacled eiders are expected to nest south of approximately MP 33 on the Mainline.

5.20.1.5.1 Marine Construction

Disturbance from nearshore construction activities at West Dock would be most likely to affect spectacled eiders during the post-breeding period. Pile and sheet driving that may be completed during spring through fall would generate sudden, erratic, acute noise, which typically results in a startle response from wildlife because the noise is perceived as a threat (Francis and Barber, 2013). Noise generated during these activities may disturb pre-nesting, nesting, brood-rearing, or post-breeding eiders within distances of up to 0.5 mile. Spectacled eiders have been observed on both the east and west side of the road south of the West Dock staging pad during nesting surveys (TERA, 1996), which would be located more than a mile from where the sheet pile and pilings would be installed.

A few spectacled eiders may use marine waters near West Dock during post-breeding (Sexson et al., 2011) and summer construction activities could displace a few spectacled eiders from nearshore habitats within the western Beaufort Sea important area which is located within about 19 miles of the coast of northern Alaska and along the coast between Point Barrow and the Sagavanirktok River delta (Smith et al., 2014). Spring migration staging was not apparent within the western Beaufort Sea; important area and timing of departure in late August through September indicated limited use of this area during molting, with adult females and juveniles remaining on land through mid-September (Smith et al., 2014). Due to the nature of spectacled eider use of this area, few eiders are expected to be disturbed or displaced by summer construction activities and no eiders would be affected by winter construction activities .

5.20.1.5.2 Vessel Traffic

Disturbance by HLV traffic and nearshore construction activities during the post-breeding period is also possible. Barge traffic is scheduled for the ice free period of 15 July to 25 August, when spectacled eiders may occur in the marine waters near West Dock and in Harrison Bay (Sexson et al., 2011). Spectacled eiders using these areas may be temporarily displaced by boat and barge traffic, but would be expected to resume normal activities after vessels pass through the area.

Pipeline and materials for constructing the PTTL would be delivered by coastal barge to the Badami Dock and staged in a pipe storage yard south of the Badami Development and airstrip. Transport of the pipeline from West Dock to Badami could disturb a few spectacled eiders in nearshore marine waters near West Dock. Marine waters to the east of the Sagavanirktok River delta are not considered part of the western Beaufort Sea important area for spectacled eiders (Sexson et al., 2014), and vessel traffic to Badami is unlikely to encounter spectacled eiders.

Pipeline and materials for construction of the Mainline would be delivered by trucks to the BCP. No additional vessel traffic to Prudhoe Bay would be necessary, so no additional effects on spectacled eiders near West Dock would be expected.

No vessel traffic associated with GTP operations has been identified. Materials and supplies for operation of the GTP would be transported by ground or air. No vessel traffic would be associated with Mainline operations.

5.20.1.5.3 Air Traffic

Air traffic associated with construction and operation of the GTP would use existing facilities at the Deadhorse airport or local helipads within the Prudhoe Bay Oilfield. The potentially increased levels of air traffic are unlikely to affect spectacled eiders, as few eiders have been documented nesting near the Deadhorse airport, and air traffic would generally not be necessary for access to the GTP (Figure 24).

Pipeline staging, construction of the camp and pipe storage yard pads, and survey work during summer may require some air transport between Point Thomson, Badami, and Deadhorse airports. Pipeline construction and survey work during summer may require some air transport and low-level overflights along the pipeline corridor between the Deadhorse airport and the southern extent of potential spectacled eider habitat at MP 63. No spectacled eiders are expected to use habitats inland from about MP 33 along the Mainline. A few spectacled eiders could be disturbed by the increase in air traffic to support construction of the Mainline between MP 0 and MP 33. Most air traffic would follow minimum flight altitudes to avoid disturbance to wildlife, but a few spectacled eiders could be disturbed by the increase in air traffic. Most construction traffic would be during winter on existing roads or ice roads and pads and would not affect spectacled eiders.

No additional air traffic would be required for construction of the PBTL. Construction traffic would occur on the existing road and ice work surface during winter when spectacled eiders do not occur on the BCP. Most air traffic would follow minimum flight altitudes to avoid disturbance to wildlife.

Routine pipeline inspections would likely be completed using a helicopter, which could create some disturbance across the PTTL ROW. Six sightings of spectacled eiders have occurred within 1,640 feet of the PTTL ROW, with a maximum of two sightings per year from 1992 to 2010 (ALCC, 2012). None of these sightings occurred near the helipad at MP 35, where most disturbance would potentially occur as helicopters land and take off. Some pipeline inspection disturbance would also be expected for the PTTL and the Badami pipeline.

No spectacled eiders are expected to nest south of approximately MP 33 on the Mainline. Aerial surveillance for the Mainline from MP to MP 33 could disturb spectacled eiders, although none have been observed within 1,640 feet of the Mainline ROW. The Mainline would cross on the east side of a lake basin complex between MP 9 and MP 10, where spectacled eiders have been observed (ALCC, 2012).

5.20.1.6 Habitat Loss

Habitat loss can occur from development within eider breeding habitat. BCP-drained lake basins, including salt affected basins exposed through shoreline erosion at the coast and fresh water inland basins which typically contain a complex mixture of ponds, deep water, emergent vegetation, and complex shorelines, appear to provide optimal breeding habitat for spectacled eiders (65 FR 6125); although, the best indicator of habitat suitability may be previous use as females show fidelity to nesting areas (66 FR 9164).

Granular material placement, as well as water reservoir and material site excavation, associated with the GTP and pipeline construction would result in the long-term loss or alteration of eider nesting habitat (Table 21). Temporary habitat loss would result from ice pads and ice roads built for pipeline construction because the ice would not be completely melted prior to initiation of nesting. Several pairs of spectacled eiders are likely to use habitats near the GTP and in areas crossed by the PTTL and PBTL and the water reservoir (Table 21, Figure 24). Nesting habitat for spectacled eiders is abundant on the BCP and was not identified as critical habitat or considered a factor limiting the recovery of spectacled eiders on the BCP (66 FR 9146).

TABLE 21

Spectacled Eider Nest Habitat and Estimated Nests Potentially Affected Annually During Project Construction and Operations

Facility Name	Habitat Effects by Breeding Pair Densities			Total (acres)	Estimated Effects of Construction (# of birds)	Estimated Effects of Operations (# of birds)
	Low Density (acres)	Low-Medium Density (acres)	Medium Density (acres)			
Granular Infrastructure[a]						
GTP & Associated Infrastructure						
GTP Pad	122.30	105.58	0.00	227.88	0.06	0.06
Operations Center Pad	0.00	56.00	0.00	56.00	0.02	0.02
Module Staging Area	58.64	27.94	0.00	86.58	0.02	0.02
Access Roads	36.33	150.36	8.15	194.84	0.08	0.08
Material Site	0.00	140.77	0.39	141.16	0.06	0.06
GTP Ice Pads	0.00	2.75	0.00	2.75	0.00	0.00
GTP Reservoir	0.00	29.65	5.48	35.12	0.01833	0.01833
Reservoir Pad		11.27	2.39	13.66	0.007	0.007
Pipeline ROW	7.88	55.10	7.33	70.32	0.03227	0.03227
GTP Subtotal	**225.15**	**565.40**	**21.34**	**811.90**	**0.29640**	**0.29640**
Pipelines						
Mainline	952.57	92.21	23.27	1,068.06	0.17	0.12
PBTL	7.31	0.00	0.00	7.31	0.00	0.00
PTTL	975.81	324.66	426.16	1,726.62	0.66	0.23
Mainline Associated Infrastructure						
ATWS	37.26	7.85	3.24	48.36	0.01072	0.00000
Access Roads	157.20	16.06	0.00	173.26	0.02474	0.00000
Construction Camps	35.28	35.24	0.00	70.52	0.01960	0.00000
Helipad	0.23	0.00	0.00	0.23	0.00003	0.00003
Pipe Storage Yards	22.04	9.18	0.00	31.22	0.00655	0.00000
Material Sites	227.68	0.00	0.00	227.68	0.02550	0.00000
PTTL Aboveground Facilities						
MLBV	0.27	0.00	0.14	0.41	0.00016	0.00016
PTTL Associated Infrastructure						
ATWS	5.00	8.09	7.88	20.97	0.01159	0.00000
Construction Camps	29.04	0.00	68.18	97.22	0.06762	0.00000
Pipe Storage Yards	14.23	0.00	13.77	28.01	0.01460	0.00000
Helipad	0.57	0.00	0.00	0.57	0.00006	0.00006
Pipeline Subtotal	***3,876.89***	***514.76***	***586.35***	***4,978.00***	***1.231***	***1.231***
Granular Material Total	**2,689.67**	**1,058.69**	**563.98**	**4,312.34**	**1.30370**	**0.64328**

TABLE 21

Spectacled Eider Nest Habitat and Estimated Nests Potentially Affected Annually During Project Construction and Operations

Facility Name	Habitat Effects by Breeding Pair Densities			Total (acres)	Estimated Effects of Construction (# of birds)	Estimated Effects of Operations (# of birds)
	Low Density (acres)	Low-Medium Density (acres)	Medium Density (acres)			
Ice Infrastructure [b]						
Mainline Associated Infrastructure						
Access Roads	352.65	27.02	6.97	386.64	0.05807	0.00000
PTTL Aboveground Facilities						
MLBV	0.14			0.14	0.000	0.000
PTTL Associated Infrastructure						
Access Roads	135.99	15.21	50.96	202.16	0.07009	0.00000
Ice Total	**391.51**	**26.09**	**2.27**	**419.86**	**0.058**	**0.000**

Sources: USFWS MBM, 2014; CONST_MS_PTTL_FAC_ACS_SPEI0912_DENSITY

Low Density = 0.000 to 0.028 birds/km^2

Low-Medium Density = 0.028 to 0.111 birds/km^2

Medium Density = 0.111 to 0.236 birds/km^2

Note the highest value within each range was used for estimating potential effects on nesting spectacled eiders.

[a] Granular footprint, excavation, pipeline construction right-of-way (ROW) [material field blank or granular material]

[b] Ice footprint – temporary (single season) habitat effects [material field ice, some infrastructure that would likely be ice was blank for material]

[c] Estimated effects (number of birds) was calculated as Project footprint acres of habitat identified as having low, low-medium, and medium nesting densities x the highest value in the range of densities indicated above

5.20.1.6.1 GTP

Construction of the GTP would include excavation and granular fill within eider nesting habitat in the Prudhoe Bay region, resulting in long-term habitat loss (Table 21, Figure 24). Excavation and initial granular fill for the GTP, material site, water reservoir, and associated roads, is planned for winter months when spectacled eiders are not present on the BCP, and no eider nests would be lost from excavation or placement of granular fill. Granular haul, smoothing, and working to dewater and compact granular material would continue through summer months.

The area for the GTP and associated facilities is located within a region of low, low-moderate, and moderate spectacled eider nesting density (Figure 24). Previous more comprehensive surveys in this region have identified spectacled eider nesting, brood-rearing, and fall staging use of the ponds between the GTP and CGF that would be crossed by the CGF Road; nesting and fall staging on islands in the Putuligayuk River delta west of the GTP; and pre-nesting, nesting, brood-rearing, and fall staging in the basin complex north of the NGI pad and west of the West Dock Road (Anderson et al., 1992). The basin complex north of the GTP and east of the Operations Center Pad that the flare stacks would extend into was used by spectacled eiders for nesting during 1991 to 1995 (TERA, 1996), with the most recent sighting in this basin during June 2005 (Larned et al., 2005).

Most of the GTP construction-related habitat loss, 70 percent, would occur within the low-medium spectacled eider density area (Table 21, Figure 24).

Summer activities such as surveys and GTP construction activities would increase local disturbance levels. Summer use of workspaces, staging areas, and roads would increase during construction and could disturb eiders nesting near these activities. Based on current density estimates, as well as 1992 to 2010 sightings (ALCC, 2012), less than one pair of spectacled eiders may use habitats that would be lost or altered due to construction of the GTP (Table 21).

Operation of the GTP would generate noise above ambient levels. Studies of responses of waterbirds, including spectacled eiders, to noise generated at the nearby GHX-1 facility found the turbines generated low frequency (31.5 Hz and 63 Hz) noise and increased industrial noise in the area by about 2.7 dBA, depending on winds. The CGF, east of the GTP, contributes to the ambient noise levels in this region which were on the order of and Leq of 52 dBA prior to operation of the GHX-1 (Anderson et al., 1992).

Snow management during operations would create snow piles on the edges of the pads that would delay access of wetland habitats in these areas to nesting birds. The area north of the GTP pad provides basin habitat that may be suitable for eider nesting. Snow piled in the lake basin could reduce the quality of this habitat for spectacled eiders, although spectacled eiders are not expected to nest close to granular pads.

5.20.1.6.2 West Dock

Dock Head 4 modifications at West Dock would fill some benthic habitats that support invertebrate prey for spectacled eiders.

5.20.1.6.3 PTTL

The PTTL runs between the Point Thomson Facility and the GTP following and is collocated on VSMs with the Point Thomson and the Badami pipelines for much of its length. The pipeline would be aboveground except for a series of buried river crossings. Aboveground facilities associated with the pipeline include MLBVs, heliport, and pads where the pipeline transitions from above to belowground and below to aboveground at the buried river crossings. This pipeline would be constructed in winter from an ice work surface and would be located on a combination of new and existing VSMs. The ROW for this pipeline crosses low density (57 percent), low-medium density (19 percent) and medium density (25 percent) spectacled eider areas (Table 21). Aboveground and associated infrastructure would affect a higher proportion (61 percent) of medium density spectacled eider area (Table 21; Figure 24). Ice roads and pads used to construct the pipeline generally would remain ice covered through late spring into early summer, such that these habitats would not be available for spectacled eider nesting the following summer. Ice infrastructure, including the pipeline ROW, therefore, would result in a temporary effect on tundra habitats (Table 19).

If PTTL camp pads and staging areas are constructed of granular fill, construction would result in long-term loss of potential spectacled eider habitat. If these areas are constructed of ice, habitat loss would be temporary. The proposed construction camps, additional workspaces, pipe storage yards, and access roads are located primarily within low (35 percent) and medium (65 percent) density spectacled eider areas (Table 24).

5.20.1.6.4 PBTL

The PBTL runs between the CGF and the GTP following an existing road along an existing pipeline rack. This pipeline would be constructed in winter from an ice work surface and would be located on existing VSMs. The ROW for this pipeline is within a low density spectacled eider area (Table 19; although the ponds and wetlands on either side of the existing road have been used by spectacled eiders during pre-nesting, nesting, brood-rearing and fall staging in 1990 (Anderson et al., 1992).

5.20.1.6.5 Mainline

Construction of the Mainline would include excavation of material sites and granular fill for construction camp pads, pipe storage yards and access roads within eider nesting habitat in the Prudhoe Bay region resulting in long-term habitat loss (Table 21, Figure 24). Construction of the Mainline from MP 0 to MP 63 within potential spectacled eider habitat is planned for winter months primarily from ice work surfaces when spectacled eiders are not present on the BCP, and no eider nests would be lost from excavation or placement of granular fill. Granular haul, smoothing, and working to dewater and compact granular materials would continue through summer months. Most of the Mainline ROW is located within low (89 percent) and low-medium (9 percent) spectacled eider density areas (Table 21, Figure 24). Spectacled eiders are not expected to occur south of MP 33 along the Mainline.

Restoration and erosion control work on the ROW during summer could potentially disturb and displace nesting eiders. Spectacled eiders have been observed at the lake basin between MP 9 and MP 10; restoration work in this area or near other lake basin complexes north of MP 33 during the nesting season could disturb spectacled eiders.

5.20.2 Indirect Effects

Potential indirect effects on spectacled eiders could include:

- Potential altered survival or productivity due to:
  - Changes in predator abundance, distribution, or predation risks; or
  - Reduced reproduction due to disturbance from noise or visual stimuli.

5.20.2.1 Altered Survival or Productivity

Facilities, communication towers, and elevated pipelines provide nesting and vantage perches for raptors, common ravens, and glaucous gulls that are not otherwise available across the BCP (USFWS, 2003). The elevated PTTL could provide a new vantage perch across low, low-medium, and medium density spectacled eider areas (Figure 24; Table 21). Much of the PTTL ROW would be collocated with the existing Point Thomson and Badami pipelines. The areas where the PTTL would not be collocated occur within low spectacled eider density areas near MP 0, between MP 18 and MP 23 (Figure 24). The portion of the pipeline between about MP 43 to MP 49 would not be collocated with other pipelines and would cross low, low-medium, and medium spectacled eider density areas where it would create a new vantage perch (Figure 24).

Facilities can also provide artificial den sites, thermal refuges, and access to human food for Arctic and red foxes (Burgess et al., 2014). Construction camps and employees can provide access to human food for Arctic and red foxes (Burgess et al., 2014). Potentially altered distribution and abundance of predators on ground-nesting birds has long been a recognized effect of development of Arctic oil fields (Liebezeit et al., 2009; Liebezeit and Zack, 2008; NRC, 2003), primarily due to access to food wastes. Over the last decades, recognition of these effects has led to an increased focus on prevention though effective waste management. Effective waste management at facilities helps to reduce the attraction of foxes, bears, ravens, and gulls to facilities. A waste management plan that covers all waste streams would be implemented during construction and would include minimizing any potential supplemental nutrition to potential predators of nesting spectacled eiders.

Because PTTL construction would occur during winter, there would be no human interaction with spectacled eiders. Summer on tundra survey work to prepare for pipeline construction would be unlikely to disturb spectacled eiders in this low density area (Table 21). Construction of the Mainline for Spread 1A within spectacled eider nesting habitat would occur during winter and there would be no human interaction with spectacled eiders. Summer survey work to prepare for pipeline construction would be unlikely to disturb spectacled eiders because most of the ROW is located in low (57 percent) and low-moderate (19 percent) spectacled eider density areas (Table 21).

Habitat degradation would potentially reduce productivity of spectacled eiders nesting or staging in coastal habitats near West Dock. Ship hulls and ballast may serve to transport invasive aquatic organism that can degrade coastal marine habitats by displacing or transmitting diseases to native aquatic organisms. HLVs would plan to ballast loads with cargo rather than water ballast and use minimal amounts of freshwater for ballast. Use of freshwater ballast would allow for removal of ballast without transporting marine aquatic invasive organisms. Invasive aquatic organisms on or in semi-submersible vessels, barges, and tugs would be controlled by ballast water regulations, which require a ship-specific Ballast Water Management Plan, a ballast water record book, ballast water exchange, an approved ballast water treatment system, and an International Ballast Water Management Certificate. HLVs would wash down before entering Alaskan coastal waters and exchange ballast at sea to ensure a clean water discharge to minimize introduction of aquatic invasive organisms. All HLV operations would comply with USCG regulations. Currently, no aquatic invasive organisms have become established at Prudhoe Bay and little is known about the environmental tolerance of species that could be released (McGee et al., 2006).

5.20.3 Effects of Non-Jurisdictional Facilities

The proposed PTU Expansion project and construction of new pipelines to the Prudhoe Bay oilfield for the production and transport of natural gas to the GTP would result in additional effects on spectacled eiders and their habitat through direct and indirect mechanisms as described previously. USFWS (2012b) recently prepared a BO for the Point Thomson Project, which consisted of the same types of activities, of similar magnitude, in the same geographic area as the PTU Expansion project. USFWS (2012b) concluded that the proposed Point Thomson Project activities may adversely affect spectacled eiders. They concluded that the activities, through habitat loss and disturbance, would result in the loss of production from a small number of spectacled eider nests, and resulting loss of recruitment of a very small number of adult eiders into the population over the life (33 years) of the project. They concluded further that this possible loss of production would not significantly affect the likelihood of survival and recovery of spectacled eiders, and accordingly, would not likely to jeopardize the continued existence of the spectacled eider or prevent its survival and recovery in the wild.

5.20.4 Cumulative Effects

Concern for spectacled eiders was tied to the severely decline nesting populations in western Alaska, and possible declining nesting populations in northern Alaska and eastern Russia (58 FR 27472). The cause or causes for the declining populations are unknown. The main stressors for spectacled eiders risks are oil spills, incidental take from research activities, incidental take for oil and gas development and exploration, infrastructure development, subsistence harvest, wastewater facilities, and powerlines (USFWS, 2015a). The nesting BCP spectacled eider population is considered to be declining under the current stressor regimes (USFWS, 2015a). With incorporation of conservation measures, activities associated with the Project are not expected to increase the overall cumulative effects to a level that would jeopardize spectacled eiders.

5.20.5 Summary of Effects

5.20.5.1 Summary of Effects on Critical Habitat

Critical habitat was designated 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). Critical habitat was not designated on the BCP because nesting habitat on the BCP was not considered to be limiting. The marine sealift vessels would use established marine shipping routes from manufacture sites through the Bering and Chukchi seas around Point Barrow to Prudhoe Bay. Vessel traffic associated with the Project would not travel through and would have no effect on designated spectacled eider critical habitat.

5.20.5.2 Summary of Effects on Spectacled Eiders

Project construction and operations may affect a few spectacled eiders breeding and molting within the action area and would remove some nesting habitat directly through fill or excavation and indirectly through displacement by disturbance or alteration. With incorporation of the conservation measures described previously, the Project would not be expected to affect more than a few spectacled eiders.

5.21 STELLER'S EIDER – ALASKA BREEDING POPULATION

Construction and operation of the Liquefaction Facility in and adjacent to Cook Inlet could but is not likely to affect Alaska-breeding Steller's eiders, which in Alaska are found in lower Cook Inlet; along the Alaska Peninsula; the Aleutian Islands; the Bering, Chukchi, and Beaufort Seas; and the Arctic Coastal Plain. Construction of Interdependent and Interrelated Project Facilities, specifically the GTP, Mainline, and PTTL, are not likely to affect Alaska-breeding Steller's eiders, as they generally nest well west of Prudhoe Bay and Point Thomson.

