U.S. DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT – ALASKA

BIOLOGICAL ASSESSMENT

FOR THE

WILLOW MASTER DEVELOPMENT PLAN

NORTH SLOPE, ALASKA

SUBMITTED TO THE

U.S. FISH AND WILDLIFE SERVICE

FAIRBANKS FIELD OFFICE

SUBMITTED BY THE

BUREAU OF LAND MANAGEMENT

U.S. ARMY CORPS OF ENGINEERS

JUNE 2022

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List of Abbreviations

>	greater than
<	less than
2:1	2 horizontal to 1 vertical ratio
3:1	3 horizontal to 1 vertical ratio
6:1	6 horizontal to 1 vertical ratio
ACP	Arctic Coastal Plain
ADF&G	Alaska Department of Fish and Game
APDES	Alaska Pollutant Discharge Elimination System
BA	Biological Assessment
BLM	Bureau of Land Management
BO	Biological Opinion
BT1/2/3/4/5	Bear Tooth drill site 1/2/3/4/5
CBS	Chukchi/Bering Sea
CI	confidence interval
CPAI	ConocoPhillips Alaska, Inc.
CPF2	Central Processing Facility 2
CRD	Colville River Delta
dB re 1 µPa rms	decibels referenced to one microPascal root mean square
dB	decibels
dBA	A-weighted decibel
DS2P	drill site 2P
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FLIR	forward-looking infrared
GMT-1	Greater Mooses Tooth 1
GMT-2	Greater Mooses Tooth 2
HDD	horizontal directional drilling
HSMs	horizontal support members
Hz	hertz
IAP/EIS	Integrated Activity Plan/Environmental Impact Statement
ITA	Incidental Take Authorizations
ITRs	Incidental Take Regulations
kHz	kilohertz
km	kilometers
Kuparuk	Kuparuk River Unit
LSs	lease stipulations
m	meter
MDP	Master Development Plan
MG	million gallons
MMM	Marine Mammals Management Office
MMPA	Marine Mammal Protection Act
n	sample size
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NPR-A	National Petroleum Reserve in Alaska
ODPCP	Oil Discharge Prevention and Contingency Plan
P	P-value or the probability of false rejection of a statistical test
PCEs	primary constituent elements
PRM	permittee responsible mitigation
Project	Willow Master Development Plan Project
Q1	first quarter

Q2	second quarter
Q3	third quarter
Q4	fourth quarter
ROD	Record of Decision
ROP	required operating procedure
SBS	Southern Beaufort Sea
SE	standard error
SPMT	self-propelled module transporter
Southwest DPS	Southwest Alaska distinct population segment
UIC	underground injection control
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VSMs	vertical support members
WOC	Willow Operations Center
WPF	Willow Processing Facility

List of Species

Arctic cod (*Arctogadus glacialis*)
Arctic fox (*Alopex lagopus*)
Bald eagle (*Haliaeetus leucocephalus*)
Baltic clam (*Macoma balthica*)
Bearded seal (*Erignathus barbatus*)
Beluga whale (*Delphinapterus leucas*)
Blue mussel (*Mytilus edulis*)
Bowhead whale (*Balaena mysticetus*)
Brown bear (*Ursus arctos*)
Canada goose (*Branta canadensis*)
Caribou (*Rangifer tarandus*)
Common raven (*Corvus corax*)
Entire-leaf mountain avens (*Dryas integrifolia*)
Golden eagle (*Aquila chrysaetos*)
Long-tailed duck (*Clangula hyemalis*)
Northern sea otter (*Enhydra lutris kenyoni*)
Pacific razor clam (*Siliqua patula*)
Pendant grass (*Arctophila fulva*)
Polar bear (*Ursus maritimus*)
Red sea cucumber (*Cucumaria miniata*)
Ringed seal (*Phoca hispida*)
River beauty (*Epilobium latifolium)*
Sea urchin (*Strongylocentrotus* spp.)
Short-tailed albatross (*Phoebastria albatrus*)
Snow owl (*Bubo scandiacus*)
Spectacled eider (*Somateria fischeri*)
Spotted seal (*Phoca largha*)
Steller's eider (*Polysticta stelleri*)
Tall cottongrass (*Eriophorum angustifolium)*
Pacific walrus (*Odobenus rosmarus divergens*)
Water sedge (*Carex aquatilis*)
Willow species *(Salix* spp.)
Wolverine (*Gulo gulo*)