5.21.1 Direct Effects

Project components that could potentially affect Steller's eiders and their habitats include:

- HLV traffic to West Dock for delivery of the GTP modules;
- Marine Terminal and Liquefaction Facility construction in Cook Inlet;
- HLV and LNGC traffic through Cook Inlet and the Aleutian Islands; and
- Vessel grounding and potential oil spills

Alaska-breeding Steller's eiders are not likely to occur near the Project facilities on the BCP because their current nesting area occurs south of Barrow, which is west of the proposed facilities at Prudhoe Bay and Point Thomson. Construction and operation of the aboveground structures for the Marine Terminal and Liquefaction Facility would occur year-round although Steller's eiders are only likely to be present in Cook Inlet during fall and winter, and, if present, only about 1 percent of Steller's eiders in Cook Inlet may belong to the Alaska-breeding population.

Potential direct effects on Alaska-breeding Steller's eiders could include:

- Potential injury and/or mortality from:
  - HLV and LNGC traffic; and
  - Exposure to spills or leaks.

5.21.1.1 Vessel Traffic

Low-flying Steller's eiders could collide during poor visibility conditions with HLVs or LNGCs. Collisions would be more likely during migration periods and may be affected by lighting on the vessel (Day et al., 2003, 2005).

5.21.1.1.1 Liquefaction Facility

Molting and wintering Alaska-breeding Steller's eiders could, but are not likely to, occur in upper Cook Inlet near the Liquefaction Facility (Figure 26, Figure 26). Steller's eiders occurring in Cook

Inlet are a mixture of Alaska-breeding and Russia-breeding populations, with about 1 percent of Steller's eiders potentially belonging to the Alaska-breeding population.

Molting and wintering Alaska-breeding Steller's eiders could be exposed to HLV traffic during construction primarily in lower Cook Inlet, Shelikof Strait, and the Aleutian Islands (Figure 25, Figure 19). HLV could also present a collision hazard for migrating eiders. Project-related vessel traffic would follow the Northern Pacific Great Circle route through the Aleutians Subarea at Unimak Pass, which is west of Steller's eider marine critical habitat. Disturbance and potential displacement would be temporary and would be unlikely to affect many eiders, as most would be expected to be close to shore, although, some Steller's eiders may use deeper waters at night.

Steller's eiders could potentially collide with LNGCs operating from the Marine Terminal in Cook Inlet during migration or overwintering. The potential for collisions would increase during fall or winter when more Steller's eiders occur in lower Cook Inlet and days are short; eiders may be affected by lighting on vessels (Day et al., 2005). The potential for collisions with Alaska-breeding Steller's eiders, however, is extremely low.

5.21.1.1.2 GTP

Molting and wintering Alaska-breeding Steller's eiders could be exposed to HLV traffic during construction primarily through the Aleutian Islands and Bering Sea (Figures 25). Project-related vessel traffic would follow the Northern Sea route through the Aleutians Subarea at Unimak Pass, which is west of Steller's eider marine critical habitat. Disturbance and potential displacement would be temporary and would be unlikely to affect many eiders, as most would be expected to be close to shore, although, some Steller's eiders may use deeper waters at night. HLV could also present a collision hazard for migrating eiders.

5.21.1.2 Potential Spills and Resultant Contamination

Fuel spills during vessel grounding could injure or kill Steller's eiders through: contamination of feathers that cause eiders to lose their ability to thermoregulate, ingestion of toxic petroleum during preening, ingestion of contaminated prey resources, or reduction in prey availability. These effects may reduce survival and reproduction that could result in population declines (Esler et al., 2000).

5.21.1.2.1 Liquefaction Facility and GTP

Fuels and oils are toxic to Steller's eiders and their invertebrate prey. Wintering Steller's eiders have been exposed to oil in Alaska harbors (USFWS, 2015a). Spills that reach molting eiders in the Kuskokwim Shoals critical habitat could affect a large proportion of the Alaska-breeding Steller's eider population (USFWS, 2015a; Martin et al., 2015). The most likely source of exposure to an oil spill would be from a grounded vessel with a subsequent release of fuel. While vessel groundings do occur within the Steller's eider range, they are rare. HLV and LNGC traffic to and from the Marine Terminal and Prudhoe Bay would follow recommended guidelines and procedures for operating in Cook Inlet (U.S. Coast Pilot 9, and guidelines and directives of the Captain of the Port).

There has never been a major incident involving a large LNG spill or fire on water. Although unlikely, a spill of LNG could be harmful to wildlife. A spill of LNG could occur from a tank rupture or valve failure, during LNGC loading, during LNGC grounding, or due to another adjacent accident. LNG is not water soluble and would vaporize rapidly upon contact. Because LNG would not mix with water, no water contamination would occur. Threats to birds near an LNG spill could include freeze burns from rapid temperature changes, injury from fire, and asphyxiation caused by methane fumes. In the case of a spill with no fire, birds would likely respond by moving away from the areas of cold water prior to receiving freeze burns. If a fire were to occur with the release of LNG, birds in the immediate vicinity of the fire could be injured or killed, particularly if floating on the surface. Birds not directly injured or displaced by a spill could be indirectly affected by loss of foraging habitat until revegetation occurs. Vaporized gas released by a spill would be a cold, heavier-than-air, vapor cloud and birds flying over the area at the time of release could experience asphyxiation from the lack of oxygen. Methane vapors are colorless, odorless and tasteless, and are classified as a simple asphyxiant. Methane vapors may cause extreme health hazards, including death, if inhaled in significant quantities within a limited time.

5.21.2 Indirect Effects

Potential indirect effects on Alaska-breeding Steller's eiders could include:

- Habitat disturbance or alteration including:
    - Displacement from molting or wintering habitats; and
    - Spread of aquatic invasive organisms.

5.21.2.1 Habitat Disturbance

Potential effects on habitat from HLV and LNGC traffic include disturbance associated with vessels sailing through swimming flocks and noise.

5.21.2.1.1 GTP

HLV traffic to West Dock during the ice-free period from 15 July to 25 August could cause short-term disturbance to Steller's eiders in the marine waters of the Bering, Chukchi, and Beaufort seas; although few Steller's eiders are expected to occur offshore where most shipping traffic occurs, and potential disturbance would be indistinguishable from other vessel traffic. Disturbance would most likely result in short-term displacement of Steller's eiders away from traffic areas, and eiders would likely return to their previous behaviors shortly after vessels have passed.

5.21.2.1.2 Liquefaction Facility

HLV and LNGC traffic associated with the construction and operation of the Marine Terminal and Liquefaction Facility in Cook Inlet could cause disturbance to wintering Steller's eiders. Shipping lanes through the Aleutian Islands, especially Unimak Pass, Akutan Pass and the approach to Dutch Harbor are used by wintering Steller's eiders. Flocks of molting and overwintering Steller's eiders have been observed in shoals, nearshore bays, and lagoons in lower Cook Inlet from late August through April, with peak winter occurrence in January and February (Larned, 2006). HLVs would likely arrive after most ice has left the upper inlet, after most wintering Steller's eiders have migrated north from Cook Inlet; although shipping would continue through late summer early fall when molting birds could likely be present in lower Cook Inlet (Larned, 2006). Construction of the Marine Terminal would occur primarily during spring through fall when few if any Steller's eiders would be expected to occur near Nikiski. HLV traffic extending into fall could potentially cause short-term disturbance to a few Steller's eiders should they occur in the vicinity, however, the likelihood that any Steller's eiders in the vicinity belong to the Alaska-breeding population would be low.

Between 17 and 30 LNGCs per month would be used for transport of LNG. LNGCs transiting through lower Cook Inlet and the Aleutian Islands could disturb a few Steller's eiders. Although, Steller's eiders typically are known to use nearshore shallow marine habitats and LNGCs would use shipping channels in deep water. Wintering Steller's eiders may, however, be present in deeper waters ranging from 1.4 to 2.1 miles from shore at night where they may be roosting on water or foraging on zooplankton (Martin et al., 2015). Most Steller's eiders molting and wintering in these areas, however, belong to Russia-breeding populations, with an estimated 1 percent of Steller's eiders in this region potentially belonging to the Alaska-breeding population (Larned, 2012).

Molting and wintering Alaska-breeding Steller's eiders could be exposed to LNGC traffic during operation primarily in lower Cook Inlet, Shelikof Strait, and the Aleutian Islands (Figures 26 and

21). Project-related vessel traffic would follow the Northern Pacific Great Circle route through the Aleutians Subarea at Unimak Pass, which is west of Steller's eider marine critical habitat. Disturbance and potential displacement would be localized and temporary, and would be unlikely to affect many eiders, as most would be expected to be close to shore, although, some Steller's eiders may use deeper waters at night. HLV could also present a collision hazard for migrating and over wintering eiders as discussed previously.

5.21.2.2 Habitat Degradation

Potential degradation of Steller's eider molting and wintering habitats from HLV or LNGC traffic could occur through grounding, spills or the introduction of aquatic invasive organisms. Vectors for introducing aquatic invasive species from ship traffic include ballast-water discharge, fouled ship hulls, and equipment placed overboard (e.g., anchors). HLV or LNGC traffic arriving from Asia or infested U.S. ports could potentially transport non-native tunicates, green crab (*Carcinus maenas*) and Chinese mitten crab (*Eriocheir sinensis*) (ADF&G, 2002), which affect food webs and can outcompete native invertebrates resulting in habitat degradation.

5.21.2.2.1 Liquefaction Facility

HLV and LNGC traffic could degrade aquatic habitats through the introduction of aquatic invasive organisms through ballast water, hull fouling, or equipment placed overboard. However, all vessels brought into the State of Alaska or federal waters are subject to USCG 33 C.F.R. 151 regulations, which are intended to reduce the transfer of invasive species. Management of ballast water discharge is regulated by federal regulations (33 C.F.R. 151.2025) that prohibit discharge of untreated ballast water into the Waters of the U.S. unless the ballast water has been subject to a mid-ocean ballast water exchange (at least 200 nautical miles offshore). Vessel operators are also required to remove "fouling organisms from hull, piping, and tanks on a regular basis and dispose of any removed substances in accordance with local, state, and federal regulations" (33 C.F.R. 151.2035(a)(6)). HLVs would wash down before entering Alaskan coastal waters and exchange ballast at sea to ensure a clean water discharge to minimize introduction of aquatic invasive organisms. All HLV and LNGC operations would comply with USCG regulations. Adherence to the USCG 33 C.F.R. 151 regulations would minimize the likelihood of Project-related vessel traffic introducing aquatic invasive organisms.

Critical habitat for Alaska-breeding Steller's eiders would not likely be affected by HLV traffic through the Aleutian Islands and Bering Sea because HLV are not likely to operate near these critical habitat areas (Figure 25).

5.21.2.2.2 GTP

HLV traffic could degrade aquatic habitats through the introduction of aquatic invasive organisms through ballast water, hull fouling, or equipment placed overboard. HLVs would plan to ballast loads with cargo rather than water ballast and use minimal amounts of freshwater for ballast. Use of fresh water ballast would allow for removal of ballast within transporting marine aquatic invasive organisms. Invasive aquatic organisms on or in semi-submersible vessels, barges, and tugs would be controlled by ballast water regulations which require a ship-specific Ballast Water Management Plan, a ballast water record book, ballast water exchange, an approved ballast water treatment system, and an International Ballast Water Management Certificate (see *GTP Project Pre-FEED Logistics Plan*). HLVs would wash down before entering Alaskan coastal waters and exchange ballast at sea to ensure a clean water discharge to minimize introduction of aquatic invasive organisms. All HLV operations would comply with USCG regulations.

5.21.3 Effects of Non-Jurisdictional Facilities

Construction of the PTU Expansion project could potentially affect Alaska-breeding Steller's eiders through HLV traffic as described previously but such effects are unlikely. USFWS (2012b) recently prepared a BO assessing potential effects on Steller's eiders from a proposed Point Thomson Project, which consisted of the same types of activities, of similar magnitude, in the same geographic area as the PTU Expansion project. USFWS (2012b) concluded that the proposed Point Thomson Project activities USFWS (2012b) concluded that adverse effects to the Steller's eiders would be extremely unlikely to occur because the best available data indicate Steller's eiders are unlikely to nest near or migrate through the project area.

5.21.4 Cumulative Effects

Concern for Alaska-breeding Steller's eiders are tied to the substantial decrease in their nesting range and increased vulnerability to extirpation (62 FR 31748). The cause or causes for the declining nesting population are unknown. The main stressors for Steller's eiders area risks of oil spills, incidental take from research activities, and incidental take from various Aleutian and BCP developments (USFWS, 2015a). The Alaska-breeding Steller's eider population is considered to be at a high risk of extinction (USFWS, 2015a). With incorporation of conservation measures, activities associated with the Project would not be expected to increase the overall cumulative effects to a level that would jeopardize Alaska-breeding Steller's eiders.

5.21.5 Summary of Effects

5.21.5.1 Summary of Effects on Critical Habitat

Designated critical habitat for Alaska-breeding Steller's eiders occurs on the Yukon-Kuskokwim Delta and in marine waters of southwestern Alaska. 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. Normal operation of Project-related HLV and LNGC traffic would have no effect on designated Steller's eider critical habitat. An oil spill associated with a vessel grounding or other accidental release could result in localized effects on marine habitats, but such an event is improbable and mitigation through the development and implementation of oil spill prevention and response plans would likely prevent any effects on Steller's eider critical habitat. Vessels would be subject to USCG 33 C.F.R. 151 regulations to prevent the introduction of aquatic invasive species into Alaska marine waters. As such, there would be no effect on Steller's eider critical habitat.

5.21.5.2 Summary of Effects on Alaska-Breeding Steller's Eiders

Project construction and operations may, but are not likely to affect Alaska-breeding Steller's eiders. Normal operation of Project-related HLV and LNGC traffic could, but would not be likely to affect, a few Steller's eiders migrating through marine waters in the Beaufort, Chukchi, and Bering seas, or molting or wintering in Cook Inlet or the Aleutian Islands. About 1 percent of Steller's eiders occurring on wintering grounds in Alaska belong to the Alaska-breeding population. With incorporation of conservation measures, no effect on Alaska-breeding Steller's eiders would be expected.

5.22 PACIFIC SALMON AND STEELHEAD TROUT

Six Chinook salmon ESUs and six steelhead trout DPSs that are listed as threatened or endangered are known or suspected to occur in Alaskan waters. Activities that could potentially affect these fish are limited to Project-related vessel traffic that would occur through the Gulf of

Alaska, lower Cook Inlet, Prince William Sound, Aleutian Islands and southern Bering Sea waters in support of construction and operation of the Liquefaction Facility, Mainline, and GTP.

5.22.1 Direct Effects

Construction-related HLV traffic and operation LNGC traffic would coincide with the at-sea distributions of Chinook salmon ESUs and Steelhead Trout DPSs. Vessel traffic would create surface water disturbance and noise that could potentially be perceived by fish as with existing marine vessel traffic.

5.22.2 Indirect Effects

Project-related vessel traffic could indirectly affect listed Chinook salmon ESUs and steelhead trout DPSs through habitat degradation caused by increased shipping traffic noise or ballast water exchange. Vessels would use safe speeds that minimize noise and allow avoidance of collisions with marine mammals. All vessels brought into the State of Alaska or federal waters are subject to USCG 33 C.F.R. 151 regulations, which are intended to reduce the transfer of invasive species. Management of ballast water discharge is regulated by federal regulations (33 C.F.R. 151.2025) that prohibit discharge of untreated ballast water into the Waters of the U.S. unless the ballast water has been subject to a mid-ocean ballast water exchange (at least 200 nautical miles offshore).

5.22.3 Cumulative Effects

These 12 Chinook salmon and steelhead trout populations have experienced declines in recent decades as a result of multiple effects: freshwater habitat reduction, modification, degradation, and elimination; estuarine rearing habitat reduction, modification, degradation, and elimination; juvenile and adult mortality from hydroelectric and flood control structures; overfishing and bycatch; detrimental effects from invasive aquatic animals and plants; interactions, genetic, and disease effects from hatchery practices; and climate changes that affect hydrologic cycles and marine water productivity.

5.22.4 Summary of Effects

5.22.4.1 Summary of Effects on Critical Habitat

No critical habitat is designated in Alaska waters for ESA-listed Chinook salmon ESUs or steelhead trout DPSs. The Project would not contribute to the loss and degradation of freshwater spawning and rearing habitat in Washington, Oregon, and Idaho that were primary factors leading to the listing of these six Chinook salmon ESUs and six steelhead trout ESUs. There would be no effect on critical habitats for these Chinook ESUs and steelhead trout DPSs that occur in freshwaters and estuaries outside of Alaska.

5.22.4.2 Summary of Effects on Pacific Salmon and Steelhead Trout

Vessel traffic would create surface water disturbance and noise that could potentially be perceived by fish like existing marine vessel traffic, but is not expected to reduce the current or expected future survival or reproduction of these Chinook ESUs and steelhead trout DPSs.

6.0 PRELIMINARY DETERMINATION OF EFFECTS

6.1 BELUGA WHALE – COOK INLET DPS

6.1.1 Effect on Cook Inlet Beluga Whales

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

- Cook Inlet beluga whales are widespread across the Project area in Cook Inlet during construction and operation of the proposed action; and
- Construction and operation of the Liquefaction Facility and Mainline would increase vessel traffic, noise, and disturbance within the action area in Cook Inlet.

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

- Sound from pile driving has the potential to be injurious at close range and result in Level A injury, and/or to exclude animals from the area;
- Construction activities at the Marine Terminal and the Mainline Cook Inlet crossing may result in Level B harassment of Cook Inlet beluga whales;
- PSOs would be used and exclusion zones would be established to prevent Level A injury and avoid Level B harassment of Cook Inlet beluga whales;
- Ship strikes could occur but would be unlikely, and the increase in annual ship traffic would not be expected to result in an increase in ship strikes; and
- A ship strike avoidance measures package would be provided to shippers that would include multiple measures to avoid striking marine mammals.

The size and scope of the Cook Inlet portion of the Project and the risks it presents to Cook Inlet beluga whales is comparable to the Port of Anchorage Marine Terminal Redevelopment Project, which NMFS concluded was **not likely to jeopardize** the continued existence of Cook Inlet beluga whales (NMFS, 2009a).

6.1.2 Effect on Cook Inlet Beluga Whale Critical Habitat

The Project **may affect** Cook Inlet beluga whale Area 2 critical habitat because:

- The Marine Terminal and Mainline would be located in Area 2 of the Cook Inlet beluga whale critical habitat; and
- Construction and operation of the Project would introduce noise and additional vessel traffic into Area 2 critical habitat.

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

- Noise and vessel traffic effects are not likely to diminish the value of the primary constituent elements of the critical habitat for the conservation of Cook Inlet beluga whales;
- Whale movements between and among habitat areas are not likely to be impeded;
- The quantity and quality of prey are unlikely to be diminished; and
- Water quality may occasionally be affected by small infrequent spills at the Marine Terminal, but these would have only minor and transitory effects on water quality, and larger spills associated with a catastrophic release of fuel oil or other contaminants are unlikely. Blue Whale

6.1.3 Effect on Blue Whales

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

- Blue whales may occur within Alaskan waters during operation of the proposed action;
- The proposed action would increase shipping traffic within Alaskan waters; and
- There is a potential for ship strikes from Project-related LNGC and HLV traffic through the Aleutian Islands, southern Bering Sea, and Gulf of Alaska.

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

- No blue whale ship strikes have been documented in Alaskan waters;
- Risk of ship strikes is considered low because of the intermittent occurrence and dispersed distribution of blue whales in Alaskan waters;
- A ship strike avoidance measures package would be provided to shippers;
- Future ship strikes have been projected to have a minimal effect on blue whales (Monnahan et al., 2014);
- Vessel noise would contribute to overall noise in Alaskan Waters, but would not exceed background ship noise levels and would not cause injury; and
- Oil spills associated with a vessel grounding would be improbable and would become even less likely to occur with compliance of the HLV and LNGC traffic with the Aleutian Islands ATBA, and spill prevention and response planning would be implemented.

6.1.4 Effect on Blue Whale Critical Habitat

No critical habitat has been designated or proposed for the blue whale.

6.2 BOWHEAD WHALE

6.2.1 Effect on Bowhead Whales

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

- Bowhead whales may occur within Alaskan waters during operation of the proposed action;
- Project construction activities at West Dock would create noise that may be detected by bowhead whales;
- The proposed action would increase shipping traffic within Alaskan waters; and
- There is a potential for ship strikes from Project-related HLV and barge traffic through the Bering, Chukchi, and Beaufort seas.

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

- Most construction would occur during winter, when bowhead whales are not present near West Dock;
- Although bowheads are vulnerable to ship strikes, no bowhead whale ship strikes have been documented (Neilson et al., 2012);
- Vessel traffic would consist of a relatively small number of slow-moving HLV and barge trips;
- A ship strike avoidance measures package would be provided to shippers;
- Noise from barge traffic associated with the Project would be near ambient noise levels and would be less than the level for injury or potential acoustic harassment; and
- Oil spills associated with a vessel grounding would be improbable and spill prevention and response planning would be implemented.

6.2.2 Effect on Bowhead Whale Critical Habitat

No critical habitat has been designated or proposed for the bowhead whale.

6.3 FIN WHALE

6.3.1 Effect on Fin Whales

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

- Fin whales may occur within Alaska waters during operation of the proposed action;
- The proposed action would increase shipping traffic within Alaska waters; and
- There is a potential for ship strikes from Project-related LNGC and HLV traffic through lower Cook Inlet, Shelikof Strait, the Aleutian Islands, Gulf of Alaska, Bering Sea, and Chukchi Sea.

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

- Few fin whale ship strikes have been documented in Alaska waters;
- Risk of ship strikes is considered low because of the seasonal occurrence and dispersed distribution of fin whales in Alaska waters;
- A ship strike avoidance measures package would be provided to shippers;
- Vessel noise would contribute to overall noise in Alaskan Waters, but would not exceed background ship noise levels and would not cause injury; and
- Oil spills associated with a vessel grounding would be improbable and would become even less likely to occur with compliance of the HLV and LNGC traffic with the Aleutian Islands ATBA, and spill prevention and response planning would be implemented.