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1.0 Introduction

This Biological Assessment (BA) assesses the potential impacts on listed species and critical habitat from the Willow Master Development Plan (MDP) Project (Project). The Project as proposed by ConocoPhillips Alaska, Inc. (CPAI) is a new development on federal oil and gas leases in the northeastern area of the National Petroleum Reserve in Alaska (NPR-A), managed by the Bureau of Land Management (BLM). Most Project facilities will be located on leased federal lands approximately 27 miles (43.5 kilometers [km]) from Nuiqsut. Supporting infrastructure, including road connections, pipeline tie-ins, and the gravel mine site, will be located on federal and Native corporation–owned lands, on non-unitized lands within the NPR-A, and on lands or waters owned and managed by the State of Alaska.

Section 7 of the Endangered Species Act (ESA) requires federal agencies to consult with the U.S. Fish and Wildlife Service (USFWS) prior to authorizing major construction projects to ensure that federally authorized actions are not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of their critical habitat (50 CFR 402). The federal action triggering the Section 7 consultation is the land use and permit authorization by the BLM for CPAI to construct facilities on BLM-managed lands. An Environmental Impact Statement (EIS) is being prepared by the BLM to consider alternatives to the proponent’s proposed Project under the National Environmental Policy Act (NEPA). This BA describes the BLM’s preferred alternative and preferred module delivery option and their potential effects on listed species and critical habitat managed by the USFWS. Figure 1 shows the Project vicinity.


INSET A
Multi-Season Ice Pad
Gravel Mine Site
Ublutuoch (Tinmiaqsiġvik) River
Bill's Creek
Beaufort Sea
Harrison Bay
Atigaru Point
Oliktok Point
Oooguruk
Mine Site E
CD3
Alpine
CD2
CD1
Kuparuk
Mine Site C
CD5
Tie-In-Pad
CPF2
CD4N
Colville River
Kalikpik River
BT2
Valve Pads
GMT-1
Multi-Season Ice Pad
Gravel Mine Site
ASRC Gravel Mine Site
INSET A
NUIQSUT
Water Source Access Pad
GMT-2
Multi-Season Ice Pad
Horizontal Directional Drilling Pads
BT1
Airstrip/ Operations Center
Pipeline Crossing Pad
Fish (Uvlutuuq) Creek
Judy (Kayyaaq) Creek
Valve Pads
Multi-Season Ice Pad
Willow Processing Facility
BT3
Judy (Iqalliqpik) Creek
Ublutuoch (Tinmiaqsiġvik) River
Ocean Point
DS2P
BT5
0
5
10 Miles
Willow Proposed Development Features
Drill Site (Not to Scale)
Ice Road
New Pipeline
Potential Vessel Route
New Gravel Footprint
Screeding
Ice Pad
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Land Designation
National Petroleum Reserve in Alaska
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 1

2.0 Consultation and Evaluation History

USFWS issued a Biological Opinion (BO) on the Willow MDP Project on October 16, 2020. Since that time, the U.S. District Court Alaska vacated and remanded the EIS and Biological Opinion; this BA was prepared to address the Court's concerns. A Supplemental EIS is being developed to document BLM's efforts to expand the range of alternatives based on discussions and comments received from tribes, cooperating agencies, and other stakeholders. This BA has been prepared to support USFWS' efforts to prepare a new Biological Opinion consistent with the Court's opinion. In addition, this BA reflects the following changes to the proposed action:

- The previously proposed constructed freshwater reservoir was removed and year-round access to four new freshwater lakes have been added as Project water sources, thereby reducing the excavation and fill footprint associated with constructing the previously proposed reservoir
- Drill site Bear Tooth 4 (BT4), located within the Teshekpuk Lake Special Area (TLSA), was eliminated from the Project
- Drill site Bear Tooth 2 (BT2) has been relocated further north, to a location north of Fish Creek
- The proposed Tiŋmiaqsiuġvik mine site excavation footprint was reduced (from approximately 149.3 acres to 119.4 acres, spread over two distinct mine site cells)
- In general, the number of wells, gravel fill volume, gravel fill acreage, gravel road mileage, pipeline mileage, freshwater use, acres of ice infrastructure (e.g., ice roads, ice pads), and traffic (e.g., ground, air, marine) have been reduced

In 2020, BLM adopted its Record of Decision (ROD) for the Integrated Activity Plan/Environmental Impact Statement (IAP/EIS) for the NPR-A (BLM 2020a). The IAP/EIS ROD allocated lands available and unavailable for oil and gas leasing, exploration, and development and included required operating procedures (ROPs) and lease stipulations (LSs) that would minimize impacts from these activities. The IAP/EIS (BLM 2020b) and the accompanying ROD (BLM 2020a) include a development scenario, for which the USFWS issued a BO concluding that the development scenario in the IAP/EIS was not likely to jeopardize the continued existence of the Alaska breeding population of Steller's eider (*Polysticta stelleri*), spectacled eider (*Somateria fischeri*), or polar bear (*Ursus maritimus*) (USFWS 2020a). The BO also concluded that the action was not likely to destroy or adversely modify critical habitat. BLM recently issued a new NPR-A IAP ROD (BLM 2022); the new ROD will not impact this Section 7 consultation when completed by USFWS.

Additional consultations were conducted for the issuance of Incidental Take Regulations (ITRs) for the nonlethal unintentional take of small numbers of polar bears and Pacific walrus (*Odobenus rosmarus divergens*) incidental to other oil and gas activities. The consultation process extended from late 2019 to mid-2021 and resulted in an original petition to USFWS for promulgation of an ITR on June 15, 2020. The petition was updated throughout consultation and a revised petition was submitted to USFWS on March 9, 2021. Under the Marine Mammal Protection Act (MMPA) of 1972, as amended and reauthorized (PL 92-522 and 103-238; 16 USC 1361–1423h), ITRs are the primary means for regulating oil and gas activities that have the potential to impact marine mammals. The current ITRs covering oil and gas activities on the North Slope were issued for a 5-year period beginning on August 5, 2021 (Year 1) and ending on August 5, 2026 (Year 6) (86 FR 42982).

Each permitted project within the NPR-A must undergo its own NEPA analysis and ESA consultation. The Willow MDP Project is such a project.

The Project will primarily source gravel from a Project-specific mine site in the Tiŋmiaqsiuġvik area near the Project. The Tiŋmiaqsiuġvik area mine site is included in this BA; however, the Project may use Mine Site C as a gravel source to support improvements and rehabilitation of existing gravel infrastructure in the Kuparuk area (e.g., Oliktok Dock); Mine Site C was previously permitted and USFWS concurred the mine expansion is not likely to adversely affect or jeopardize the continued existence of ESA species (USFWS 2015a). That concurrence is conditioned on the applicant of that project (in this case, the U.S.

Army Corps of Engineers) following the project plans and minimization measures as outlined in the BO. Therefore, Mine Site C is not included in the Willow MDP BA.

The Project may also use Mine Site E as a gravel source to support improvements and rehabilitation of existing gravel infrastructure in the Kuparuk area (e.g., Oliktok Dock); Mine Site E was previously permitted and USFWS concurred the mine expansion is not likely to adversely affect or jeopardize the continued existence of ESA species (USFWS 2019a, 2020b). Similarly, that concurrence is conditioned on the applicant of that project (in this case, the U.S. Army Corps of Engineers) following the project plans, reasonable and prudent measures, and terms and conditions as outlined in the BO. Therefore, Mine Site E is not included in the Willow MDP BA.

The Project will primarily source gravel from a Project-specific mine site in the Tiŋmiaqsiuġvik area near the Project. The Project mine site is included in this BA (Section 3.2.2.5, *Gravel Mine Sites*).