6.3.2 Effect on Fin Whale Critical Habitat

No critical habitat has been designated or proposed for the fin whale.

6.4 GRAY WHALE – WESTERN NORTH PACIFIC DPS

6.4.1 Effect on WNP Gray Whales

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

- WNP gray whales may occur within Alaskan waters during operation of the proposed action;
- The proposed action would increase shipping traffic within Alaskan waters; and
- There is a potential for ship strikes from Project-related LNGC and HLV traffic through lower Cook Inlet, Gulf of Alaska, Bering Sea, Chukchi Sea and Beaufort Sea.

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

- Gray whales that could be encountered would not be expected to be from the WNP gray whale DPS (most gray whales in Alaskan waters belong to the ENP gray whale DPS);
- Risk of ship strikes is considered low because of the seasonal occurrence and dispersed distribution of WNP gray whales in Alaskan waters;
- A ship strike avoidance measures package would be provided to shippers;
- Vessel noise would contribute to overall noise in Alaskan Waters, but would not exceed background ship noise levels and would not cause injury; and

- Oil spills associated with a vessel grounding would be improbable and would become even less likely to occur with compliance of the HLV and LNGC traffic with the Aleutian Islands ATBA, and spill prevention and response planning would be implemented.

6.4.2 Effect on Gray Whale Critical Habitat

No critical habitat has been designated or proposed for the gray whale.

6.5 HUMPBACK WHALE – WESTERN NORTH PACIFIC DPS

6.5.1 Effect on WNP Humpback Whales

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

- WNP humpback whales may occur within Alaskan waters during operation of the proposed action;
- The proposed action would increase shipping traffic within Alaskan waters; and
- There is a potential for ship strikes from Project-related LNGC and HLV traffic through lower Cook Inlet, Gulf of Alaska, Bering Sea, Chukchi Sea and Beaufort Sea.

The project is **not likely to adversely affect** WNP humpback whales because:

- Humpback whales that could be encountered would not be expected to be from the WNP humpback whale DPS (most humpback whales in Alaskan waters belong to the proposed delisted Hawaii and Mexico humpback whale DPSs);
- Risk of ship strikes is considered low because of the seasonal occurrence and dispersed distribution of WNP humpback whales in Alaskan waters;
- A ship strike avoidance measures package would be provided to shippers;
- Vessel noise would contribute to overall noise in Alaskan Waters, but would not exceed background ship noise levels and would not cause injury; and
- Oil spills associated with a vessel grounding would be improbable and would become even less likely to occur with compliance of the HLV and LNGC traffic with the Aleutian Islands ATBA, and spill prevention and response planning would be implemented.

6.5.2 Effect on Humpback Whale Critical Habitat

No critical habitat has been designated or proposed for the humpback whale.

6.6 NORTH PACIFIC RIGHT WHALE

6.6.1 Effect on North Pacific Right Whales

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

- North Pacific right whales may occur within Alaskan waters during operation of the proposed action;
- The proposed action would increase shipping traffic within Alaskan waters; and
- There is a potential for ship strikes from Project-related LNGC and HLV traffic through lower Cook Inlet, Shelikof Strait, Gulf of Alaska, Aleutian Islands, and Bering Sea.

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

- Risk of ship strikes is considered low because of the rare occurrence and scattered distribution of North Pacific right whales in Alaskan waters;
- Project-related vessel traffic would avoid crossing though critical habitats in the southeastern Bering Sea and in the Gulf of Alaska south of Kodiak Island;
- A ship strike avoidance measures package would be provided to shippers;
- Vessel noise would contribute to overall noise in Alaskan Waters, but would not exceed background ship noise levels and would not cause injury; and
- Oil spills associated with a vessel grounding are improbable and would become even less likely to occur with compliance of the HLV and LNGC traffic with the Aleutian Islands ATBA, and spill prevention and response planning would be implemented.

6.6.2 Effect on North Pacific Right Whale Critical Habitat

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

- Critical habitat has been designated in the southeastern Bering Sea and in the Gulf of Alaska south of Kodiak Island; and
- Project-related vessels would use established marine shipping routes to transit Alaskan waters through Shelikof Strait, the Gulf of Alaska, the Aleutian Islands, and the Bering Sea.

The Project is **not likely to adversely modify** North Pacific right whale critical habitat because:

- Vessel traffic would not cross or approach designated critical habitat in the Bering Sea or on the south side of Kodiak Island;
- Vessel traffic would not affect zooplankton prey of North Pacific right whales;
- Ballast water exchange would comply with U.S. Coast Guard regulations and would occur outside of U.S. waters;
- Oil spills associated with a vessel grounding would be improbable and would become even less likely to occur with compliance of the HLV and LNGC traffic with the Aleutian Islands ATBA, and spill prevention and response planning would be implemented; and
- Vessels would be subject to USCG 33 CFR 151 regulations to prevent the introduction of aquatic invasive organisms.

6.7 SEI WHALE

6.7.1 Effect on the Sei Whale

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

- Sei whales may occur within Alaskan waters during operation of the proposed action;
- The proposed action would increase shipping traffic within Alaskan waters; and
- There is a potential for ship strikes from Project-related LNGC and HLV traffic through the Gulf of Alaska.

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

- Risk of ship strikes is considered low because few sei whale ship strike mortalities have been documented and because of the seasonal occurrence and scattered distribution of sei whales in Gulf of Alaska waters;
- A ship strike avoidance measures package would be provided to shippers;
- Vessel noise would contribute to overall noise in Alaskan Waters, but would not exceed background ship noise levels and would not cause injury; and

- Oil spills associated with a vessel grounding would be improbable and would become even less likely to occur with compliance of the HLV and LNGC traffic with the Aleutian Islands ATBA, and spill prevention and response planning would be implemented.

6.7.2 Effect on Sei Whale Critical Habitat

No critical habitat has been designated or proposed for the sei whale.

6.8 SPERM WHALE

6.8.1 Effect on the Sperm Whale

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

- Sperm whales may occur within Alaskan waters during operation of the proposed action;
- The proposed action would increase shipping traffic within Alaskan waters; and
- There is a potential for ship strikes from Project-related LNGC and HLV traffic in coastal waters around the central and western Aleutian Islands and southern Bering Sea during summer, although they may occur year-round in the Gulf of Alaska.

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

- Risk of ship strikes is considered low because few sperm whale ship strike mortalities have been documented and because of the seasonal occurrence and scattered distribution of sperm whales in Gulf of Alaska waters;
- A ship strike avoidance measures package would be provided to shippers;
- Vessel noise would contribute to overall noise in Alaskan Waters, but would not exceed background ship noise levels and would not cause injury; and
- Oil spills associated with a vessel grounding would be improbable and would become even less likely to occur with compliance of the HLV and LNGC traffic with the Aleutian Islands ATBA, and spill prevention and response planning would be implemented.

6.8.2 Effect on Sperm Whale Critical Habitat

No critical habitat has been designated or proposed for the sperm whale.

6.9 ARCTIC RINGED SEAL

6.9.1 Effect on Arctic Ringed Seals

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

- Ringed seals occur within Beaufort Sea waters during construction and operation of the proposed action; and
- The proposed construction and HLV docking activities at West Dock could result in acoustic harassment, and injury or mortality.

The Project may affect, and is **likely to adversely affect** a small number of ringed seals because:

- No ringed seals were estimated to be exposed to harassing or injurious levels of impact or vibratory pile driving noise during construction activities at West Dock;

- Ringed seals are generally tolerant of industrial noise and they are less sensitive to lower frequency noises, such that sound generated during HLV docking is unlikely to harass ringed seals;
- Vessel noise would contribute to overall noise in Alaska waters, but would not exceed background ship noise levels and would not cause injury; and
- Oil spills associated with a vessel grounding would be improbable, and spill prevention and response planning would be implemented.

6.9.2 Effect on Ringed Seal Critical Habitat

The Project may affect proposed ringed seal critical habitat because:

- Critical habitat has been proposed that includes all contiguous marine waters from the coastline of Alaska to the limit of the EEA in the northern Bering, Chukchi, and Beaufort seas; and
- Project construction would result in disturbance of a small amount of sea ice and forage critical habitat in the vicinity of West Dock for modifications to construct Dock Head 4.

6.10 BEARDED SEAL – BERINGIA DPS

6.10.1 Effect on the Bearded Seals

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

- Bearded seals occur within Beaufort Sea waters during construction and operation of the proposed action; and
- The proposed HLV docking could result in acoustic harassment.

The Project is **likely to adversely affect** a small number of bearded seals because:

- Bearded seals may be exposed to harassing levels HLV docking noise during open water construction activities at West Dock;
- Bearded seals are generally tolerant of industrial noise and they are less sensitive to lower frequency noises, such that noise generated during HLV docking is unlikely to harass bearded seals;
- Protective injury and harassment ZOIs would be established and PSOs would be used to monitor for presence of marine mammals with authority to halt activities if marine mammals enter the ZOIs during open water construction activities at West Dock;
- Vessel noise would contribute to overall noise in Alaskan Waters, but would not exceed background ship noise levels and would not cause injury; and
- Oil spills associated with a vessel grounding would be improbable, and spill prevention and response planning would be implemented.

6.10.2 Effect on Bearded Seal Critical Habitat

No critical habitat has been designated or proposed for bearded seals.

6.11 STELLER SEA LION – WESTERN DPS

6.11.1 Effect on the Steller Sea Lions

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

- Western DPS Steller sea lions may occur within Alaskan waters during operation of the proposed action;
- The proposed action would increase shipping traffic within Alaskan waters; and
- There is a potential for disturbance from Project-related LNGC and HLV traffic through lower Cook Inlet, Gulf of Alaska, and Bering Sea.

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

- The Project could result in disturbance of individual Steller sea lions as a result of vessel traffic, but effects are likely to minor and transitory having little effect on the fitness of exposed individuals and would be indistinguishable from normal shipping traffic;
- Ship strikes from vessels associated with construction or operations could occur, however ship strikes are not likely to occur as sea lions are able to detect and avoid vessels;
- Vessel noise would contribute to overall noise in Alaskan Waters, but would generally be below the hearing sensitivity of Steller sea lions, would not exceed background ship noise levels, and would not cause injury; and
- Oil spills associated with a vessel grounding would be improbable and would become even less likely to occur with compliance of the HLV and LNGC traffic with the Aleutian Islands ATBA, and spill prevention and response planning would be implemented.

6.11.2 Effect on Steller Sea Lion Critical Habitat

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

- Critical habitat was designated for a 20-nautical-mile buffer around all major haulouts and rookeries, and within three aquatic foraging areas in Shelikof Strait, the area north of Unimak Pass along the Bering Shelf, and the Sequam Pass area in the Western Aleutian Islands; and
- Project-related vessels would use established marine shipping routes to transit Alaskan waters through Cook Inlet, Shelikof Strait, and the Aleutian Islands.

The Project is **not likely to adversely modify** Steller sea lion critical habitat because:

- Project-related vessel traffic would not cross through critical habitat areas close to shorelines near haulouts or rookeries;
- Oil spills associated with a vessel grounding would be improbable and would become even less likely to occur with compliance of the HLV and LNGC traffic with the Aleutian Islands ATBA, and spill prevention and response planning would be implemented; and
- Vessels would be subject to USCG 33 CFR 151 regulations to prevent the introduction of aquatic invasive organisms.

6.12 PACIFIC WALRUS

6.12.1 Effect on the Pacific Walrus

The Project **may affect** Pacific walrus because:

- Pacific walruses may occur within Beaufort Sea waters during construction and operation of the proposed action; and
- the proposed action would increase shipping traffic within Alaskan waters.

The project is **not likely to adversely affect** a Pacific walruses because:

- Pacific walruses are extralimital in the area of the Beaufort Sea where noise from HLV docking and construction activities would occur at West Dock;
- protective injury and harassment ZOIs would be established and PSOs would be used to monitor for presence of marine mammals with authority to halt activities if marine mammals enter the ZOIs during open construction activities at West Dock;
- vessel noise would contribute to overall noise in Alaskan Waters, but would not exceed background ship noise levels and would not cause injury; and
- oil spills associated with a vessel grounding are improbable, and spill prevention and response planning would be implemented.

6.12.2 Effect on Pacific Walrus Critical Habitat

Critical habitat does not apply to candidate species.

6.13 NORTHERN SEA OTTER – SOUTHWEST ALASKA DPS

6.13.1 Effect on the Northern Sea Otter – Southwest Alaska DPS

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

- Southwest Alaska DPS northern sea otters may occur within Alaska waters during operation of the proposed action;
- The proposed action would increase shipping traffic within Alaska waters; and
- There is a potential for disturbance from Project-related LNGC and HLV traffic through lower Cook Inlet, Shelikoff Strait, and the Aleutian Islands.

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

- Vessel noise would contribute to overall noise in Alaskan Waters, but would generally be below the hearing sensitivity of northern sea otters, would not exceed background ship noise levels, and would not cause injury; and
- Oil spills associated with a vessel grounding would be improbable and would become even less likely to occur with compliance of the HLV and LNGC traffic with the Aleutian Islands ATBA, and spill prevention and response planning would be implemented.

6.13.2 Effect on Northern Sea Otter Critical Habitat

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

- Critical habitat was designated for 5,855 square miles of shallow coastal waters from Attu Island in the Aleutians to Redoubt Point in Cook Inlet; and
- Project-related vessels would use established marine shipping routes to transit Alaskan waters from the Marine Terminal through Shelikof Strait and the Aleutian Islands.

The Project is **not likely to adversely modify** northern sea otter critical habitat because:

- Project-related vessel traffic would not cross through sea otter critical habitat;

- Oil spills associated with a vessel grounding would be improbable and would become even less likely to occur with compliance of the HLV and LNGC traffic with the Aleutian Islands ATBA, and spill prevention and response planning would be implemented; and
- Vessels would be subject to USCG 33 CFR 151 regulations to prevent the introduction of aquatic invasive organisms.

6.14 POLAR BEARS

6.14.1 Effect on Polar Bears

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

- Polar bears may occur in the vicinity of the Project within the BCP during any time of year, but are more likely to occur during fall through spring during construction and operation of the proposed action; and
- The proposed construction and operation activities at GTP, PTTL, and Mainline (MP 0 to MP 14) could result in injury, mortality, or disturbance.

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

- The Project may cause some disturbance to a few polar bears primarily during construction, with a low level of continued potential for disturbance during operations;
- The GTP would be located away from the coast within an industrialized area and few polar bears would be expected to occur near the facility during construction; and
- Development and implementation of LOAs and appropriate conservation measures and interaction plans, however, are likely to limit adverse effects to no more than a few polar bears.

6.14.2 Effect on Polar Bear Critical Habitat

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

- Critical habitat was designated for more than 187,000 square miles of offshore barrier islands, terrestrial denning areas, and offshore sea ice; and
- Project-related construction would occur within polar bear critical habitat.

The Project is **may affect, but is not likely to adversely modify** polar bear critical habitat because:

- Small amounts of potentially suitable den habitat would be removed as a result of facility construction that has not been documented as used by polar bears for denning;
- An area of potentially suitable den habitat would be temporarily affected through ice road and pad construction that would be surveyed prior to construction to ensure that no active dens are disturbed;
- The GTP may alter habitat suitability for a small area around the facility as a result of noise generated during operation, although noise would likely be indistinguishable from existing CGF operations;
- Oil spills associated with a vessel grounding would be improbable and spill prevention and response planning would be implemented.

6.15 WOOD BISON

6.15.1 Effect on Wood Bison

There would be **no effect** on wood bison because:

- Wood bison from the lower Innoko/Yukon River reintroduction site are not expected to range within the Project action area; and
- Project-related construction and operation would occur within the lower Innoko/Yukon River reintroduction site.

6.15.2 Effect on Wood Bison Critical Habitat

Critical habitat cannot be designated (ND) for the nonessential experimental populations.

6.16 ESKIMO CURLEW

6.16.1 Effect on the Eskimo Curlew

There would be **no effect** on Eskimo curlews because:

- Eskimo curlews are extirpated, and may no longer occur in Alaska.

6.16.2 Effect on Eskimo Curlew Critical Habitat

No critical habitat has been designated or proposed for the Eskimo curlew.

6.17 SHORT-TAILED ALBATROSS

6.17.1 Effect on the Short-tailed Albatross

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

- Short-tailed albatrosses may occur within Alaskan waters during construction and operation of the proposed action; and
- The proposed action would increase shipping traffic within Alaska waters.

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

- While a potential exists for vessel disturbance the wide-spread distribution of short-tailed albatross pose little risk of encounters with LNGC traffic in the Gulf of Alaska and Aleutian Islands, and HLV traffic through the Gulf of Alaska, Aleutian Islands, and Bering Sea;
- Vessel grounding and fuel spills are unlikely; and
- Compliance with the Aleutian Islands ATBAs and recommended short-tailed albatross avoidance areas by Project-related vessel traffic would reduce the potential for effects from possible vessel grounding and associated releases on short-tailed albatross.

6.17.2 Effect on Short-tailed Albatross Critical Habitat

No critical habitat has been designated or proposed for the short-tailed albatross.

6.18 SPECTACLED EIDER

6.18.1 Effect on the Spectacled Eider

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

- Spectacled eiders are found in the Bering, Chukchi, and Beaufort Seas and nest within the Project action area on the Arctic Coastal Plain; and
- The proposed action would increase construction and operation activity on the Arctic Coastal Plain, and would increase shipping activity traffic within Alaska waters.

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

- Construction and operations may injure or kill a few spectacled eiders breeding and molting within the action area; and
- Construction and operation of the GTP, PTTL, and northern portion of the Mainline would result in long-term habitat loss for a few spectacled eiders.

6.18.2 Effect on Spectacled Eider Critical Habitat

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

- Critical habitat was designated in for nesting on the Yukon-Kuskokwim Delta; for molting in Norton Sound and Ledyard Bay; and for wintering south of St. Lawrence Island; and
- Project-related vessels would use established marine shipping routes from manufacture sites through the Bering and Chukchi seas around Point Barrow to Prudhoe Bay.

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

- Nesting habitat on the BCP where Project facilities would be constructed and operated was not designated critical habitat because it was not considered to be limiting;
- Project-related vessel traffic would not cross through marine molting critical habitats;
- Oil spills associated with a vessel grounding or other accidental release would be improbable and mitigation through the development and implementation of oil spill prevention and response plans would likely prevent effects on spectacled eider critical habitat; and
- Vessels would be subject to USCG 33 CFR 151 regulations to prevent the introduction of aquatic invasive species into Alaska marine waters.

6.19 STELLER'S EIDER – ALASKA BREEDING POPULATION

6.19.1 Effect on the Alaska-Breeding Steller's Eider

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 molting and wintering in Cook Inlet or the Aleutian Islands;
- The proposed action would increase shipping traffic within Alaskan waters; and
- There is a potential for disturbance from Project-related LNGC and HLV traffic through lower Cook Inlet, Shelikoff Strait, and the Aleutian Islands.

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

- Very few Steller's eiders occurring on molting and wintering grounds in Alaska belong to the Alaska-breeding population;

- While a potential exists for vessel disturbance the rarity and wide-spread distribution of Alaska-breeding Steller's eiders pose little risk of encounters with LNGC traffic in the Gulf of Alaska and Aleutian Islands, and HLV traffic through the Gulf of Alaska, Aleutian Islands, and Bering Sea;
- Vessel grounding and fuel spills are unlikely; and
- Compliance with the Aleutian Islands ATBAs and recommended short-tailed albatross avoidance areas by Project-related vessel traffic would reduce the potential for effects from possible vessel grounding and associated releases on Alaska-breeding Steller's eiders.

6.19.2 Effect on Steller's Eider Critical Habitat

The Project **may affect** 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; and
- 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.

The Project is **not likely to adversely modify** Steller's eider critical habitat because:

- Project-related HLV and LNGC traffic would not cross Steller's eider critical habitat;
- Oil spills associated with a vessel grounding or other accidental release would be improbable and mitigation through the development and implementation of oil spill prevention and response plans would likely prevent effects on Steller's eider critical habitat; and
- Vessels would be subject to USCG 33 CFR 151 regulations to prevent the introduction of aquatic invasive species into Alaska marine waters.

6.20 PACIFIC SALMON AND STEELHEAD TROUT

6.20.1 Effect on the Pacific Salmon and Steelhead Trout

The Project **may affect** Pacific salmon ESUs and steelhead trout DPSs that occur in Alaska waters because:

- Pacific Salmon ESUs and steelhead trout DPSs may occur within Alaska waters during operation of the proposed action; and
- The proposed actions would increase shipping traffic within Alaska waters.

The Project is **not likely to adversely affect** Pacific salmon ESUs and steelhead trout DPSs because:

- Vessel traffic would create surface water disturbance and noise that could potentially be perceived by fish; and
- Like existing marine vessel traffic, this disturbance and noise would not reduce their survival or reproduction.

6.20.2 Effect on Pacific Salmon and Steelhead Critical Habitat

There would be **no effect** on critical habitats for these Pacific salmon ESUs and steelhead trout DPSs because:

- Critical habitats occur in freshwaters and estuaries outside of Alaska and Alaskan waters and outside of the Project action area.

7.0 LITERATURE CITED

32 FR 4001. 1967. Native Fish and Wildlife: Endangered Species. Notice. Secretary of the Interior. p. 4001.

35 FR 8491. 1970. Wildlife and Fisheries/Conservation of Endangered Species and Other Fish or Wildlife, Rules and Regulations. Department of the Interior, Fish and Wildlife Service. pp. 8491-8498.

55 FR 49204. 1990. Listing of Steller Sea Lions as Threatened Under the Endangered Species Act, Final Rule. Department of Commerce, National Marine Fisheries Service, pp. 49204-49241.

58 FR 27474. 1993. Endangered and Threatened Wildlife and Plants: Final Rule to List Spectacled Eider as Threatened, Final Rule. Department of the Interior, Fish and Wildlife Service. pp. 27474-27480.

58 FR 45269. 1993. Designated Critical Habitat/ Steller Sea Lion, Final Rule. Department of Commerce, National Marine Fisheries Service. pp. 45269-45285.