3.0 Project Description and Action Area

3.1 Definition of Action Area

The *action area* as defined by the ESA as the area directly or indirectly affected by the Project (50 CFR 402.02), and generally extends outside the Project footprint to the point where there are no measurable effects from Project activities.

The onshore action area is the area within 1 mile (1.6 km) of Project activities, or the buffer used by the USFWS for polar bear den disturbance (Figure 2, Table 1). The offshore action area is the area within 1.5 miles (2.4 km) of the main offshore Project components: the barge transit route from Dutch Harbor in the southern Bering Sea to the offshore barge lightering area; screeding at the barge lightering area and the barge and support vessel route from the lightering area to Oliktok Dock; and construction, screeding, and offloading activities at Oliktok Dock (Figure 3). Because the barge route is estimated, it is not quantified for the BA. Table 1 summarizes the onshore and offshore action areas with the exception of the barge route.

Table 1. Summary of Action Area

Description	Area (square miles)	Area (acres)
Offshore effects to marine mammals (area within 1.5 miles of screeding and Oliktok Dock activities)[a]	13.5	8,633.2
Onshore effects to polar bears (area within 1.0 mile of Project activities)	367.8	235,380.2
Onshore effects to eiders (area within 656 feet of summer terrestrial activities)	12.7	8,136.7
Total Action Area[a,b]	**381.3**	**244,013.4**

[a] Because offshore barge and support vessel routes are estimated, they are included in the analysis of the action area, but not quantified in this table.
[b] The total action area does not equal the rows above as it does not include areas of overlap between individual effects areas.

The onshore action area was determined by using the 1-mile (1.6-km) buffer used by the USFWS for avoiding den disturbance from noise, vibration, physical presence, and human activity. The BLM acknowledges polar bears may be attracted to facilities (food, waste) at distances greater than 1 mile (1.6 km), but this distance is unknown and therefore not used to quantify potential effects. This distance is consistent with other ESA consultations for oil and gas development projects in Alaska.

The offshore action area for screeding and Oliktok Dock work was determined by using the estimated distance to the National Marine Fisheries Service (NMFS) acoustic Level B harassment disturbance threshold for non-impulsive noise sources (120 decibels [dB] referenced to one microPascal root mean square [dB re 1 µPa rms]). To remain consistent with the Project's EIS and the NMFS BA, the 120 dB re 1 µPa threshold was used to define the offshore action area (though it is understood that the USFWS recommends the use of 160 dB rms as the disturbance threshold for impulsive and non-impulsive sounds). To estimate the distance to the 120 dB re 1 µPa threshold for the marine barge route, a source level of 170 dB re 1 µPa rms at 3.28 feet (1 meter [m]) (Blackwell and Greene 2003) and a transmission loss of 15 log(R) were used, resulting in an estimated distance of 7,067 feet (2,154 m), or 1.3 miles (2.16 km). This distance was then rounded up to 1.5 miles (2.41 km). This distance is consistent with other NMFS ESA consultations and MMPA authorizations in Alaska.

BLM NPR-A ROP E13 restricts ground-level activity (not on pads or roads) within 656 feet (200 m) of occupied Steller's and spectacled eider nests from June 1 through August 15 (BLM 2022).