59 FR 31094. 1994. Endangered and Threatened Wildlife and Plants; Final Rule to Remove the Eastern North Pacific Population of the Gray Whale from the List of Endangered Wildlife. Final Rule. Department of Interior, Fish and Wildlife Service and Department of Commerce, National Marine Fisheries Service. pp. 31094-31095.

62 FR 24345. 1997. Threatened Fish and Wildlife/ Change in Listing Status of Steller Sea Lions Under the Endangered Species Act, Final Rule. Department of Commerce, National Marine Fisheries Service. pp. 24345-24355.

62 FR 31748. 1997. Endangered and Threatened Wildlife and Plants; Threatened Status for the Alaska Breeding Population of the Steller's Eider, Final Rule. Department of the Interior, Fish and Wildlife Service. pp. 31748-31757.

66 FR 8850. 2001. Endangered and Threatened Wildlife and Plants; Final Determination of Critical Habitat for the Alaska-Breeding Population of the Steller's Eider, Final Rule. Department of the Interior, Fish and Wildlife Service. pp. 8850-8884.

66 FR 9146. 2001. Endangered and Threatened Wildlife and Plants; Final Determination of Critical Habitat for the Spectacled Eider, Final Rule. Department of the Interior, Fish and Wildlife Service. pp. 9146-9185.

70 FR 46366. 2005. Endangered and Threatened Wildlife and Plants/Determination of Threatened Status for the Southwest Alaska Distinct Population Segment of the Northern Sea Otter (*Enhydra lutris kenyoni*), Final Rule. Department of the Interior, Fish and Wildlife Service. pp. 46366-46386.

73 FR 12024. 2008. Endangered and Threatened Species; Endangered status for North Pacific and North Atlantic Right Whales, Final Rule. Department of Commerce, National Oceanic and Atmospheric Administration. pp. 12024-12030.

73 FR 19000. 2008. Endangered and Threatened Species; Designation of Critical habitat for North Pacific Right Whale, Final Rule. Department of Commerce, National Oceanic and Atmospheric Administration. pp. 19000-19014.

73 FR 28212. 2008. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Polar Bear (*Ursus maritimus*) Throughout Its Range, Final Rule. Department of the Interior, Fish and Wildlife Service. pp. 28212-28303.

73 FR 62919. 2008. Endangered and Threatened Species/ Endangered Status for the Cook Inlet Beluga Whale, Final Rule. Department of Commerce, National Marine Fisheries Service. pp. 62919-62930.

74 FR 51988. 2009. Endangered and Threatened Wildlife and Plants/ Designation of Critical Habitat for the Southwest Alaska Distinct Population Segment of the Northern Sea Otter, Final Rule. Department of the Interior, Fish and Wildlife Service. pp. 51988-52012.

75 FR 76086. 2010. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Polar Bear (*Ursus maritimus*) in the United States, Final Rule. Department of the Interior, Fish and Wildlife Service. pp. 76086-76137.

76 FR 7634. 2011. Endangered and Threatened Wildlife and Plants/12-Month Finding on a Petition to List the Pacific Walrus as Endangered or Threatened, Notice of 12-month Petition Finding. Department of the Interior, Fish and Wildlife Service. pp. 7634-7679.

76 FR 47010. 2011. Marine Mammals; Incidental Take During Specified Activities, Final Rule. Department of the Interior, Fish and Wildlife Service. pp. 47010-47054.

76 FR 20180. 2011. Endangered and Threatened Species/ Designation of Critical Habitat for Cook Inlet Beluga Whale, Final Rule. Department of Commerce, National Marine Fisheries Service. pp. 20180-20214.

77 FR 76706. 2012. Endangered and Threatened Species/ Threatened Status for the Arctic, Okhotsk, and Baltic Subspecies of the Ringed Seal and Endangered Status for the Ladoga Subspecies of the Ringed Seal, Final Rule. Department of Commerce, National Marine Fisheries Service. pp. 76706-76738.

77 FR 76740. 2012. Endangered and Threatened Species/ Threatened Status for the Beringia and Okhotsk Distinct Population Segments of the *Erignathus barbatus nauticus* Subspecies of the Bearded Seal, Final Rule. Department of Commerce, National Marine Fisheries Service. pp. 76740-76768.

78 FR 35364. 2013. Marine Mammals; Incidental Take During Specified Activities, Final Rule. Department of the Interior, Fish and Wildlife Service. pp. 35364-35427.

78 FR 11766. 2013. Endangered and Threatened Wildlife and Plants; Special Rule for the Polar Bear Under Section 4(d) of the Endangered Species Act. Department of the Interior, Fish and Wildlife Service. pp. 11766-11788.

78 FR 66140. 2013. Endangered and Threatened Species; Delisting of the Eastern Distinct Population Segment of the Steller Sea Lion Under the Endangered Species Act; Amendment to Special Protection Measures for Endangered Marine Mammals. Final Rule. Department of Commerce, National Marine Fisheries Service. pp. 66140-66199.

79 FR 22154. 2014. Marine Mammal Protection Act; Stock assessment Reports. Department of the Interior, Fish and Wildlife Service. pp. 22154-22159.

79 FR 26175. 2014. Endangered and Threatened Wildlife and Plants; Establishment of a Nonessential Population of Wood Bison in Alaska. Department of the Interior, Fish and Wildlife Service. pp. 26175-26188.

79 FR 73010. 2014. Endangered and Threatened Species; Designation of Critical Habitat for the Arctic Ringed Seal. Proposed Rule; withdrawal and reproposal. Department of Commerce, National Marine Fisheries Service. pp. 73010-73025.

80 FR 22304. 2015. Endangered and Threatened Species; Identification of 14 Distinct Population Segments of the Humpback Whale (*Megaptera novaeangliae*) and Proposed Revision of Species-Wide Listing, Proposed Rule; 12-month Findings. Department of Commerce, National Marine Fisheries Service. pp. 22304-22356.

Aars J., N.J. Lunn, and A.E. Derocher (Compilers and Editors). 2006. Polar Bears: Proceedings of the 14th Working Meeting of the IUCN/SSC Polar Bear Specialist Group, 20-24 June 2005, Seattle, United States of America. IUCN, Gland, Switzerland, and Cambridge, U.K.

ADF&G (Alaska Department of Fish and Game). 2013. Environmental Assessment: Designation of Nonessential Experimental Population Status for Wood Bison in Interior Alaska. Prepared in cooperation with the U.S. Fish and Wildlife Service.

ADF&G (Alaska Department of Fish and Game). 2015a. Recovery by Fishery Report – FI086220. June 11, 2015. Mark, Tag, and Age Laboratory Online Report. http://mtalab.adfg.alaska.gov/CWT/reports/default.asp. Submitted June 11, 2015.

ADF&G (Alaska Department of Fish and Game). 2015b. Recovery by Fishery Report – F106199. June 11, 2015. Mark, Tag, and Age Laboratory Online Report. http://mtalab.adfg.alaska.gov/CWT/reports/default.asp. Submitted June 11, 2015.

ADF&G (Alaska Department of Fish and Game). 2015c. Recovery by Fishery Report – F2086201. June 11, 2015. Mark, Tag, and Age Laboratory Online Report. http://mtalab.adfg.alaska.gov/CWT/reports/default.asp. Submitted June 11, 2015.

ADF&G (Alaska Department of Fish and Game). 2015d. Recovery by Fishery Report – FI086207. June 11, 2015. Mark, Tag, and Age Laboratory Online Report. http://mtalab.adfg.alaska.gov/CWT/reports/default.asp. Submitted June 11, 2015.

ADF&G (Alaska Department of Fish and Game). 2015e. Species Profile. Available online at: http://www.adfg.alaska.gov/index.cfm?adfg=animals.listmammals. Accessed August 2015.

ADF&G (Alaska Department of Fish and Game). 2016. Alaska Subsistence Bird and Egg Harvest Estimates (2004-2013). Alaska Migratory Bird Co-Management Council, Harvest Assessment Program. Accessed online at: http://www.adfg.alaska.gov/SUB_AMBCCDB/

Aerts, L., M. Blees, S. Blackwell, C. Greene, K. Kim, D. Hannay and M. Austin. 2008. Marine mammal monitoring and mitigation during BP Liberty OBC seismic survey in Foggy Island Bay, Beaufort Sea, July-August 2008: 90-day report. LGL Rep. P1011-1. Rep. from LGL Alaska Research Associates Inc., LGL Ltd., Greeneridge Sciences Inc. and JASCO Research Ltd. for BP Exploration Alaska.

AFSC (Alaska Fisheries Science Center). 2015. National Marine Mammal Laboratory. Available online at: http://www.afsc.noaa.gov/nmml/species/index_ceta.php and http://www.afsc.noaa.gov/nmml/species/index_pin.php. Accessed August 7, 2015.

Alaska Wood Bison Management Planning Team. 2015. Wood bison management plan for lower Innoko/Yukon River in westcentral Alaska, 2015-2020. Alaska Department of Fish and Game, Division of Wildlife Conservation, Wildlife Management Plan ADF&G/DWC/WMP-2015-1, Fairbanks.

ALCC (Arctic Landscape Conservation Cooperative). 2012. Threatened Eider Geodatabase for Northern Alaska. August 29, 2012. [SPEI, STEI sightings 1992 to 2010]. Available online at: http://arcticlcc.org/products/spatial-data/show/threatened-eider-geodatabase-for-northern-alaska-2012-edition. Accessed November 11, 2015.

Aleutian Islands Risk Assessment Management Team. 2011. Aleutian Islands Risk Assessment Project Phase A Summary Report. August 2011. 58 pp. http://www.aleutiansriskassessment.com/documents/110826AIRA_SummaryReportvFINALlr.pdf.

Allen, B. M., and R. P. Angliss. 2014. Alaska marine mammal stock assessments, 2013. U.S. Department of Commerce, NOAA Tech. Memo. NMFSAFSC-277, 294 p. Available online at: http://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-277.pdf. Accessed October 4, 2014.

Allen, B. M., and R. P. Angliss. 2015. Alaska marine mammal stock assessments, 2014. June 2015. U.S. Department of Commerce, NOAA Tech. Memo. NMFS-AFSC-301, 313 pp. Available online at: http://www.nmfs.noaa.gov/pr/sars/draft.htm. Accessed July 8, 2015.

Amstrup, S. C. 1993. Human disturbances of denning polar bears in Alaska. Arctic 46(3):246–250.

Amstrup, S.C. 2000. Polar bear. Pages 133-157 in Truett, J.J. and S.R. Johnson, eds. The Natural History of an Arctic Oilfield: Development and the Biota. Academic Press, Inc. New York.

Amstrup, S.C., and C. Gardner. 1994. Polar bear maternity denning in the Beaufort Sea. Journal of Wildlife Management 58:1–10.

Amstrup, S.C., G.M. Durner, I. Stirling, N.J. Lunn, and F. Messier. 2000. Movements and distribution of polar bears in the Beaufort Sea. Canadian Journal of Zoology 78:948–66.

Amstrup, S.C., G.M. Durner, I. Stirling, and T.L. McDonald. 2005. Allocating harvests among polar bear stocks in the Beaufort Sea. Arctic 58(3): 247-259.

Anderson, B.A., A.A. Stickney, T. Obritschkewitsch, P.E. Seiser, and J.E. Shook. 2009. Avian studies in the Kuparuk oilfield, Alaska, 2008. Prepared for ARCO Alaska, Inc. and the Kuparuk River Unit, 1994-1998; prepared for Phillips Alaska, Inc. and the Kuparuk River Unit, 1999-2000; prepared for ConocoPhillips Alaska, Inc. and the Kuparuk River Unit, 2001-2008 prepared by ABR, Inc.-Environmental Research & Services, Fairbanks, Alaska.

Anderson, B.A., S.M. Murphy, M.T. Jorgenson, D.S. Barber, and B.A. Kugler. 1992. GHX-1 Waterbird and Noise Monitoring Program. Prepared for ARCO Alaska, Inc. by Alaska

Biological Research, Fairbanks, Alaska and BBN Systems and Technologies Corp, Canoga Park, California. 132 pp.

Atwood, T.C., B.G. Marcot, D.C. Douglas, S.C. Amstrup, K.D. Rode, G.M. Durner, and J.F. Bromaghin, 2015. Evaluating and ranking threats to the long-term persistence of polar bears: U.S. Geological Survey Open-File Report 2014-1254. 114 p., http://dx.doi.org/10.3133/ofr20141254. Available online at: http://alaska.usgs.gov/science/biology/polar_bears/pubs.html. Accessed June 30, 2015.

Barlow J., J. Calambokidis, E.A. Falcone, C.S. Baker, A.M. Burdin, P.J. Clapham, J.K.B. Ford, C.M. Gabriele, R. LeDuc, D.K. Mattila, T.J. Quinn, L. Rojas-Bracho, J.M. Straley, B.L. Taylor, R.J. Urbán, P. Wade, D. Weller, B.H. Witteveen, M. Yamaguch.i 2011. Humpback whale abundance in the North Pacific estimated by photographic capture-recapture with bias correction from simulation studies. Mar. Mamm. Sci. 27:793-818.

Bassett, C., B. Polagye, M. Holt, and J. Thomson. 2012. A vessel noise budget for Admiralty Inlet, Puget Sound, Washington (USA). J. Accoust. Soc. Am. 132(6):3706-3719.

Bettridge, S., C.S. Baker, J. Barlow, P.J. Clapham, M. Ford, D. Gouveia, D.K. Mattila, R.M. Pace, III, P.E. Rosel, G.K. Silber, and P.R. Wade. 2015. Status Review of the Humpback Whale (*Megaptera novaeangliae*) under the Endangered Species Act. March 2015. NOAA-TM-NMFS-SWFSC-540. Available online at:http://www.fisheries.noaa.gov/pr/species/mammals/whales/humpback-whale.html. Accessed June 5, 2015.

Blackwell, S.B. and C.R. Greene, Jr. 2002. Acoustic Measurements in Cook Inlet, Alaska, During August 2001. NMFS Contract number 40HANF100123, Greeneridge Report 271-1. 41 pp

Bodkin, J.L., D.H. Monson, G.E. Esslinger. 2003. A report on the results of the 2002 Kenai Peninsula and Lower Cook Inlet aerial sea otter survey. US Geological Survey, Alaska.

Bracis, C. 2010. A model of the ocean migration of Pacific salmon. Master's Thesis. University of Washington, Seattle, Washington. Available online at:http://www.cbr.washington.edu/sites/default/files/papers/BracisThesis.pdf. Accessed October 4, 2014.

Brownell, R. L., P. J. Clapham, T. Miyashita, and T. Kasuya. 2001. Conservation status of North Pacific right whales. J. Cetacean Res. Manage. (Special Issue). 2:269-86.

Brueggeman, J., B. Watts, M. Wahl, P. Seiser, and A. Cyr. 2009. Marine mammal surveys at the Klondike and Burger survey areas in the Chukchi Sea during the 2008 open water season. Report for ConocoPhillips Alaska, Inc., and Shell Exploration and Production by Canyon Creek Consulting, LLC, Seattle, WA.

Bruning, D.L. 2012. Unit 20D bison. Pages 28-54 in Alaska Department of Fish and Game, P. Harper, editor. Bison management report of survey and inventory activities, 1 July 2009-20 June 2011. Species Management Report ADF&G/DWC/SMR-2012-1, Juneau, Alaska.

Burn, D.M. and A.M. Doroff. 2005. Decline in sea otter (*Enhydra lutris*) populations along the Alaska Peninsula, 1986-2001. Fishery Bulletin103:270-279.

Calambokidis, J. 2013. Updated abundance estimates of blue and humpback whales off the US west coast incorporating photo-identifications from 2010 and 2011. Document PSRG-2013-13 presented to the Pacific Scientific Review Group. April.

Calambokidis, J. E.A. Falcone, T.J. Quinn, A.M. Burdin, P.J. Clapham, J.K.B. Ford, C.M. Gabriele, R. LeDuc, D. Mattila, L. Rojas-Bracho, J.M. Straley, B.L. Taylor, J. Urbán R., D. Weller, B.H. Witteveen, M. Yamaguchi, A. Bendlin, D. Camacho, K. Flynn, A. Havron, J. Huggins, and N. Maloney. 2008. SPLASH: Structure of Populations, Levels of Abundance and Status of Humpback Whales in the North Pacific. Final report for Contract AB133F-03-RP-00078 US Department of Commerce Western Administrative Center, Seattle, Washington. Available online at: http://www.cascadiaresearch.org/SPLASH/SPLASH-contract-Report-May08.pdf. Accessed October 4, 2014.

Cameron, M.F., J.L. Bengtson, P.L. Boveng, J.K. Jansen, B.P. Kelly, S.P. Dahle, E.A. Logerwell, J.E. Overland, C.L. Sabine, G.T. Waring, and J.M. Wilder. 2010. Status review of the bearded seal (*Erignathus barbatus*). US Department of Commerce, NOAA Technical Memorandum No. NMFS-AFSC-211.Ireland et al. (2009)

Carretta, J.V., E. Oleson, D.W. Weller, A.R. Lang, K A. Forney, J. Baker, Brad Hanson, K. Martien, M.M. Muto, A. J. Orr, H. Huber, M. S. Lowry, J. Barlow, D. Lynch, L. Carswell,R. L. Brownell Jr, and D. K. Mattila. 2014. U.S. Pacific Marine Mammal Stock Assessments, 2013. NOAA-TM-NMFS-SWFSC-532.

Celewycz, A.G., E.A. Fergusson, J.H. Moss, and J.A. Orsi. 2014. High seas salmonid coded-wire tag recovery data, 2013. NPAFC Doc. 1528. NOAA, NMFS, Alaska Fisheries Science Center, Auke Bay Laboratories, Ted Stevens Marine Research Institute, Northwest Fisheries Science Center Available online at: http://www.npafc.org. 37 p. Accessed June 11, 2015.

CH2MHill. 2015. Soil stratigraphy report. Alaska LNG Document No. USAL-CH-JBDES-90-000005-000. Report prepared by CH2MHILL for Alaska LNG. 28 pp.

Clapham, P.J., K.E.W. Shelden, and P.R. Wade. 2006. Review of information relating to possible Critical Habitat for eastern North Pacific right whales. Pp. 1-27 In Habitat Requirements and Extinction Risks of Eastern North Pacific Right Whales. Eds: Clapham, P.J., Shelden, K. E. W. and Wade, P. R. AFSC Processed Report 2006-06, Alaska Fisheries Science Center, National Marine Fisheries Service, Seattle.

Clarke, J.T., M.C. Ferguson, C. Curtice, and J. Harrison. 2015. Biologically Important Areas for Cetaceans Within U.S. Waters – Arctic Region. Aquatic Mammals 41(1):94-103.

Coletti, H.A., J.L. Bodkin, T.A. Dean, K.A. Kloecker. 2009. Nearshore Marine Vital Signs Monitoring in the Southwest Alaska Network of National Parks. Natural Resource Technical Report NPS/SWAN/NRTR—2009/252. Natural Resource Program Center. National Park Service. Fort Collins, Colorado.

Conn, P.B., J.M. Ver Hoef, B.T. McClintock, E.E. Moreland, J.M. London, M.F. Cameron, S.P. Dahle, and P.L. Boveng. 2014. Estimating multispecies abundance using automated detection systems: ice-associated seals in the Bering Sea. Methods in Ecology and Evolution 5:1280-1293. doi: 10.1111/2041-210X.12127

Cooke, J.G., D.W. Weller, A.L. Bradford, O.A. Sychenko, A.M. Burdin, and R.L. Brownell, Jr. 2013. Population assessment of the Sakhalin gray whale aggregation. Paper SC/65a/BRG27 presented to the International Whaling Commission Scientific Committee. Available online from https://iwc.int/sc65adocs. Accessed July 8, 2015.

Day, R.H., A.K Prichard, and J.R. Rose. 2005. Migration and Collision Avoidance of Eiders and other Birds at Northstar Island, Alaska, 2001-2004: Final Report. Prepared for BP Exploration (Alaska) Inc. by ABR, Inc.-Environmental Research & Services, Fairbanks, Alaska.

Day, R.H., A.K. Prichard, J.R. Rose, and A.A. Stickney. 2003. Migration and Collision Avoidance of Eiders and other Birds at Northstar Island, Alaska, 2001 and 2002. Prepared for BP Exploration (Alaska), Inc. by ABR, Inc.-Environmental Research & Services, Fairbanks, AK.

Day, R.H., J.R. Rose, A.K. Prichard, and B. Streever. 2015. Impact of Gas Flaring on the Behavior of Night-Migrating Birds at an Artificial Oil-Production Island, Arctic Alaska. Arctic 68(3):367-379.

Delarue, J., B. Martin, D. Hannay, and C.L. Berchok. 2013. Acoustic occurrence and affiliation of fin whales detected in the northeastern Chukchi Sea, July to October 2007–2010. Arctic 66:159–172.

DeMaster, D.P. 2012. Results of Steller sea lion surveys in Aleutian Islands, Alaska, June 2012. Memorandum to J. Balsiger, J. Kurland, L. Rotterman, B. Berke, and D. Seagars, 21 August 2012. Available at http://www.afsc.noaa.gov/nmml/PDF/SSL-Survey-memo-2012.pdf. Accessed on October 10, 2014.

DeMaster, D.P. and I. Stirling. 1981. *Ursus maritimus*. Polar bear. Mammalian Species 145:1–7.

DNV and ERM (Det Norske Veritas and ERM-West Inc). 2010. Task 2A marine spill frequency and size report. Report no./DNV ref no: EP007543-1. Aleutian Islands Risk Assessment Phase A. Available: http://www.aleutiansriskassessment.com/documents/2010.09.03_FinalTask2AMarineRiskAssessmentResultseReport.pdf

DNV and ERM (Det Norske Veritas and ERM-West, Inc. 2011. Tasks 3 and 4: Consequence Analysis Report, Aleutian Islands Risk Assessment Phase A Preliminary Risk Assessment. Available: http://www.aleutianriskassessment.com/documents/2011_7_7_AIRAPhaseACAReportFINALwCovLtr.pdf

Durner, G.M., S.C. Amstrup, and K.J. Ambrosius. 2001. Remote identification of polar bear maternal den habitat in northern Alaska. Arctic 54(2):115–121.