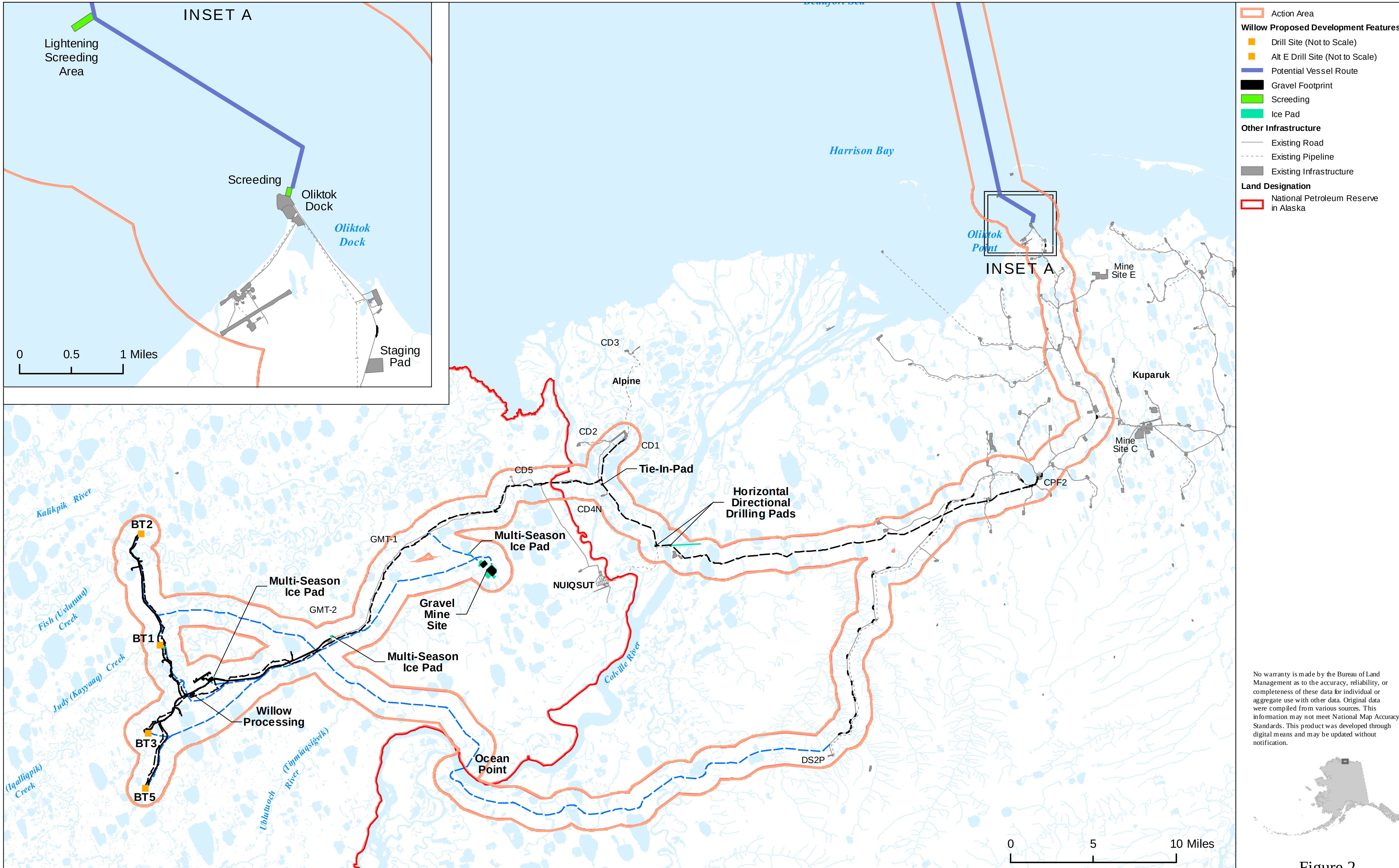
INSET A
Lightening
Screeding
Area
Screeding
Oliktok
Dock
Oliktok
Dock
Staging
Pad
0
0.5
1 Miles
Harrison Bay
Oliktok
Point
INSET A
Mine
Site E
Kuparuk
Mine
Site C
CPF2
CD3
Alpine
CD2
CD1
Tie-In-Pad
CD5
CD4N
Horizontal
Directional
Drilling Pads
Multi-Season
Ice Pad
GMT-1
NUIQSUT
Gravel
Mine
Site
Multi-Season
Ice Pad
GMT-2
Multi-Season
Ice Pad
Willow
Processing
BT2
BT1
BT3
BT5
Kalikpik River
Fish (Uvlutuuq) Creek
Judy (Kayyaaq) Creek