Durner, G.M., S.C. Amstrup, and A.S. Fischbach. 2003. Habitat characteristics of polar bear terrestrial maternal den sites in northern Alaska. Arctic 56(1):55–62.

Durner, G.M., S.C. Amstrup, R. Neilson, and T. McDonald. 2004. The Use of Sea Ice Habitat by Female Polar Bears in the Beaufort Sea. US Geological Survey, Alaska Science Center, Anchorage, Alaska. OCS study, MMS 2004-014.

Durner, G.M., S.C. Amstrup, and K.J. Ambrosius. 2006. Polar bear maternal den habitat in the Arctic national Wildlife Refuge, Alaska. Arctic 59(1):31-36.

Esler D., J.A. Schmutz, R.L. Jarvis, D.M. Mulchay. 2000. Winter survival of adult female harlequin ducks in relation to history of contamination by the Exxon Valdez oil spill. J. Wildl. Management 64(3):839-847.

Ferguson, M.C., J.M. Waite, C. Curtice, J.T. Clarke, and J. Harrison. 2015a. Biologically Important Areas for Cetaceans Within U.S. Waters – Aleutian Islands and Bering Sea Region. Aquatic Mammals 41(1):79-93.

Ferguson, M.C., C. Curtice, and J. Harrison. 2015b. Biologically Important Areas for Cetaceans Within U.S. Waters – Gulf of Alaska Region. Aquatic Mammals 41(1):65-78.

Ferguson, S.H., M.K. Taylor, and F. Messier. 2000b. Influence of sea ice dynamics on habitat selection by polar bears. Ecology 81:761–772.

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

Fischbach, A.S., S.C. Amstrup and D.C. Douglas. 2007. Landward and eastward shift of Alaskan polar bear denning associated with recent ice changes. Polar Biology 30:1395-1405. DOI 10.1007/s00300-007-0300-4

Fischer, J.B., and W.W. Larned. 2004. Summer distribution of marine birds in the western Beaufort Sea. Arctic 57(2):143-159.

Folkens, Pieter. 2001. Marine Mammals of the Pacific Northwest, including Oregon, Washington, British Columbia and South Alaska. Harbour Press. June 1.

FR 62260. 2016. Endangered and threatened species: identification of 14 Distinct Population Segments of the humpback whale (*Megaptera novaeangliae*) and revision of species-wide listing. Federal Register 81(174):62260-62320.

Fredrickson, L.H. 2001. Steller's Eider (*Polysticta stelleri*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/571 doi:10.2173/bna.571. Accessed October 13, 2014.

Fritz, L.W., K. Sweeney, and D. Johnson. 2013. Aerial and Ship-Based Surveys of Steller sea lions (*Eumetopias jubatus*) Conducted in Alaska June-July 2008 through 2012 and an Update on the Status and Trend of the Western Stock in Alaska. NOAA Tech. Memo. NMFS-AFSC-251: 91.

Fritz, L., R. Towell, T. S. Gelatt, D. S. Johnson, and T. R. Loughlin. 2014. Recent increases in survival of western Steller sea lions in Alaska and implications for recovery. Endangered Species Review 26:12-24.

Fritz, L.W., K. Sweeney, D. Johnson, and T. Gelatt. 2015. Results of Steller Sea Lion Surveys in Alaska, June-July 2014. NOAA Memo. F/AKC3:lwf.

Frost, K.J. 1985. Unpubl. rep. The ringed seal. Alaska Dep. Fish and Game, Fairbanks.

Garlich-Miller, J., J.G. MacCracken, J. Snyder, R. Meehan, M. Myers, J.M. Wilder, E. Lance, and A. Matz. 2011. Status review of the Pacific walrus (*Odobenus rosmarus divergens*). January 2011. US Fish and Wildlife Service, Marine Mammals Management, Anchorage, AK. 163 p.

Garshelis, D.L., A.M. Johnson, J.A. Garshelis. 1984. Social organization of sea otters in Prince William Sound. Alaska. Can. J. Zool. 62:2648-2658.

George, J. C., J. Zeh, R. Suydam, and C. Clark. 2004. Abundance and population trend (1978-2001) of western arctic bowhead whales surveyed near Barrow, Alaska. Mar. Mammal Sci. 20:755-773.

Givens, G.H., S.L. Edmondson, J.C. George, R. Suydam, R.A. Charif, A. Rahaman, D. Hawthorne, B. Tudor, R.A. DeLong, and C.W. Clark. 2013. Estimate of 2011 abundance of the Bering–Chukchi–Beaufort seas bowhead whale population. Presented to the 65th International Whaling Commission, SC/65a/BRG01.

Goddard, P.C., and D.J. Rugh. 1998. A group of right whales seen in the Bering Sea in July 1996. Mar. Mammal Sci. 14(2):344-349.

Goetz, K.T., R.A. Montgomery, J.M. Ver Hoef, R.C. Hobbs, and D.S. Johnson. 2012a. Identifying essential summer habitat of the endangered beluga whale *Delphinapterus leucas* in Cook Inlet, Alaska. Endangered Species Research 16(2012):135-147. DOI: 10.3354/esr00394.

Goetz, K.T., P.W. Robinson, R.C. Hobbs, K.L. Laidre, L.A. Huckstadt, and K.E.W. Shelden. 2012b. Movement and dive behavior of beluga whales in Cook Inlet, Alaska. AFSC Processed Rep. 2012-03, 40 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115.

Gosho, M. E., D. W. Rice, and J. M. Breiwick. 1984. The sperm whale, *Physeter macrocephalus*. Marine Fisheries Review 46(4), NOAA, pp. 54-64. Available online at: http://spo.nmfs.noaa.gov/mfr464/mfr46410.pdf. Accessed June 17, 2015.

Hannay, D.E., J. Delarue, X. Mouy, B.S. Martin, D. Leary, J.N. Oswald, and J. Vallarta. 2013. Marine mammal acoustic detections in the northeastern Chukchi Sea, September 2007–July 2011. Continental Shelf Research 67:127–146.

Hakamada, T., H. Kiwada, K. Matsuoka, and T. Kitakado. 2014. Preliminary estimation of North Pacific sei whale abundance derived from 2010 IWC/Japan Joint Cetacean Sighting Survey data. SC/63/IA13. Available online at: http://iwc.int/document_535. Accessed October 6, 2014.

Hansen, D.J., and J.D. Hubbard. 1999. Distribution of Cook Inlet beluga whales (*Delphinapterus leucas*) in winter. Final Rep. OCS Study. MMS 99-0024. US Department of the Interior, Minerals Management Service. Alaska OCS Region, Anchorage, AK.

Hashagen, K.L., G.A. Green, and B. Adams. 2009. Observation of humpback whales in the Beaufort Sea, Alaska. Northwestern Naturalist 90:160–162.

Hobbs, R.C., K. L. Laidre, D. J. Vos, B. A. Mahoney, and M. Eagleton. 2005. Movements and area use of belugas, *Delphinapterus leucas*, in a subarctic Alaskan estuary. Arctic 58(4):331-340.

Hobbs, R. C., C. L. Sims, and K. E. W Shelden. 2012. Estimated abundance of belugas in Cook Inlet, Alaska, from aerial surveys conducted in June 2012. NMFS, NMML Unpublished Report. Available online at: http://alaskafisheries.noaa.gov/protectedresources/whales/beluga/abundance/2012estimates.pdf. Accessed October 13, 2014.

Hunter, C.M., H. Caswell, M.C. Runge, E.V. Regehr, S.C. Amstrup, and I. Stirling. 2010. Climate change threatens polar bear populations: a stochastic demographic analysis. Ecology 91(10):2883-2897.

Huntington, H. P., R. Daniel, A. Hartsig, K. Harun, M. Heiman, R. Meehan, G. Noongwook, L. Pearson, M. Prior-Parks, M. Robards, G. Stetson. 2015. Vessels, risks, and rules: Planning for safe shipping in Bering Strait. Marine Policy 51:119-127.

International Council on Clean Transportation (ICCT). 2015. A 10-year Projection of Maritime Activity in the U.S. Arctic Region. The International Council on Clean Transportation, 1225 Eye Street NW Suite 900, Washington, DC 20005 73 pp.

International Maritime Organization (IMO). 2016. Routeing measures and mandatory ship reporting systems establishment of five areas to be avoided in the region of the Aleutian Islands. Submitted by the United States. NCSR 2/3/X. December 4, 2014.

Ireland, D., R. Rodrigues, D. Funk, W.R. Koski, and D. Hannay. 2009. Marine mammal monitoring and mitigation during open water seismic exploration by Shell Offshore Inc. in the Chukchi and Beaufort seas, July—November 2007, 90–day report. LGL report P1049–1. Report from LGL Alaska Research Associates, Inc., LGL Ltd., and JASCO Research Ltd. For Shell Offshore, Inc., National Marine Fisheries Service, and U.S. Fish and Wildlife Service. Available online at: http://www.nmfs.noaa.gov/pr/pdfs/permits/shell_seismic_monitoring_mitigation.pdf. Accessed January 27, 2014.

IWC (International Whaling Commission). 2007. Report of the Scientific Committee. Annex K. Report of the Standing Working Group on Environmental Concerns. Journal of Cetacean Research and Management (Suppl) 9:227-296.

Jay, C.V., A.S. Fischbach, and A.A. Kochnev. 2012. Walrus areas of use in the Chukchi Sea during sparse sea ice cover. Marine Ecology Progress Series 468:1–13.

Johnson, C.B., J.P. Parrett, and P.E. Seiser. 2008. Spectacled eider monitoring at the CD-3 Development, 2007. Prepared for ConocoPhillips Alaska, Inc. and Anadarko Petroleum Corporation by ABR, Inc.-Environmental Research & Services, Fairbanks, AK. 51 p.

Johnson, C.B., B.E. Lawhead, and A.M. Wildman. 2011. Draft Biological Assessment of the Polar Bear (*Ursus maritimus*), Spectacled Eider (*Somateria fischeri*), Steller's Eider (*Polysticta stelleri*), and Yellow-Billed Loon (*Gavia adamsii*). October 2011. Prepared for ExxonMobil Point Thomson Project North Slope, Alaska by ABR, Inc.—Environmental Research and Services (Fairbanks and Anchorage, AK), and URS Corporation (Anchorage, AK).

Johnson, D.S., and L. Fritz. 2014. agTrend: A Bayesian approach for estimating trends of aggregated abundance. Methods in Ecology and Evolution 2014:1-6. DOI: 10.1111/2041-210X.12231

Kanda, N., M. Goto, K. Matsuoka, H. Yoshida, and L.A. Pastene. 2014. Stock identity of sei whales in the central North Pacific based on microsatellite analysis of biopsy samples obtained from ISC/Japan joint cetacean sighting survey in 2010. SC/63/IA12. Available online at: http://iwc.int/document_534. Accessed October 6, 2014.

Kastelein, R.A., R. van Schie, W. Verboom, and D. Haan. 2005. Underwater hearing sensitivity of a male and a female Steller sea lion (*Eumetopias jubatus*). Journal of the Acoustical Society of America, 118:1820-1829.

Kelly, B.P., J.L. Bengtson, P.L. Boveng, M.F. Cameron, S.P. Dahle, J.K. Jansen, E.A. Logerwell, J.E. Overland, C.L. Sabine, G.T. Waring, and J.M. Wilder. 2010. Status review of the ringed seal (*Phoca hispida*). US Department of Commerce, NOAA Tech. Memo. NMFS-AFSC-212, 250 p.

Lacroix, D.L., Lanctot, R.B., Reed, J.A., and T.L. McDonald. 2003. Effect of underwater seismic surveys on molting male long-tailed ducks in the Beaufort Sea, Alaska. Canadian Journal of Zoology 81:1862-1875.

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

Larned, W.W. 2006. Winter distribution and abundance of Steller's eiders (*Polysticta stelleri*) in Cook Inlet, Alaska, 2004-2005. Final Report December 2006. OCS Study MMS 2009-66. Prepared for US Department of Interior, Minerals Management Service, Alaska Outer Continental Shelf Region, Environmental Studies Section. Anchorage, AK. Available online at: http://www.fws.gov/alaska/mbsp/mbm/waterfowl/surveys/pdf/cistei_report.pdf. Accessed October 11, 2014.

Larned, W.W. 2012. Steller's eider spring migration surveys, Southwest Alaska 2012. US Fish and Wildlife Service, Waterfowl Management, Soldotna, Alaska. Available online at: http://www.fws.gov/alaska/mbsp/mbm/waterfowl/surveys/pdf/swstrpt12.pdf. Accessed October 11, 2014.

Larned, W., R. Stehn, and R. Platte. 2011. Waterfowl breeding population survey Arctic Coastal Plain, Alaska 2010. Unpublished report. U.S. Fish and Wildlife Service, Anchorage, AK. 52 pp.

Larned, W., K. Bollinger, and R. Stehn. 2012. Late Winter Population and Distribution of Spectacled Eiders (*Somateria fischeri*) in the Bering Sea 2009 and 2010. Project No. 820, US Department of Commerce, National Oceanic and Atmospheric Administration. Prepared by US Fish and Wildlife Service, Migratory Bird Management, Soldotna, Fairbanks, and Anchorage, AK.

Larned, W. W., R. A. Stehn, and R. M. Platte. 2012. Waterfowl breeding population survey, Arctic Coastal Plain, Alaska, 2011. Unpubl. Rept., U. S. Fish and Wildlife Service. 55p.

Laubhan, M. K. and K. A. Metzner 1999. Distribution and diurnal behavior of Steller's Eiders wintering on the Alaska Peninsula. Condor 101: 694–698.

LeDuc, R.G., Taylor, B.L., Kartien, K., Robertson, K.M., Pitman, R.L., Salinas, J.C., Burdin, A.M., Kennedy, A.S., Wade, P.R., Clapham, P.J. & Brownell, R.L. Jr. 2012. Genetic analysis of right whales in the eastern North Pacific confirms severe extinction risk. Endang. Species Res. 18: 163-167.

LGL Alaska Research Associates, Inc., JASCO Applied Sciences, Inc., and Greeneridge Sciences, Inc. 2013. Joint Monitoring Program in the Chukchi and Beaufort Seas, 2012. LGL Alaska Draft Report P1272-2 for Shell Offshore, Inc. ION Geophysical, Inc., and Other Industry Contributors,

National Marine Fisheries Service, and U.S. Fish and Wildlife Service. 320 p. plus Appendices.

Liebezeit, J.R., and S. Zack. 2008. Point counts underestimate the importance of arctic foxes as avian nest predators: evidence from remote video cameras in Arctic Alaskan oil fields. Arctic 61:153–161.

Liebezeit, J.R., S.J. Kendall, S. Brown, C.B. Johnson, P. Martin, T.L. McDonald, D.C. Payer, C.L. Rea, B. Streever, A.M. Wildman, and S. Zack. 2009. Influence of human development and predators on nest survival of tundra birds, Arctic Coastal Plain, Alaska. Ecological Applications 19(6):1628-1644.

Light, J. T., C. K. Harris, and R. L. Burgner. 1989. Ocean distribution and migration of steelhead (*Oncorhynchus mykiss*, formerly *Salmo gairdneri*). (Document submitted to the International North Pacific Fisheries Commission.) FRI-UW-8912. Fisheries Research Institute, University of Washington, Seattle. Available online at: https://digital.lib.washington.edu/researchworks/bitstream/handle/1773/4115/8913.pdf?sequence=1. Accessed October 4, 2014.

Linnell, J. D. C., J. E. Swenson, R. Andersen, and B. Barnes. 2000. How vulnerable are denning bears to disturbance? Wildlife Society Bulletin 28: 400–413.

Lovvorn, J.R., S.E. Richman, J.M. Grebmeier, and L.W. Cooper. 2003. Diet and Body Condition of Spectacled Eiders Wintering in Pack Ice of the Bering Sea. Polar Biology 26: 259-267.

Marques, T. A., L. Munger, L. Thomas, S. Wiggins, and J. A. Hildebrand. 2011. Estimating North Pacific right whale *Eubalaena japonica* density using passive acoustic cue counting. Endangered Species Research 13(3):163-172.

Martin, P. D., D. C. Douglas, T. Obritschkewitsch, and S. Torrence. 2015. Distribution and movements of Alaska-breeding Steller's eiders in the nonbreeding period. Ornithological Applications 117: 431-353. Cooper Ornithological Society. ISSN 0004-8038.

McConnell, M.C., L.W. Brigham, T. Laughlin, and L. Speer. 2013. IUCN/NRDC/UAF Workshop on Expanded Shipping and Other Marine Activities and the Ecology of the Bering Strait Region. Workshop II Report. 31October–2 November 2012. Washington, DC USA.

McGee, S., R. Piorkowski, and G. Ruiz. 2006. Analysis of recent vessel arrivals and ballast water discharge in Alaska: Toward assessing ship-mediated invasion risk. Marine Pollution Bulletin 52(2006):1634-1645.

McKenna, M.F., D. Ross, S.M. Wiggins, and J.A. Hildebrand. 2012. Underwater radiated noise from modern commercial ships. Journal of the Acoustical Society of America 131(1):92-103.

Mellinger, D.K., K.M. Stafford, and C.G. Fox. 2004. Seasonal occurrence of sperm whale (*Physeter macrocephalus*) sounds in the Gulf of Alaska, 1999-2001. Mar. Mammal Sci. 20(1):48-62.

Mizroch S.A., and D.W. Rice. 2012. Ocean nomads: distribution and movements of sperm whales in the North Pacific shown by whaling data and Discovery marks. Mar. Mamm. Sci. 29(2):E136-E165. DOI: 10.1111/j.1748-7692.2012.00601.x

MMS. 2006b. Biological evaluation of Steller's eider (*Polysticta stelleri*), spectacled eider (*Somateria fischeri*), and Kittlitz's murrelet (*Brachyramphus brevirostris*) for seismic surveys in the northeast Chukchi Sea and western Beaufort Sea Planning Areas. March 2006. USDOI Minerals Management Service, Alaska OCS Region, Anchorage, AK.

Monnahan, C.C., Trevor, T. A. Branch, and A. E. Punt. 2014. Do ship strikes threaten the recovery of endangered eastern North Pacific blue whales? Marine Mammal Science DOI: 10.1111/mms.12157

Moore, S.E. and H. P. Huntington. 2008. Arctic marine mammals and climate change: impacts and resilience. Ecological Applications 18:S157-S165. Available online at: http://www.esajournals.org/doi/full/10.1890/06-0571.1. Accessed June 17, 2015.

Moore, S. E., J. M. Waite, L. L. Mazzuca, and R. C. Hobbs. 2000. Mysticete whale abundance and observations of prey associations on the central Bering Sea shelf. J. Cetacean Res. Manage. 2(3):227-234.

Moore. S.E., W.A. Watkins, M.A. Daher, J.R. Davies, M.E. Dalheim. 2002a. Blue whale habitat associations in the northwest Pacific: an analysis of remotely sensed data using a Geographical Information System. Oceanography 15(3): 20-25.

Moore, S. E., J. M. Waite, N. A. Friday and T. Honkalehto. 2002b. Cetacean distribution and relative abundance on the central-eastern and southeastern Bering Sea with reference to oceanographic domains. Progress in Oceanography 55(2002):249-261.

Moulton, L.L. 1997. Early marine residence, growth, and feeding by juvenile salmon in northern Cook Inlet, Alaska. Alaska Fishery Research Bulletin 4(2):154-177. Available online at: http://www.adfg.alaska.gov/static/home/library/PDFs/afrb/moulv4n2.pdf. Accessed October 6, 2014.

Munger, L.M., S.M. Wiggins, S.E. Moore, and J.A. Hildebrand. 2008. North Pacific right whale (Eubalaena japonica) seasonal and diel calling patterns from long-term acoustic recordings in the southeastern Bering Sea, 2000-2006. Marine Mammal Science 24(4):795-814.

Muslow, J. and C. Reichmuth. 2010. Psychophysical and electrophysiological aerial audiograms of a Steller sea lion (*Eumetopia jubatus*). Journal of the Acoustical Society of America 127:2692-2701.

Navigation, Communications, and Search and Rescue (NCSR). 2014. Routeing measures and mandatory ship reporting systems establishment of five areas to be avoided in the region of the Aleutian Islands. Submitted by the United States. NCSR 2/3/X. December 4, 2014.

Neilson, J.L., C.M. Gabriele, A.S Jensen, K. Jackson. 2012 Summary of Reported Whales-Vessel collisions in Alaskan Waters. Journal of Marine Biology. Volume 2012, Article ID 106282, 18 pages

NMFS (National Marine Fisheries Service). 1998. Recovery plan for the blue whale (*Balaenoptera musculus*). Prepared by Reeves, R. R., P. J. Clapham, R. L. Brownell, Jr., and G. K. Silber. National Marine Fisheries Service, Silver Spring, MD. 42 pp.

NMFS (National Marine Fisheries Service). 2008. Recovery Plan for the Steller Sea Lion: Eastern and Western Distinct Population Segments (*Eumetopias jubatus*). Revision. Available online at: http://alaskafisheries.noaa.gov/protectedresources/stellers/recovery/sslrpfinalrev030408.pdf. Accessed October 9, 2014.

NMFS (National Marine Fisheries Service). 2009a. Biological Opinion on Marine Terminal Redevelopment Project at Port of Anchorage Alaska 76 pp. Available online at: https://alaskafisheries.noaa.gov/protectedresources/whales/beluga/section7/poa_biop0709.pdf. Accessed October 13, 2014.

NMFS (National Marine Fisheries Service). 2009b. A Prudent Mariner's Guide to Right Whale Protection CD-ROM. Version 1.1 - Updated April 2009.

NMFS (National Marine Fisheries Service). 2011. Biological Opinion. Cook Inlet Beluga Whale Critical Habitat and the Marine Terminal Redevelopment Project at Port of Anchorage Alaska. 87 pp. Available online at: http://alaskafisheries.noaa.gov/protectedresources/whales/beluga/section7/biop.htm. Accessed October 13, 2014.