(Iqalliqpik) Creek
Ublutuoch (Tiŋmiaqsiġvik) River
Colville River
Ocean
Point
DS2P
0
5
10 Miles
Action Area
Willow Proposed Development Features
Drill Site (Not to Scale)
Alt E Drill Site (Not to Scale)
Potential Vessel Route
Gravel Footprint
Screeding
Ice Pad
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Land Designation
National Petroleum Reserve
in Alaska
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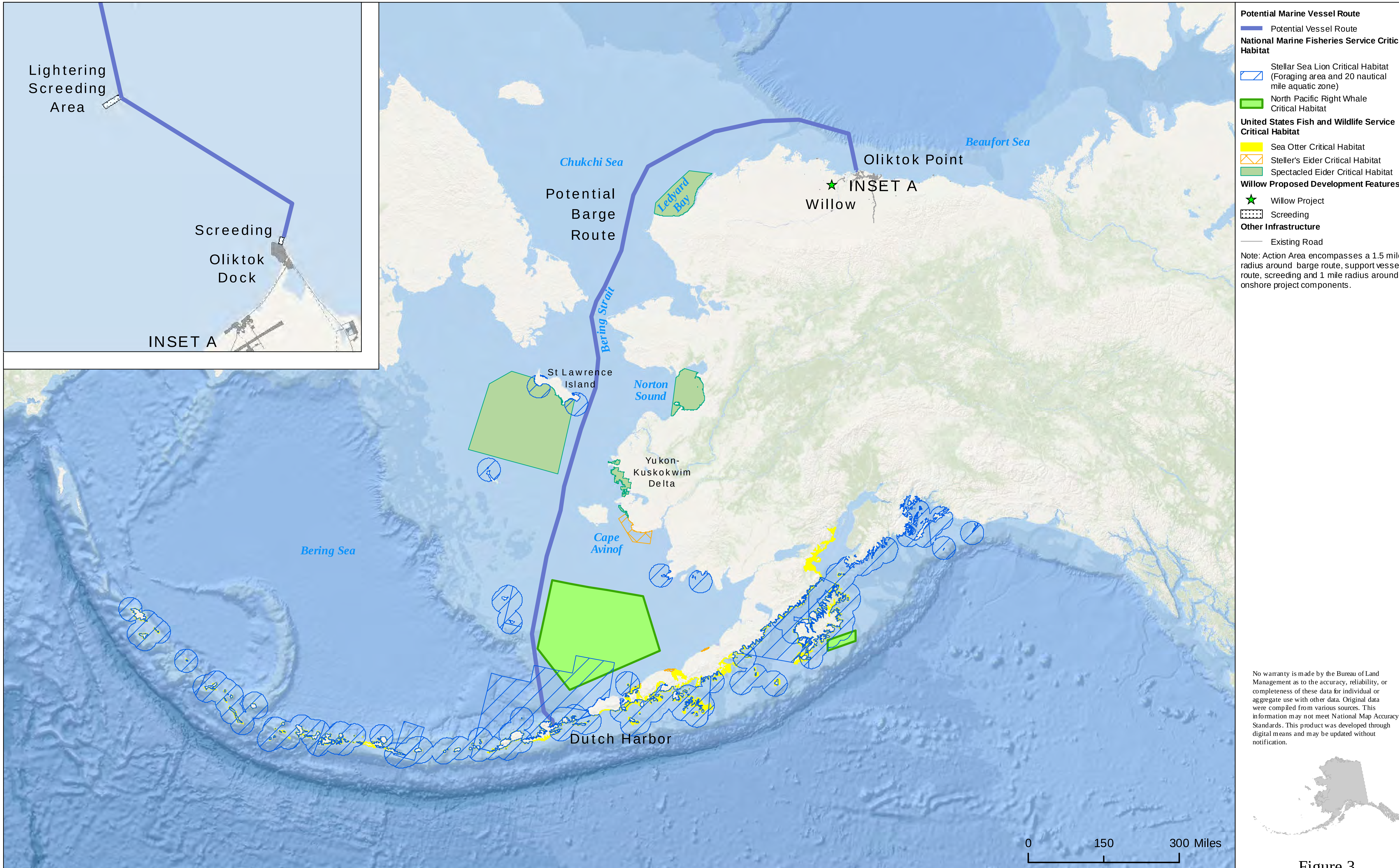
Figure 2


Lightering Screeding Area
Screeding
Oliktok Dock
INSET A
Chukchi Sea
Beaufort Sea
Potential Barge Route
Ledyard Bay
Oliktok Point
INSET A
Willow
Bering Strait
St Lawrence Island
Norton Sound
Yukon-Kuskokwim Delta
Cape Avinof
Bering Sea
Dutch Harbor
Potential Marine Vessel Route
Potential Vessel Route
National Marine Fisheries Service Critical Habitat
Stellar Sea Lion Critical Habitat (Foraging area and 20 nautical mile aquatic zone)
North Pacific Right Whale Critical Habitat
United States Fish and Wildlife Service Critical Habitat
Sea Otter Critical Habitat
Steller's Eider Critical Habitat
Spectacled Eider Critical Habitat
Willow Proposed Development Features
Willow Project
Screeding
Other Infrastructure
Existing Road
Note: Action Area encompasses a 1.5 mile radius around barge route, support vessel route, screeding and 1 mile radius around onshore project components.
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0 150 300 Miles

Figure 3

3.2 Proposed Action

3.2.1 General Description and Summary

The Project will extend an all-season gravel road from the existing Greater Mooses Tooth 2 (GMT-2) development southwest to the Willow area (Figure 1). The Project will include the Willow Processing Facility (WPF), Willow Operations Center (WOC), four gravel drill pads, gravel access and infield roads, airstrip, import and export pipelines, Tiŋmiaqsiuġvik gravel mine site, sealift module delivery via barges, improvements at Oliktok Dock, and an offshore screeding at the barge lightering area. Each of these components is described in detail in subsequent sections. The area where most of the onshore gravel infrastructure will occur (area near the drill sites and new infield and access roads) is referred to as the Willow area. Construction will occur over 8 years, and the total Project life is 30 years. The Project timeline and schedule are detailed in Section 3.3, *Dates and Duration*. Table 2 summarizes Project components. Section 3.4, *Minimization, Avoidance, and Mitigation*, details the mitigation measures that have been incorporated into the Project to reduce Project impacts to the environment.

Table 2. Summary of Project Components

Project Component	Onshore Details	Offshore Details	Total
Drill site gravel pads	Four pads (68.0 acres total): BT1 (18.4 acres), BT2 North (18.2 acres), BT3 (17.0 acres), and BT5 (14.4 acres)	NA	See onshore total
Willow Processing Facility gravel pad	22.8-acre pad	NA	See onshore total
Willow Operations Center gravel pad	31.3-acre pad	NA	See onshore total
Water source and water source access gravel pads	Five water source access pads (6.6 acres total) at lakes L9911, M0235, M0112, M0015, and M1523A	NA	See onshore total
Other gravel pads	Four valve pads (1.3 acres total); 2 pads at Judy (Iqalliqpik) Creek pipeline crossing and 2 pads at Fish (Uvlutuuq) Creek pipeline crossing Two HDD pipeline pads at Colville River crossing (1.5 acres total) Pipeline tie-in pad near Alpine CD4N (0.7 acre) Pipeline crossing pad near GMT-2 (0.5 acre) Kuparuk CPF2 pad expansion (1.0 acre) Communications tower pad (0.5 acre) Oliktok Dock and module staging pad improvements (within existing footprint) Boat ramps (5.9 total acres) Ublutuoch (Tiŋmiaqsiuġvik) River (1.8 acres) Judy (Iqalliqpik) Creek (2.0 acres) Fish (Uvlutuuq) Creek (2.1 acres)	NA	See onshore total
Single-season ice pads	Used during construction at the Tiŋmiaqsiuġvik gravel mine site, bridge crossings, the Colville River HDD crossing, and other locations as needed in the Project area (914.0 acres total)	NA	See onshore total
Multi-season ice pads[a]	30.0 acres total at 3 locations: 10.0-acre multi-season ice pad for 4 years near GMT-2 (Q1 Year 1 to Q2 Year 5) 10.0-acre multi-season ice pad for 1 year at WOC (Q1 Year 1 to Q2 Year 2) 10.0-acre multi-season ice pad for 2 years at the Tiŋmiaqsiuġvik Mine Site (Q1 Year 1 to Q2 Year 3)	NA	See onshore total