NMFS (National Marine Fisheries Service). 2012a. North Pacific Right Whale *(Eubalaena japonica*) 5-Year Review: Summary and Evaluation. National Marine Fisheries Service, Office of Protected Resources, Silver Spring, MD. September 2012.

NMFS (National Marine Fisheries Service). 2012b. Sei Whale (*Balaenoptera borealis*), 5-Year Review: Summary and Evaluation. National Marine Fisheries Service, Office of Protected Resources, Silver Spring, MD. June 2012.

NMFS (National Marine Fisheries Service). 2012c. Point Thomson Project, POA-2001-1082-M1. Concurrence Letter. National Marine Fisheries Service, Alaska Region, Juneau, AK. September 14, 2012.

NMFS (National Marine Fisheries Service). 2013a. 2012 Annual Report for the Alaska Groundfish Fisheries Chinook Salmon Incidental Catch and Endangered Species Act Consultation. Prepared by National Marine Fisheries Service – Alaska Region, Juneau, AK. Available online at: http://alaskafisheries.noaa.gov/Sustainablefisheries/bycatch/default.htm. Accessed July 9, 2015. 46 pp.

NMFS (National Marine Fisheries Service). 2013b. Endangered Species Act Section 7 Consultation Biological Opinion: 3-D Seismic surveys of Cook Inlet Alaska by Apache Alaska Corporation. National Marine Fisheries Service, Alaska Region, Juneau, AK. February 14, 2013.

NMFS (National Marine Fisheries Service). 2014a. Northern Pinnipeds Unusual Mortality Event: Update 2014. Available online at: http://alaskafisheries.noaa.gov/protectedresources/seals/ice/diseased/ume_factsheet0214.pdf. Accessed October 8, 2014.

NMFS (National Marine Fisheries Service). 2014b. Endangered Species Act Section 7 Consultation Biological Opinion: Authorization of the Alaska Groundfish Fisheries Under the Proposed Revised Steller Sea Lion Protection Measures. April 2, 2014. Available online at: http://alaskafisheries.noaa.gov/protectedresources/stellers/esa/biop/2014/default.htm. Accessed October 9, 2014.

NMFS (National Marine Fisheries Service). 2015a. Alaska Liquefied Natural Gas Export Project. Letter containing species list for the action area for the Alaska LNG Project. January 30, 2015. To Mr. Charlie Kominas, Alaska LNG Project, from Dr. James Balsiger, Alaska Region, National Marine Fisheries Service, Juneau, Alaska.

NMFS (National Marine Fisheries Service). 2015b. Draft Recovery Plan for the Cook Inlet Beluga Whale (*Delphinapterus leucas*). National Marine Fisheries Service, Alaska Regional Office, Protected Resources division, Juneau, Alaska. 274 pp.

NMFS (National Marine Fisheries Service). 2015c. Endangered Species Act Section 7 Consultation – Biological Opinion: Alaska Federal/State Preparedness Plan for Response to Oil and Hazardous Substance Discharges/Releases (Unified Plan). U.S. Coast Guard, District 17 and U.S. Environmental Protection Agency, Region 10. Prepared by National Marine Fisheries Service, Alaska Region, Juneau, Alaska. 177 pp.

NMFS (National Marine Fisheries Service). 2015d. Endangered Species Act Section 7 Consultation – Biological Opinion and Section Conference Opinion: Issuance of Incidental Harassment Authorization under section 101(a)(5)(a) of the Marine Mammal Protection Act to Shell Gulf of Mexico and Shell Offshore Inc. for Aviation Operations Associated with ice condition Monitoring over the Beaufort and Chukchi seas from May 2015 through April 2016. Prepared by National Marine Fisheries Service, Alaska Region, Juneau, Alaska. 25 pp.

NMFS (National Marine Fisheries Service). 2015e. Species Profile. Available online at: http://www.nmfs.noaa.gov/pr/species/mammals/. Accessed August 2015.

NRC (National Research Council). 2003. Cumulative environmental effects of oil and gas activities on Alaska's North Slope. National Research Council of the National Academies. National Academies Press, Washington, D.C.

Nuka (Nuka Research and Planning Group, LLC). 2015a. Aleutian Islands Risk Assessment Project Home, Routing Measures for the Aleutian Islands Adopted by the IMO Maritime Safety Committee. Available online at: http://www.aleutianriskassessment.com/. Accessed July 9, 2015.

Nuka (Nuka Research and Planning Group, LLC). 2015b. Aleutian Islands Risk Assessment Recommending an optimal response system for the Aleutians Islands: Summary Report. February 2015. 72 pp. Available online at: http://www.aleutiansriskassessment.com/documents/110826AIRA_SummaryReportvFINALlr.pdf. Accessed July 9, 2015.

Obbard, M.E., G.W. Thiemann, E. Peacock, and T.D. DeBruyn (Editors). 2010. Polar Bears: Proceedings of the 15th Working Meeting of the IUCN/SSC Polar Bear Specialist Group, Copenhagen, Denmark, 29 June–3 July 2009. Gland, Switzerland and Cambridge, U.K.

Petersen, M. R. 1980. Observations of wing-feather moult and summer feeding ecology of Steller's Eiders at Nelson Lagoon, Alaska. Wildfowl 31(1980):99-106.

Petersen, Margaret R., J. Barry Grand and Christian P. Dau. 2000. Spectacled Eider (*Somateria fischeri*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America. Available online at: http://bna.birds.cornell.edu/bna/species/547 doi:10.2173/bna.547. Accessed October 11, 2014.

Quakenbush, L.T., R.H. Day, B.A. Anderson, F.A. Pitelka, and B.J. McCaffery. 2002. Historical and present breeding season distribution of Steller's eiders in Alaska. Western Birds 33:99-120.

Quakenbush, L., R. Suydam, T. Obritschkewitsch, and M. Deering. 2004. Breeding biology of Steller's eiders (*Polysticta stelleri*) near Barrow, Alaska, 1991-99. Arctic 57(2):166-182.

Regehr, E.V., S.C. Amstrup and I. Stirling. 2006. Polar bear population status in the Southern Beaufort Sea. Report Series 2006-1337, U.S. Geological Survey, Anchorage, AK.

Regehr, E.V., R.R. Wilson, K.D. Rode, and M.C. Runge. 2015. Resilience and risk – A demographic model to inform conservation planning for polar bears. U.S. Geological survey Open-File report 2015-1029. 56 pp. Available online at: http://dx.doi.org/10.3133/ofr20151029. Accessed June 30, 2015.

Rugh, D., D. DeMaster, A. Rooney, J. Breiwick, K. Shelden, and S. Moore. 2003. A review of bowhead whale (*Balaena mysticetus*) stock identity. J. Cetacean Res. Manage. 5(3): 267-279.

Rugh, D. J., B. A. Mahoney, and B. K. Smith. 2004. Aerial surveys of beluga whales in Cook Inlet, Alaska, between June 2001 and June 2002. U.S. Department Of Commerce. NOAA Tech. Memo. NMFS-AFSC-145.

Rugh D. J., K. E. W. Shelden, R. C. Hobbs. 2010. Range contraction in a beluga whale population. Endangered Species Research 12:69-75.

Schliebe, S., K. D. Rode, J. S. Gleason, J. Wilder, K. Proffitt, T. J. Evans, and S. Miller. 2008. Effects of sea ice extent and food availability on spatial and temporal distribution of polar bears during the fall open-water period in the southern Beaufort Sea. Polar Biology 31:999–1010.

Schweder, T., D. Sadykova, D. Rugh, and W. Koski. 2009. Population Estimates from Aerial Photographic Surveys of Naturally and Variably Marked Bowhead Whales. Journal of Agricultural, Biological, and Environmental Statistics 15(1):1–19.

Sexson, M., M.R. Petersen, and A.N. Powell. 2011. Distribution and migratory timing of threatened Spectacled Eiders in the Beaufort and eastern Chukchi seas. Poster presented at the Alaska Marine Science Symposium, January 2011, Anchorage, Alaska. 1 p. Available online at: www.arcus.org/files/meetings/279/281/presentations/sexson.pdf. Accessed October 11, 2014.

Shelden, K.E.W., C.L. Sims, L.V. Brattstrom, K.T. Goetz, and R.C. Hobbs. 2015. Aerial Surveys of Beluga Whales (*Delphinapterus leucas*) in Cook Inlet, Alaska, June 2014. AFSC Processed Report 2015-03. Alaska Fisheries Science Center, National Oceanic and

Atmospheric Administration, National Marine Fisheries Service, 7600 Sand Point Way NE, Seattle, Washington 98115. 55 pp.

Shideler, R. and J. Hechtel. 2000. Grizzly Bear. Chapter 6 pages 105-132 in J.C. Truett and S.R. Johnson (eds). The Natural History of an Arctic Oil Field: Development and the Biota. Academic Press, San Diego, CA.

Smith, T.S., S.T. Partridge, S.C. Amstrup, and S. Schliebe. 2007. Post-den emergence behavior of polar bears (Ursus maritimus in Northern Alaska. Arctic 60(2):187-194.

Speckman, S.G., V. Chernook, D.M. Burn, M.S. Udevitz, A.A. Kochnev, A. Vasilev, and C.V. Jay. 2010. Results and evaluation of a survey to estimate Pacific walrus population size, 2006. Marine Mammal Science DOI: 10.1111/j.1748-7692.2010.00419.x.

Stafford, K. M. and D. K. Mellinger. 2009. Analysis of acoustic and oceanographic data from the Bering Sea, May 2006 – April 2007. North Pacific Research Board Final Report, NPRB Project #719.

Stafford, K.M., S.L. Nieukirk, and C.G. Fox. 2001. Geographic and seasonal variation of blue whale calls in the North Pacific. Journal Cetacean Research and Management. 3(1):65-76.

Stafford, K.M., S.E. Moore, P.J. Stabeno, D.V. Holliday, J.M. Napp, and D.K. Mellinger. 2010. Biophysical ocean observation in the southeastern Bering Sea. Geophysical Research Letters, Vol. 37, L02606, doi:10.1029/2009GL040724, 2010.

Stehn, R.A., W.W. Larned, and R.M. Platte. 2013. Analysis of aerial survey indices monitoring waterbird populations of the Arctic coastal Plain, Alaska, 1986-2012. March 25, 2013. Prepared by US Fish and Wildlife Service, Migratory Bird Management, Anchorage and Soldotna, AK.

Stirling, I., N. J. Lunn, and J. Iacozza. 1999. Long-term trends in the population ecology of polar bears in Western Hudson Bay in relation to climatic change. Arctic 52:294–306.

Suryan, R.M., F. Sato, G.R. Balogh, K.D. Hyrenbach, P.R. Sievert, and K. Ozaki. 2006. Foraging destinations and marine habitat use of short-tailed albatross: A multi-scale approach using first-passage time analysis. Deep-Sea Research II 53 (2006) 370–386.

Suryan, R.M., G.R. Balogh, and K.N. Fischer. 2007a. Marine Habitat Use of North Pacific Albatross During the Non-breeding Season and Their Spatial and Temporal Interactions with Commercial Fisheries in Alaska. North Pacific Research Board Project 532 Final Report. 69pp.

Suryan, R.M., K.S. Dietrich, E.F. Melvin, G.R. Balogh, F. Sato, and K. Ozaki. 2007b. Migratory routes of short-tailed albatross: use of exclusive economic zones of North Pacific Rim countries and spatial overlap with commercial fisheries in Alaska. Biological Conservation 137: 450-460.

TERA (Troy Ecological Research Associates). 1995. Distribution and Abundance of Spectacled Eiders in the Vicinity of Prudhoe Bay, Alaska, 1991-1993. March 1995. Prepare for BP Exploration (Alaska) Inc. by Troy Ecological Research Associates, Anchorage, Alaska. 17 pp. + Appendices.

TERA (Troy Ecological Research Associates). 1996. Distribution and Abundance of Spectacled Eiders in the Vicinity of Prudhoe Bay, Alaska: 1995 Status Report. August 1996. Prepare for BP Exploration (Alaska) Inc. by Troy Ecological Research Associates, Anchorage, Alaska. 12 pp. + Appendices.

Tickell, W.L.N. 2000. Albatross. New Haven: Yale University Press.

Udevitz, M.S., J.L. Bodkin, D.P. Costa. 1995. Detection of sea otters in boat-based surveys of Prince William Sound, Alaska. Marine Mammal Science 11(1): 59.

USACE. 2000a. Ouzinke Harbor trip report, Steller's eider Survey No. 1 and 2. Unpublished memorandum for the Record. CEPOA-EN-CW-ER. Alaska District, Anchorage.

USACE. 2000b. Sand Point trip report, Steller's eider Survey No. 1, 2, and 3. Unpublished memorandum for the Record. CEPOA-EN-CW-ER. Alaska District, Anchorage.

USACE. 2000c. Unalaska trip report, Steller's eider Survey No. 1 of 4. Unpublished memorandum for the Record. CEPOA-EN-CW-ER. Alaska District, Anchorage.

USACE. 2000d. Biological Assessment of Steller's eider *Polysticta stelleri* (Pallas) for Harbor Construction at Sand Point, Alaska. Unpublished memorandum for the Record. CEPOA-EN-CW-PF. Alaska District, Anchorage.

USCG. 2013. U.S. Coast Guard Seventeenth District presentation at the Nome Maritime Symposium, February 2013.

USFWS (U.S. Fish and Wildlife Service). 2002. Steller's Eider Recovery Plan. Fairbanks, Alaska. Available online at: http://ecos.fws.gov/docs/recovery_plan/020930b.pdf. Accessed October 12, 2014.

USFWS (U.S. Fish and Wildlife Service). 2003. Humans Influences on Predators of Nesting Birds on the North Slope of Alaska. Proceedings of a Public Workshop Held 17-18 April, 2003 in Anchorage, AK. Fairbanks Fish and Wildlife Field Office, Fairbanks, AK.

USFWS (U.S. Fish and Wildlife Service). 2008. Short-tailed Albatross Recovery Plan. Anchorage, AK, 105 pp.

USFWS (U.S. Fish and Wildlife Service). 2009a. Short-tailed Albatross (*Phoebastria albatrus*) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Anchorage Fish and Wildlife Field Office, Anchorage, Alaska. Available online at: http://ecos.fws.gov/docs/five_year_review/doc2623.pdf. Accessed September 29, 2014.

USFWS (U.S. Fish and Wildlife Service). 2009b. Steller's Eider Spotlight Species Action Plan. November 23, 2009. Available online at: http://ecos.fws.gov/docs/action_plans/doc3196.pdf. Accessed October 12, 2014.

USFWS (U.S. Fish and Wildlife Service). 2010a. Spectacled Eider (*Somateria fischeri*) 5-year review: summary and evaluation. August 23, 2010. Fairbanks Fish and Wildlife Field Office, Fairbanks, AK. Available online at: http://ecos.fws.gov/docs/five_year_review/doc3281.pdf. Accessed October 10, 2014.

USFWS (US Fish and Wildlife Service). 2010b. Range Map: Steller's Eider (*Polysticta stelleri*). Last updated: March 24, 2010. Available online at:http://www.fws.gov/alaska/fisheries/endangered/StellEider_RangeMap.htm. Accessed October 11, 2014.

USFWS (U.S. Fish and Wildlife Service). 2011a. Programmatic Biological Opinion for Polar Bears (*Ursus maritimus*), Polar Bear Critical Habitat, and Conference Opinion for the Pacific Walrus (*Odobenus rosmarus divergens*) on Beaufort Sea Incidental Take Regulations. Prepared by Fairbanks Fish and Wildlife Field Office, Fairbanks, AK. 93 pp.

USFWS (U.S. Fish and Wildlife Service). 2011b. Biological Opinion on Alaska's Revised Mixing Zone Policy within the Alaska Water Quality Standards. Anchorage Fish and Wildlife Field Office, Anchorage, AK. April 2011.

USFWS (U.S. Fish and Wildlife Service). 2012a. Threatened and Endangered species: Northern Sea Otter (Southwest Alaska Distinct Population Segment) (*Enhydra lutris kenyoni*). Fact Sheet. May 2012. Available online at: http://www.fws.gov/alaska/fisheries/endangered/pdf/Nseaotter_factsheet_v2.pdf. Accessed October 14, 2014.

USFWS (U.S. Fish and Wildlife Service). 2012b. Biological Opinion for ExxonMobil's Point Thomson Project. September 14, 2012. Consultation with the US Army Corps of Engineers, Anchorage, Alaska. Prepared by Fairbanks Fish and Wildlife Field Office, Fairbanks, AK.

USFWS (U.S. Fish and Wildlife Service). 2012c. Biological Opinion: Wildlife Conservation Society shorebird breeding ecology and artificial nest depredation studies near Prudhoe Bay, Alaska, 2012 and 2013. Fairbanks Fish and Wildlife Field Office, Fairbanks, AK. May 2012.

USFWS (U.S. Fish and Wildlife Service). 2013a. Programmatic Biological Opinion for Polar Bears (*Ursus maritimus*) and Conference Opinion for the Pacific Walrus (*Odobenus rosmarus divergens*) on Chukchi Sea Incidental Take Regulations. Prepared by Fairbanks Fish and Wildlife Field Office. 67 pp.

USFWS (U.S. Fish and Wildlife Service). 2013b. Southwest Alaska Distinct Population Segment of the Northern Sea Otter (*Enhydra lutris kenyoni*) - Recovery Plan. US Fish and Wildlife Service, Region 7, Alaska. Available online at: http://ecos.fws.gov/docs/recovery_plan/Recovery%20Plan%20SW%20AK%20DPS%20Sea%20Otter%20Aug13.pdf. Accessed October 10, 2014.

USFWS (US Fish and Wildlife Service). 2013c. Environmental Assessment Endangered Species Act 4(d) Regulations for Threatened Polar Bears. Alaska Regional Office, Marine Mammals Management Office, Anchorage Alaska.

USFWS (U.S. Fish and Wildlife Service). 2014a. Species list for the Alaska LNG Project, Ref. No. LT-AKE-PT-14-0103-001. December 1, 2014. To Mr. Charlie Kominas, Alaska LNG Project, from Ms. Sara C. Conn, Fairbanks Fish and Wildlife Field Office, Fairbanks, Alaska.

USFWS (US Fish and Wildlife Service). 2014b. Biological Opinion for the USFWS Region 7 Polar Bear and Pacific Walrus Deterrence Program. January 13, 2014. Fairbanks, Alaska.

USFWS (U.S. Fish and Wildlife Service). 2014c. Northern sea otter (*Enhydra lutris kenyoni*): Southwest Alaska Stock. Revised April 2014. 23 pp.

USFWS (U.S. Fish and Wildlife Service). 2014d. 5-Year Review: Summary and Evaluation of the Short-tailed Albatross (*Phoebastria albatrus*). Anchorage Fish and Wildlife Field Office. 43 pp.

USFWS (U.S. Fish and Wildlife Service). 2014e. Intra-Service Biological Opinion for Alaska Region Migratory Bird Management's 2013-2014 Shorebird Breeding Ecology Studies, Barrow, Alaska. Consultation with U.S. Fish and Wildlife Service, Alaska Region Migratory Bird Management. Prepared by Fairbanks Fish and Wildlife Field Office, Fairbanks, Alaska. 56 pp.

USFWS (U.S. Fish and Wildlife Service). 2015a. Biological Opinion for the Alaska Federal/State Preparedness Plan for Response to Oil and Hazardous Substance Discharges/Releases. Consultation with U.S. Coast Guard, District 17 and U.S. Environmental Protection Agency, Region 10. Prepared by Anchorage Fish and Wildlife Field Office, Anchorage, Alaska. 250 pp.

USFWS (U.S. Fish and Wildlife Service). 2015b. Polar Bears: an Improved Framework for Harvest Management. June 2015. Available online at: http://www.fws.gov/alaska/pbrt/. Accessed June 30, 2015.

Ver Hoef, J.M., M.F. Cameron, P.L. Boveng, J.M. London, E.E. Moreland. 2014. A spatial hierarchical model for abundance of three ice-associated seal species in the eastern Bering Sea. Statistical Methodology 17:46-66.

Wade, P. R., A. Kennedy, R. LeDuc, J. Barlow, J. Carretta, K. Shelden, W. Perryman, R. Pitman, K. Robertson, B. Rone, J. Carlos Salinas, A. Zerbini, R. L. Brownell, Jr., and P. Clapham. 2011a. The world's smallest whale population. Biology Letters 7:83-85.

Wade, P. R., A. De Robertis, K. Hough, R. Booth, A. Kennedy, R. LeDuc, L. Munger, J. Napp, K. E. W. Shelden, S. Rankin, O. Vasquez, C. Wilson. 2011b. Rare detections of North Pacific right whales in the Gulf of Alaska, with observations of their potential prey. Endang. Species Res. 13:99-109.

Wartzok, D. and D.R. Ketten. 1999. Marine mammal sensory systems. Pages 117-148 in J.E. Reynolds III and S.A. Rommel (eds), Biology of Marine Mammals. Washington D.C.: Smithsonian Institution Press.

Watkins, W.A., M.A. Daher, G.M. Reppucci, J.E. George, D.L. Martin, N.A. DiMarzio, and D.P. Gannon. 2000. Seasonality and distribution of whale calls in the North Pacific. Oceanography 13(1):62-67.

Weller, D.W., A.M. Burdin, A.L. Bradford, Y.V. Ivashchenko, G.A. Tsidulko, A.F. Lang, R.L. Brownell, Jr. 2004. Western Gray Whales off Sakhalin Island, Russia: A Joint Russia-U.S. Scientific Investigation July-September 2003. July 15, 2004. Final Research Report. National Marine Fisheries Service, Southwest Fisheries Science Center, La Jolla, California. 41 pp.

Weller, D.W., S. Bettridge, R.L. Brownell, Jr., J.L. Laake, J.E. Moore, P.E. Rosel, B.L. Taylor, and P.R. Wade. 2013. Report of the National Marine Fisheries Service gray whale stock identification workshop. U.S. Department of Commerce, NOAA Tech. Memo. NMFS-SWFSC-507. 62 pp.

Whitehead, H. and T. Arnbom. 1987. Social organization of sperm whales off the Galapagos Islands, February-April 1985. Canadian Journal of Zoology 65(4):913-919.

York, G., S. C. Amstrup, and K. Simac. 2004. Using forward-looking infrared (FLIR) imagery to detect polar bear maternal dens: Operations manual. OCS Study MMS 2004-062, prepared for Minerals Management Service, Alaska OCS Region, by US Geological Survey, Alaska Science Center, Anchorage.

Zerbini, A.N., J.M. Waite, J.L. Laake, and P.R. Wade. 2006. Abundance, trends and distribution of baleen whales off western Alaska and the central Aleutian Islands. Deep-Sea Research Part I 53(2006):1772-1790.

ATTACHMENT A

VESSEL WHALE STRIKE ANALYSIS

1.0 VESSEL STRIKE

Collisions with marine vessels have been implicated in the deaths of marine mammals (Goldstein et al., 1999; Laist et al., 2001; Jensen and Silber, 2004; Panigada et al,. 2006; Van Waerebeek et al., 2007; Berman-Kowalewski et al., 2010). Whale mortality from ship strike is usually a result of blunt force injury from striking the ship bow (blunt trauma), or lethal wounding from propeller cuts (sharp trauma) (Moore et al., 2013). Worldwide (Laist et al., 2001; Jensen and Silber, 2004; Douglas et al., 2008), fin whales are the most common cetacean killed by vessels. This may be a function of a greater population size or higher density within shipping lanes as opposed to a greater biological vulnerability (Douglas et al., 2008). Douglas et al. (2008) also noted that fin whales were more susceptible to blunt trauma from a bow strike, while gray whales were more likely to be injured by sharp trauma from a propeller strike. Neilson et al. (2012) documented 108 ship strikes resulting in 25 known mortalities in Alaska from 1978 to 2011 and found the vast majority involved humpback whales in Southeast Alaska. Helker et al. (2016) reported 23 vessel strikes in Alaska that resulted in a mortality, serious injury, or were prorated to reflect the likelihood of a serious injury during 2010 to 2014. All of these records indicate that baleen whales are more susceptible to vessel strike than toothed whales.

Relatively large and relatively fast moving vessel are most often involved in large whale ship strikes (Jensen and Silber, 2004). Vessel speed is also a factor in the probability of a vessel strike being lethal (Jensen and Silber, 2004; Vanderlaan and Taggart, 2007). The large whale ship strike database (Jensen and Silber, 2004) indicates that the number of vessel strikes by vessels traveling at less than 11.5 miles per hour (10 knots) is very low relative to the number of vessels normally traveling at those speeds. Vanderlaan and Taggart (2007) analyzed the ship strike database (Jensen and Silber, 2004) and found that the probability of a strike being lethal (as opposed to survivable) was also low (less than 20 percent) for strikes at speeds less than 9.3 miles per hour (8 knots), but high (greater than 50 percent) at speeds greater than 13.7 miles per hour (12 knots).

The relationship between vessel speed and the probability of a whale ship strike and other information were used to develop the 10-knot restriction now enforced in North Atlantic right whale (NMFS, 2008) habitat off New England. Conn and Silber (2013) estimated that implementation of this vessel speed rule reduced the risk of vessel collisions with right whales by 80 to 90 percent. A study to determine the effectiveness of the Ship Strike Rule and Seasonal Management Areas (SMAs) for the North Atlantic right whale found that while overall, lethal vessel strikes appeared to be less common than before the regulations were implemented, the SMAs were ineffective in reducing ship strike mortality during managed times (van der Hoop et al., 2015). Inability to detect the intended effects of the Ship Strike Rule were attributed to (1) low vessel compliance with SMAs; (2) insufficient time and/or monitoring to evaluate rule effectiveness; and (3) SMAs may be too small, in the wrong locations, or in effect for too short of duration (van der Hoop et al., 2015).

Small cetaceans appear to be less susceptible to ship strikes. No dolphin or porpoise ship strikes were documented for Alaska stocks during 2010 to 2014 (Helker et al., 2016). One possible ship strike of a Cook Inlet beluga whale and one ship strike of a killer whale have been documented in Alaska (Neilson et al., 2012; Helker et al., 2016). Both appeared to be sharp trauma from a propeller strike. Because the killer whale ship strike involved a fishery vessel, and the killer whale was likely attracted to the actively fishing vessel, it is not included in this analysis of potential Liquid Natural Gas Carrier (LNGC) whale strikes. This 2010 killer whale ship strike record was similarly not included in the Neilson et al. (2012) ship strike analysis.

Pinnipeds are far less susceptible to vessel strikes than cetaceans, probably because of their visual awareness both above and below water, and their quick maneuverability. Of 6,197 strandings of six species of pinnipeds in central California between 1986 and 1998, only five exhibited vessel strike damage. No ship strike mortality or serious injuries were reported for pinnipeds in Alaska during 2010 to 2014, although records do include one serious injury to a harbor seal by a NOAA Law Enforcement vessel traveling at 35 knots in Southeast Alaska in 2012 (Helker et al., 2016).

1.1 METHODS

The relationship between current levels of vessel traffic and reported whale strikes provides a baseline for predicting increases in whale strikes from increases in vessel traffic. The probability of a whale strike can be stated in terms of strikes per port calls or vessel transits. LNGCs traveling to and from the Marine Terminal at Nikiski Alaska would represent new and additional ship traffic within Cook Inlet and across the North Pacific. The method used in estimating whale strikes for Project-related LNGC traffic is that the likelihood of an LNGC striking a whale is proportional to the current estimated level of vessel traffic and the estimated annual rate of whale strikes within the routes traveled during 2000 to 2014.

Data reviewed and used for the estimate included:

- Port calls in Cook Inlet in 2010 (Cape International, Inc., 2012);
- Vessel traffic through the Aleutian Islands – Great Circle Route and southern route in 2012 (Nuka, 2015);
- LNGC routes and projected frequency; and
- NMFS records of ship strikes in Alaska (Neilson et al., 2012; Helker et al., 2016).

The anticipated risk of ship strikes resulting from increased vessel traffic due to Project LNGC port calls in Cook Inlet and transits through the North Pacific Great Circle or southern routes were projected based on the 2000 to 2014 rate of whale ship strikes for these areas. Shelikof Strait was included with Cook Inlet for projections.

1.2 EXISTING VESSEL TRAFFIC

1.2.1 Cook Inlet

There were 490 calls to Cook Inlet ports by vessels greater than 300 Goss Tons (GT) in 2010 (Table 1). This included the *Polar Spirit*, which was the sole LNGC to call at the existing Kenai LNG Plant at Nikiski that year with a total of 16 port calls. No published studies have quantitatively summarized vessel traffic through Shelikof Strait, although many of the commercial vessels, cruise ships, tugs with barges, and ferries that operate in Cook Inlet also transit Shelikof Strait.

Table 1 Port calls in Cook Inlet in 2010 for vessels > 300 Gross Tons

Vessel Type	Number of Calls	Percent of Calls
Cargo/General	35	7.1%
Cargo/Container	109	22.2%
Cargo/ Roll-on/Roll-off (RORO)	109	22.2%
Cruise ship	12	2.4%
Ferry	114	23.3%
LNGC	16	3.3%
Tank Ship	95	19.4%
Grand Total	490[1]	100%

Source: Cape International, Inc., 2012

1 Total differs from the 480 port calls cited due to an error in the original document.

Figure 1 shows possible LNGC routes through Cook Inlet and Shelikof Strait. Most deep-draft vessels transit north-south along the east side of Cook Inlet while tank ships occasionally transit east/west between Nikiski and the Drift River terminal on the western side of middle Cook Inlet.

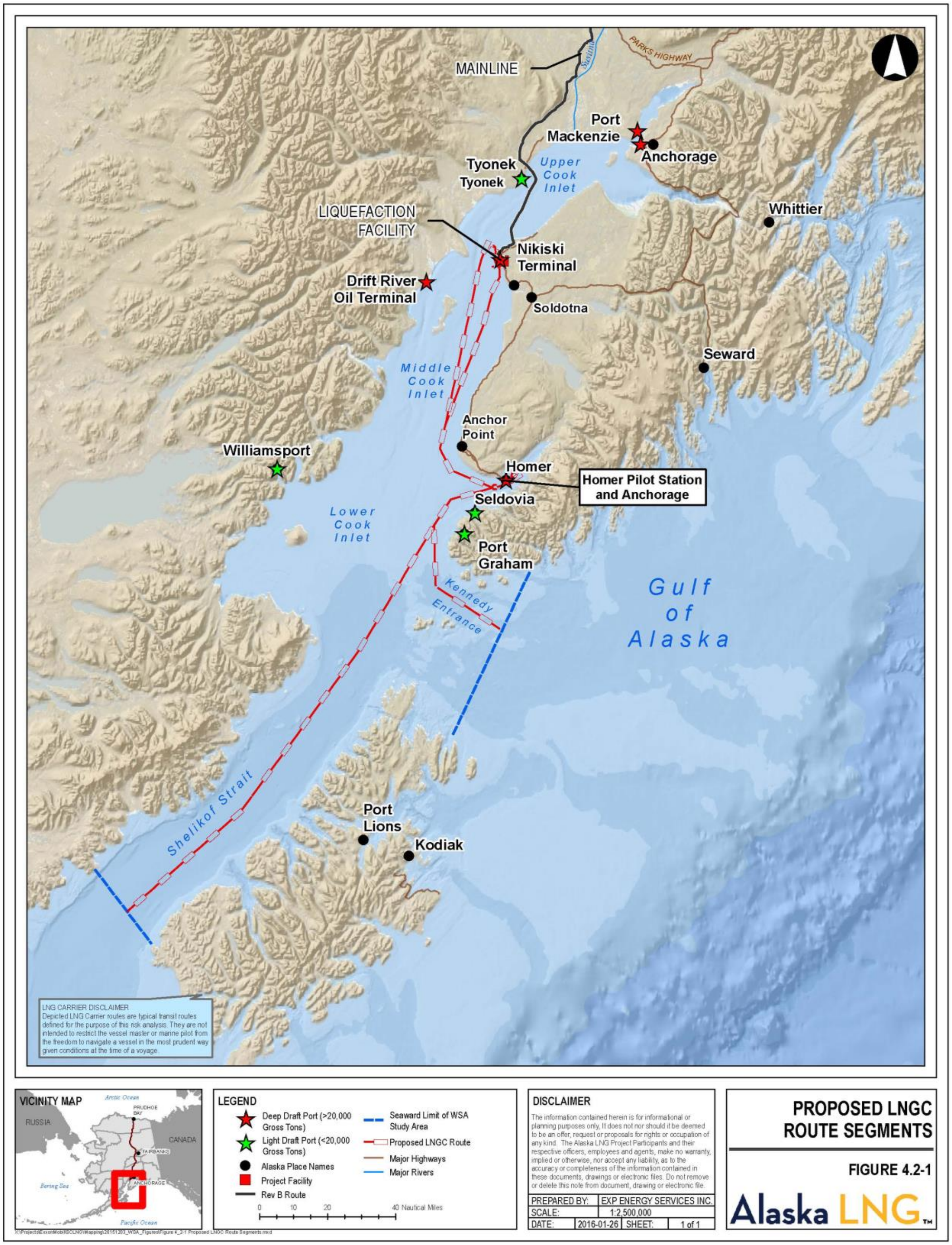

Figure 1 Proposed Cook Inlet LNGC Traffic Routes

1.2.2 Great Circle and Southern Routes

Vessels of 300 GT or larger transiting the Aleutian Islands are typically moving commercial goods and raw materials along the North Pacific Great Circle Route between western North America and East Asia (Nuka, 2015). Depending on conditions, vessels may stay entirely to the south of the Islands or they may pass through the Aleutian Island chain through Unimak Pass or another pass. Vessels that remain south of the islands often pass very close to shore. Monitoring data for Automated Identification System (AIS) signals from passing ships recorded 4,615 transits through Unimak Pass in 2012 (Nuka, 2015). Vessels that skirted the island chain to the south were not completely captured via AIS signals, although 1,023 transits were recorded (Figure 2; Nuka, 2015).

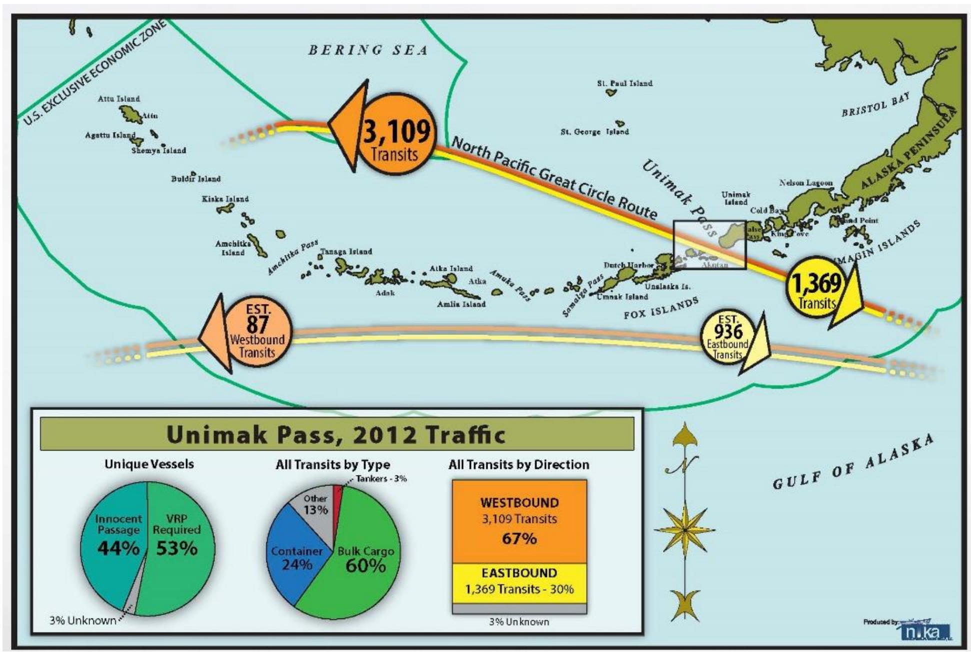

Figure 2 Idealized Routes with Summary of 2012 Vessel Transits (Nuka, 2015)

1.3 ALASKA LNGCS

Loading berths at the Marine Terminal would be designed for a range of LNGC sizes to accommodate specific marketing requirements. Based on a nominal 176,000 cubic meters LNGC design vessel, approximately 21 vessel calls per month or 252 calls per year and 504 transits across the North Pacific would be required to export the produced LNG. The LNGCs would range in size between 125,000 cubic meters (approximately 30 vessel visits per month) and 216,000 cubic meters (approximately 17 vessel visits per month). LNGCs operating speeds range from 19 to 19.5 knots. Project LNGC traffic would increase Cook Inlet large vessel port calls by 51.4 percent and transits through the North Pacific Great Circle and southern routes by 8.9 percent.

1.4 MARINE MAMMAL SHIP STRIKE ESTIMATES

Neilson et al. (2012) documented 108 ship strikes resulting in 25 whale mortalities in Alaska from 1978 to 2011 and found the vast majority to involved humpback whales in southeast Alaska. After review, these records were narrowed to the ship strikes that likely resulted in severe injury or mortality and occurred within or near projected LNGC routes. Ship strikes that may have occurred in Gulf of Alaska waters and then transported the whale to interior ports were included. Helker et al. (2016) was reviewed for ship strike records within the areas of interest during 2012 to 2014. A total of 18 documented and probable ship strike records resulting in death or serious injury were identified for the Cook Inlet, and North Pacific Great Circle and southern routes (Attachment 1). These records were used to generate annual ship strike estimates for LNGC routes through Cook Inlet and the North Pacific Great Circle Route and southern routes. Because whale strikes occur infrequently, and strikes often are unnoticed or unreported, these data may underestimate the number of whale strikes.

Most ship strike records identified within the LNGC routes were for baleen or unidentified whales, with the exception of two toothed whales; a single Cuvier's beaked whale and a single beluga whale; and an unidentified whale. No lethal or injurious ship strikes of sperm whales have been documented in Alaskan waters (Neilson et al., 2012; Helker et al., 2016). Average annual ship strikes were 0.11 whales for Cook Inlet and 0.38 whales for the North Pacific Great Circle Route during the 37-year period from 1978 to 2014. Average annual ship strikes were 0.27 whales for Cook Inlet and 0.73 whales for the North Pacific Great Circle Route during the 15-year period from 2000 to 2014. The increase in average annual ship strikes between these two periods may be due to an increase in ship strikes or from more comprehensive reporting; although with many whale populations increasing and the likely increase in shipping traffic it is possible that there has been a real increase in ship strikes in these regions. The ship strike records for the 15-year period from 2000 to 2014 are considered to be most representative of current ship strike risk and shipping traffic levels and were carried forward in this assessment. Whale ship strikes in Cook Inlet during 2000 to 2014 have occurred during spring and fall, while ship strikes in the North Pacific occurred from March through September, with the peak in July (Figure 3).

Projected increases in the annual rates of whale strikes due to the projected increase in vessel port calls are indicated in Table 2. Potential strikes resulting from those increases in strike rates, estimated by applying the rate increases to the current strike rates are indicated in Table 2 and summarized over the Project life in Table 3.

Table 2 Estimated Annual Increase of Whale Strikes by Species from Alaska LNGCs

Species	Documented Strikes[1]		Strikes per Year		Increase in Traffic		Increase in Strikes per Year	
	Cook Inlet	Great Circle	Cook Inlet	Great Circle	Cook Inlet	Great Circle	Cook Inlet	Great Circle
Beluga Whale, Cook Inlet	1	0	0.067	0	51.4%	8.9%	0.034	0
Cuvier's Beaked Whale	0	1	0	0.067	51.4%	8.9%	0	0.006
Fin Whale	0	3	0	0.200	51.4%	8.9%	0	0.018
Large Baleen Whale[2]	1	2	0.067	0.133	51.4%	8.9%	0.034	0.012
Humpback Whale	2	4	0.133	0.267	51.4%	8.9%	0.069	0.024
Unidentified Whale	0	1	0	0.067	51.4%	8.9%	0	0.006
All Whales	4	11	0.267	0.733	51.4%	8.9%	0.137	0.065

Sources: Neilson et al., 2012; Nuka, 2015; Helker et al., 2016

1 Based on 15 ship strike records from 2000 to 2014 identified as serious injury or mortality located within Cook Inlet and Shelikof Strait (Cook Inlet); or Gulf of Alaska and Aleutian Island region along the North Pacific Great Circle Route and southern route (Great Circle).

2 unidentified appeared to be a fin, blue or sei whale

Table 3 Projected Whale Strikes from Alaska LNGCs over the 30-Year Project Life

Species	Increase in Strikes per Year		Projected Strikes (30 years)		
	Cook Inlet	Great Circle	Cook Inlet	Great Circle	Total
Beluga Whale, Cook Inlet	0.034	0	1.03	0	1.03
Cuvier's Beaked Whale	0	0.006	0	0.18	0.18
Fin Whale	0	0.018	0	0.53	0.53
Large Baleen Whale[2]	0.034	0.012	1.03	0.36	1.38
Humpback Whale	0.069	0.024	2.06	0.71	2.77
Unidentified Whale	0	0.006	0	0.18	0.18
All Whales	0.137	0.065	4.11	1.96	6.07

Sources: Neilson et al., 2012; Nuka, 2015; Helker et al., 2016

1 Based on 15 ship strike records from 2000 to 2014 identified as serious injury or mortality located within Cook Inlet and Shelikof Strait (Cook Inlet); or Gulf of Alaska and Aleutian Island region along the North Pacific Great Circle Route and southern route (Great Circle).

2 unidentified appeared to be a fin, blue or sei whale

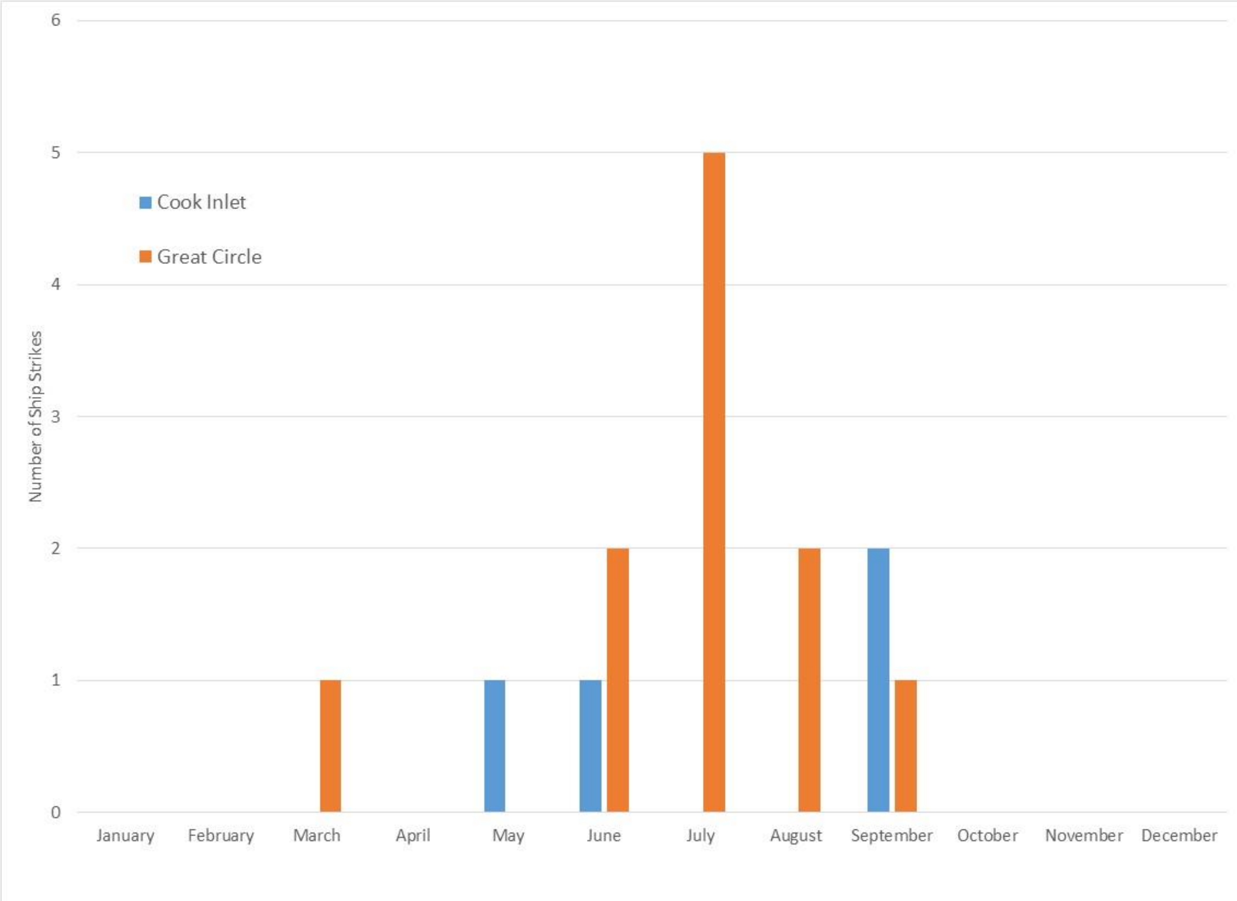

Figure 3 Monthly Distribution of Recorded Whale Ship Strikes During 2000 to 2014 for Cook Inlet and the North Pacific Great Circle Route

1.5 CONCLUSION

The estimated increase in the number of whale strikes per year due to the increase in vessel traffic from Project LNGCs would be negligible ranging from 0.065 strikes per year for the North Pacific Great Circle and southern routes to 0.137 strikes per year for the Cook Inlet routes. Based on these projected increases in whale strike rates, LNGC traffic over the 30-year life of the Project could potentially result in mortality of 1 Cook Inlet beluga whale; 2 large baleen whales which could including blue, fin, or sei whales; and 3 humpback whales. Based on the available ship strike records, no other species of whales or pinnipeds are likely to be injured or killed by collisions with LNGCs.

Because NMFS believes the Cook Inlet beluga whale population has not increased due to unknown reasons, NMFS does not calculate the Potential Biological Removal (PBR) for this stock (Allen and Angliss, 2015). Because an estimated minimum abundance is not available, the PBR level for the Alaska fin whale stock is undetermined (Allen and Angliss, 2015). Central North Pacific blue whale and Eastern North Pacific sei whale stocks may range into Alaska waters: PBR for blue whales is 0.10, and for sei whales is 0.17 for these stocks (Carretta et al., 2015). The projected annual increases in ship strikes from LNGC for these large baleen whales of 0.046 represents 17 percent of the combined PBR of 0.27 for these endangered whales.

The PBR for the Western North Pacific (WNP) humpback whale stock is 3.0 and for the Central North Pacific (CNP) entire stock is 82.8. The projected increase in ship strikes from LNGC for humpback whales of 0.093 represents 3 percent of the PBR for the WNP humpback whale stock if all strikes were of members of this stock and would represent 0.1 percent of the PBR for the CNP stock. Both stocks feed in the regions that would be transited by LNGCs, although the CNP is much more abundant.

1.6 MITIGATION

The Applicant would provide a Ship Strike Avoidance Measures Package to 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. Some of the suggested measures include those listed below.

- Provide training 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.
- Provide a copy of the NMFS CD-ROM–based training program entitled *A Prudent Mariner's Guide to Right Whale Protection* (NMFS, 2009b) as part of a ship-strike avoidance measures package to all vessels calling on the terminal. While this training program is specific to right whales, the guidance and avoidance measures are also applicable to blue, fin, sei, humpback, and sperm whales.
- Require vessel crews to maintain a watch for marine mammals to avoid striking protected species.
- Attempt to maintain a parallel course to the animal and avoid excessive speed or abrupt changes in direction until the animal has left the area.
- Route LNGC traffic well offshore of the Aleutian Islands whenever possible in compliance with the International Maritime Organization, Maritime Safety Committee's Aleutian Island Areas to Be Avoided (ATBAs; NCSR, 2014).

Vessel masters would be requested to provide reports of sightings of marine mammals while in the EEZ and to provide the report 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.

2.0 REFERENCES

ADF&G (Alaska Department of Fish and Game). 2015e. Steller's Eider Species Profile. Accessed online at: http://www.adfg.alaska.gov/index.cfm?adfg=stellerseider.main. Accessed on March 10, 2017.

Allen, B.M. and R.P. Angliss. 2015. Alaska Marine Mammal Stock Assessments. 2014. NOAA Technical Memorandum NMFS-AFSC-301. Seattle, Washington, National Marine Fisheries Service. 304 pp.

Berman-Kowalewski, M., F.M.D Gulland, S. Wilkin, J. Calambokidis, B. Mate, J. Cordaro, D. Rotstein, J. St. Leger, P. Collins, K. Fahy, and S. Dover. 2010. Association between blue whale (*Balaenoptera musculus*) mortality and ship strikes along the California coast. Aquatic Mammals 36(1), 59-66.

Cape International, Inc. 2012. Cook Inlet vessel traffic study. Report to Cook Inlet Risk Assessment Advisory Panel. Retrieved from http://www.cookinletriskassessment.com/files/120206CIVTSvFINAL.pdf. Accessed April 25, 2016.

Carretta, J.V., E. Oleson, D.W. Weller, A.R. Lang, K.A. Forney, J. Baker, M.M. Muto, B. Hanson, A.J. Orr, H. Huber, M.S. Lowry, J. Barlow, J.E. Moore, D. Lynch, L. Carswell, and R. L. Brownell Jr. 2015. U.S. Pacific Marine Mammal Stock Assessments: 2014. U.S. Department of Commerce, NOAA Technical Memorandum, NMFS-SWFSC-549. 414 pp.

Conn, P.B. and G.K. Silber. 2013. Vessel speed restrictions reduce risk of collision-related mortality for North Atlantic right whales. Ecosphere 4(4) 1-15.

Douglas, A.B., J. Calambokidis, S. Raverty, S.J. Jeffries, D.M. Lambourn, and S.A. Norman. 2008. Incidence of ship strikes of large whales in Washington State. Journal of the Marine Biological Association of the UK 88(06) DOI: http://dx.doi.org/10.1017/S0025315408000295.

Folkens, Pieter. 2001. Marine Mammals of the Pacific Northwest, including Oregon, Washington, British Columbia and South Alaska. Harbour Press. June 1.

Goldstein, T., S.P. Johnson, A.V. Phillips, K.D. Hanni, D.A. Fauquier, and F.M.D. Gulland. 1999. Human-related injuries observed in live stranded pinnipeds along the central California coast 1986-1998. Aquatic Mammals 25:43-51.

Helker, V. T., M. M. Muto, and L. A. Jemison. 2016. Human-caused injury and mortality of NMFS-managed Alaska marine mammal stocks, v2010-2014. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-315, 89 p. doi:10.7289/V5/TM-AFSC-315.

Jensen, A.S. and G.K. Silber. 2004. Large whale ship strike database. U.S. Department of Commerce, NOAA Technical Memorandum. NMFS-OPR-25.

Kaplan, C.C., T.L. McGuire, M.K. Blees, and S.W. Raborn. 2009. Longevity and causes of marks seen on Cook Inlet Beluga Whales. Chapter 1 In: Photo-identification of beluga whales in Upper Cook Inlet, Alaska: Mark analysis, mark-resight estimates, and color analysis from photographs taken in 2008. Report prepared by LGL Alaska Research Associates, Inc., Anchorage, AK, for National Fish and Wildlife Foundation, Chevron, and ConocoPhillips Alaska, Inc. 32 pp.

Laist, D.W., A.R. Knowlton, J.G. Mead, A.S. Collet, and M. Podesta. 2001. Collisions between ships and whales. Marine Mammal Science 17(1):35-75.

Larter N.C. and C.C. Gates. 1991. Diet and habitat selection of wood bison in relation to seasonal change in forage quantity and quality. Canadian Journal of Zoology. 69:2677-85.

Moore M. J., J. van der Hoop, S.G. Barco, A.M. Costidis, F.M. Gulland, P.D. Jepson, K.T. Moore, S.A. Raverty, and W.A. McLellan. 2013. Criteria and case definitions for serious injury and death of pinnipeds and cetaceans caused by anthropogenic trauma. Diseases of Aquatic Organisms 103:229-264.

NCSR (Navigation, Communications, and Search and Rescue). 2014. Routing measures and mandatory ship reporting systems establishment of five areas to be avoided in the region of the Aleutian Islands. Submitted by the United States. NCSR 2/3/X. December 4, 2014.

Neilson, J.L., C.M. Gabriele, A.S. Jensen, K. Jackson, and J.M. Straley. 2012. Summary of reported whale-vessel collisions in Alaskan waters. Journal of Marine Biology 2012:1-18.

NMFS (National Marine Fisheries Service). 2008. Conservation plan for the Cook Inlet beluga whale (*Delphinapterus leucas*). Juneau: National Marine Fisheries Service.

NMFS (National Marine Fisheries Service). 2009b. A Prudent Mariner's Guide to Right Whale Protection CD-ROM. Version 1.1 - Updated April 2009.

Nuka (Nuka Research and Planning Group, LLC). 2015a. Aleutian Islands Risk Assessment Project Home, Routing Measures for the Aleutian Islands Adopted by the IMO Maritime Safety Committee. Available online at: http://www.aleutianriskassessment.com/. Accessed July 9, 2015.

Panigada, S., G. Pesante, M. Zanardelli, F. Capoulade, A. Grannier, and M.T. Weinrich. 2006. Mediterranean fin whales at risk from fatal ship strikes. Marine Pollution Bulletin 52; 1287-1298.

USACE. 2000a. Ouzinke Harbor trip report, Steller's eider Survey No. 1 and 2. Unpublished memorandum for the Record. CEPOA-EN-CW-ER. Alaska District, Anchorage.

USACE. 2000b. Sand Point trip report, Steller's eider Survey No. 1, 2, and 3. Unpublished memorandum for the Record. CEPOA-EN-CW-ER. Alaska District, Anchorage.

USACE. 2000c. Unalaska trip report, Steller's eider Survey No. 1 of 4. Unpublished memorandum for the Record. CEPOA-EN-CW-ER. Alaska District, Anchorage.

USACE. 2000d. Biological Assessment of Steller's eider *Polysticta stelleri* (Pallas) for Harbor Construction at Sand Point, Alaska. Unpublished memorandum for the Record. CEPOA-EN-CW-PF. Alaska District, Anchorage.

USFWS. (U.S. Fish and Wildlife Service). Threatened and Endangered Species Short -Tailed Albatross. Available online at: https://www.fws.gov/alaska/fisheries/fieldoffice/anchorage/endangered/pdf/factsheet_stal.pdf. Accesses March 10, 2017.

van der Hoop, J.M., A.S.M Vanderlaan, T.V.N. Cole, A.G. Henry, L. Hall, B. Mase-Guthrie, T. Wimmer, and M.J. Moore. 2015. Vessel strikes to large whales before and after the 2008 Ship Strike Rule. Conservation Letters 8(1):24-32.

van Waerebeek, K., A. N. Baker, F. Felix, J. Gedamke, M. Iniguez, G. P. Sanino, E. Secchi, D. Sutaria, A. van Helden, and Y. Wang. 2007. Vessel collisions with small cetaceans worldwide and with large whales in the Southern Hemisphere, an initial assessment. Latin American Journal of Aquatic Mammals 6:43–69.

Vanderlaan, A. S. M., and C. T. Taggart. 2009. Efficacy of voluntary areas to be avoided to reduce risk of lethal vessel strikes to endangered whales. Conservation Biology 23:1467–1474.

Attachment 1 Whale Strike Records for Cook Inlet and North Pacific Great Circle and Southern Routes

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NMFS Record #	Date	Year	Location	Analysis Area	Confidence Category	Species Struck	age, class, sex	Fate of whale	Vessel type [length]	Vessel speed at time of collision	Description of event	Source
96006	5/16/1996	1996	near Blying Sound, southeast coast of Kenai Peninsula, Gulf of Alaska	North Pacific Great Circle and southern routes	definite strike	unidentified large whale	age class & sex unknown]	severe injury	U.S. Coast Guard cutter [115 m]	15 knots	Whale surfaced ~46 m ahead of the cutter. An attempt was made to avoid the whale, but a shudder was felt throughout the ship indicating a collision. The ship circled back and found blood in the water but did not see an injured or dead whale. Two live whales were spotted in the area. The crew believes that although likely, it is unknown if the whale was killed. The ship was not damaged.	[1]
1998136	7/13/1998	1998	Marmot Bay, Kodiak	North Pacific Great Circle and southern routes	possible strike	likely Cuvier's beaked whale	age class & sex unknown]	dead	unknown	unknown	Report is based on U.S. Coast Guard video from helicopter. Carcass was floating dorsal side up with the head turned at an angle almost perpendicular to the body, giving the impression of a deep v-cleft.	[1]
98020	7/14/1998	1998	Bear Glacier beach front, Seward	North Pacific Great Circle and southern routes	possible strike	Stejneger's beaked whale	5.5 m adult, sex unknown]	dead	unknown	unknown	Decomposed carcass found beach-cast. Right flank showed signs of possible collision trauma with some of the ribs separated from each other. Species confirmed with genetic analysis of tissue sample.	[1]
2001061	9/18/2001	2001	Port of Anchorage	Cook Inlet and Shelikof Strait	definite strike	humpback whale	age class & sex unknown]	dead	cargo [261 m]	unknown but average cruising speed 18-19 knots (12 knots when in Cook Inlet)	Carcass was discovered on a container ship's bulbous bow as it docked. It is unknown where the collision occurred. The ship travels the "typical" offshore shipping route between Seattle, WA and Anchorage, AK. Average transit speed is 18-19 knots but 12 knots in Cook Inlet. Carcass was removed and floated away with no necropsy.	[1]
AK2002-1000124	3/1/2002	2002	Pasagshak Beach, Kodiak	North Pacific Great Circle and southern routes	probable strike	Cuvier's beaked whale	5.1 m subadult, male]	dead	unknown	unknown	Carcass was found beach-cast. Necropsy found a large gash on the whale's side and a cut behind one of the pectoral fins.	[1]
Temp43	9/24/2002	2002	Knik Arm, Cook Inlet	Cook Inlet and Shelikof Strait	possible strike	beluga whale	age class & sex unknown]	dead	unknown	unknown	An employee of Cook Inlet Tug & Barge Company observed a dead beluga floating by, dorsal side up, ~8-9 m from where he stood. He reported 3-4 propeller cuts on the animal's back. He did not think the slashes were from a killer whale but could not be certain.	[1]
2005003	5/13/2005	2005	Kenai River	Cook Inlet and Shelikof Strait	probable strike	humpback whale	8.2 m subadult, male]	dead	unknown	unknown	Carcass was found beach-cast. Necropsy revealed severe blunt trauma with cervical spinal cord and muscle and fascial hemorrhage. There was generalized organ congestion and hemorrhage in a section of skeletal muscle and no other major histologic lesions. The animal appeared to be nutritionally stressed with serous atrophy of fat in the deep dermis and other tissues.	[1]
2005060	6/24/2005	2005	Kachemak Bay, Homer	Cook Inlet and Shelikof Strait	definite strike	unidentified large whale	age class & sex unknown]	severe injury	commercial recreational [9 m]	unknown	Vessel was transiting when they saw a whale surface near the propeller. The whale "thumped" under the boat and they observed blood in the water. Only saw a dark tail, possibly a humpback whale, and then the whale swam away.	[1]
2006140	8/19/2006	2006	Resurrection Bay, Seward	North Pacific Great Circle and southern routes	definite strike	fin whale	13.2 m subadult, male]	dead	cruise ship [294 m]	unknown	Carcass was brought into port wrapped around the ship's bulbous bow. Collision occurred somewhere between Disenchantment Bay (near Yakutat) and Seward. Crew reported feeling no "bumps" during the voyage. Necropsy revealed ante mortem acute hemorrhage, multiple fractured bones (vertebrae, ribs, scapula, carpus) and rupture of the ventral body wall with evisceration and loss of the stomach, liver, spleen and small intestine.	[1]
2008138	9/7/2008	2008	Resurrection Bay, Seward	North Pacific Great Circle and southern routes	definite strike	humpback whale	age class & sex unknown]	severe injury	commercial recreational [27m]	moving slowly forward along shore just above idle	Visibility was poor and the captain and crew were unaware that a whale was in the area. They heard a loud thump at the aft end of the vessel and the vessel shuddered. A whale surfaced behind the vessel 30 sec to 1 min after the collision. A crew member saw ~1 m square patches of blood in the water every time the animal surfaced to breathe but could not see where it was injured. Another crew member reported that the whale surfaced under the vessel just forward of the propellers and presumably was hit by them as the boat moved forward. Passengers felt and heard the whale hit the underside of the boat.	[1]

Attachment 1 Whale Strike Records for Cook Inlet and North Pacific Great Circle and Southern Routes

NMFS Record #	Date	Year	Location	Analysis Area	Confidence Category	Species Struck	age, class, sex	Fate of whale	Vessel type [length]	Vessel speed at time of collision	Description of event	Source
2009022	6/1/2009	2009	Valdez Arm, Prince William Sound	North Pacific Great Circle and southern routes	definite strike	unidentified large baleen whale (appeared to be a fin, blue or sei whale)	age class & sex unknown]	dead	cargo [254 m]	unknown	Carcass was found on the bulbous bow of an oil tanker as it came into port. NMFS attempted to organize a necropsy but meanwhile the whale became a Homeland Security issue so the carcass was towed out of port and sunk. No samples were collected and the species was never confirmed, however in photos it appeared to be a fin, blue or sei whale.	[1]
2010102	7/3/2010	2010	Belikovsky Bay, King Cove, Aleutian Islands	North Pacific Great Circle and southern routes	definite strike	humpback whale	12.9 m adult, female]	dead	unknown	unknown	Carcass was first reported floating, then beach-cast. Necropsy concluded the animal was in good body condition but there were multiple fractures at the base of the skull and both tympanic bulla were separated from basilar fragments of occipital bone. Severe autolysis and green discoloration was seen in muscles and fascia along right shoulder, neck and right abdominal wall. Muscles around right base of skull appeared more severely autolytic and discolored than on left side but fragmented basilar bones were seen bilaterally.	[1]
2010170	8/29/2010	2010	Uski Island, Kodiak	North Pacific Great Circle and southern routes	definite strike	fin whale	14.0 m subadult, female]	dead	unknown	unknown	Carcass was found floating and then towed to shore. Necropsy found long ante mortem skull fracture.	[1]
NA	7/9/2012	2012	Seward	North Pacific Great Circle and southern routes	ship strike	humpback whale		severe injury	commercial	20 knots	A passenger provided an extensive report regarding a ship strike of a humpback whale. The vessel was travelling at greater than 20 knots and was greater than 65 feet. The animal was observed bleeding and after breaching remained in one spot. Pictures are available and show blood in water. This interaction is considered a SI under criteria L6a.	[2]
NA	7/19/2012	2012	Prince William Sound	North Pacific Great Circle and southern routes	ship strike	unidentified whale		severe injury	unknown	unknown	A ship struck an unknown large whale and the vessel operator observed the animal following the strike. There was blood in the water and after the animal dove it was not seen again. This interaction will be prorated using criteria L11 because of a number of unknowns, including vessel specifics and severity of the laceration.	[2]
NA	6/14/2013	2013	Aleutians	North Pacific Great Circle and southern routes	ship strike	unidentified large baleen whale (appeared to be a fin, blue or sei whale)		dead	commercial	unknown	A container ship reported discovering an unidentified dead whale on the ship's bulbous bow. The reporter believed the strike occurred during the night. The whale was removed by maneuvering the ship. It could not be determined whether the ship killed whale. The report indicated the whale was probably a fin or sei whale.	[2]
NA	7/13/2014	2014	Dutch Harbor	North Pacific Great Circle and southern routes	ship strike	fin whale		dead	commercial	unknown	An 800+ feet container ship's captain discovered that a fresh dead fin whale was lodged on the vessel's bulbous bow. In order to free the dead whale from the bow the vessel had to back down. The Captain believes the vessel struck the whale 75 miles south of Buldir Island. The strike occurred and night and no necropsy was conducted. Assigning cause of death to a ship strike may be speculative as it is possible the whale was already dead when it was picked up by the bulbous bow, though considering the whale appeared to be fresh dead it is likely the whale was killed by the ship.	[2]
NA	7/26/2014	2014	Kodiak Island	North Pacific Great Circle and southern routes	ship strike	humpback whale		dead	government	unknown	A humpback whale was struck by a vessel (~400 feet) during a period of poor visibility on 7/26/2014. No one aboard realized the vessel struck a humpback whale until a whale was observed sliding off the bulbous bow when the vessel was put into reverse while pulling into port. The whale appeared dead and sank. Two days later the whale was found floating off Puffin Island and the whale was necropsied on 7/30/2014. The necropsy confirmed the whale was fresh dead and killed by ship strike. There were multiple comminuted fractures of the cranium and ribs.	[2]

Attachment 1 Whale Strike Records for Cook Inlet and North Pacific Great Circle and Southern Routes

NMFS Record #	Date	Year	Location	Analysis Area	Confidence Category	Species Struck	age, class, sex	Fate of whale	Vessel type [length]	Vessel speed at time of collision	Description of event	Source

NA = Not Available; m = meter

Sources: [1] Appendix 1 from Neilson, J.L., C.M. Gabriele, A.S. Jensen, K. Jackson, and J.M. Straley. 2012. Summary of reported whale-vessel collisions in Alaskan waters. Journal of Marine Biology 2012:1-18.
[2] Appendix Table 1.11 from Helker, V. T., M. M. Muto, and L. A. Jemison. 2016. Human-caused injury and mortality of NMFS-managed Alaska marine mammal stocks, v2010-2014. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-315, 89 p. doi:10.7289/V5/TM-AFSC-315.