Project Component	Onshore Details	Offshore Details	Total
Infield pipelines	33.9 total segment miles: BT1 to WPF (4.3 miles) BT2 to BT1 (7.8 miles) BT3 to WPF (4.2 miles) BT5 to WPF (7.4 miles) GMT-2 to WPF (10.3 miles)	NA	See onshore total
Willow export pipeline	33.5 total miles, WPF to tie-in pad near Alpine CD4N)	NA	See onshore total
Other pipelines	64.9-mile seawater pipeline from Kuparuk CPF2 to WPF on new VSMs (includes HDD crossing of Colville River and 0.1-mile spur pipeline to K-Pad) 34.7-mile diesel pipeline from Kuparuk CPF2 to Alpine CD1 on new and shared VSMs (31.6 miles) and Alpine CD4N to the Alpine processing facility at Alpine CD1 on existing VSMs (3.1 miles); includes HDD crossing of Colville River 2.8-mile fuel gas pipeline from WOC to WPF Five freshwater intake pipelines (0.9-miles) from freshwater source lakes to the freshwater access pads 2.8-mile treated water from WOC to WPF	NA	See onshore total
Pipeline VSMs below ordinary high water (number)	108 total: 44 in Lake L9911 2 in Lake M1523A 2 in Lake M0112 24 in Lake M0015 24 in Lake M0235 6 in Lake L9323 2 in the Miluveach River 2 in the Kachemach River 1 in the East Fork of Kalubik Creek 1 in the West Fork of Kalubik Creek	NA	See onshore total
Gravel roads	30.3 total new miles (216.4 acres total, including seven turnouts) connecting drill sites to the WPF, WPF to GMT-2, water source access, and airstrip access Seven turnouts with subsistence/tundra access ramps (2.6 acres total) 5.0 total acres of curve widening along existing Kuparuk gravel roads (between Oliktok Dock and DS2P)	NA	30.3 miles (221.4 acres total)
Bridges	Six total bridges: Judy (Iqalliqpik) Creek, Judy (Kayyaaq) Creek, Fish (Uvlutuuq) Creek, Willow Creek 2, Willow Creek 4, and Willow Creek 8	NA	See onshore total
Bridge or other piles below ordinary high water (number)	36 total bridge piles (installed through groundfast ice): 16 at Judy (Iqalliqpik) Creek 4 at Judy (Kayyaaq) Creek 16 at Fish (Uvlutuuq) Creek	NA	See onshore total
Culverts or culvert batteries (number)	9	NA	See onshore total
Cross-drainage culverts (number)	160	NA	See onshore total

Project Component	Onshore Details	Offshore Details	Total
Airstrip	5,700 × 200–foot airstrip and apron (42.2 acres total)	NA	See onshore total
Total footprint and fill volume[b]	434.0 total acres of fill using 4.86 million cubic yards of fill material: • 403.7 acres of gravel fill using 4.57 million cubic yards of gravel • 30.3 acres of overburden fill using 292,000 cubic yards of overburden	NA	See onshore total
Gravel source	Up to 119.4-acre excavation site in Tiŋmiaqsiuġvik area; 30.3 acres in mine site excavation berms Existing mine site in Kuparuk area (e.g., Mine Site C, Mine Site E)	NA	See onshore total
Total permanent excavation (acres)	119.4 acres total over 2 mine site cells at the Tiŋmiaqsiuġvik Mine Site	NA	See onshore total
Ice roads	511.4 total miles (3,749.4 acres total) over eight construction seasons (Year 1 through Year 8)	NA	See onshore total
Total freshwater use	1,735.9 million gallons over the life of the Project (30 years)	NA	See onshore total
Screeding	NA	12.1 total acres: 2.5 acres at Oliktok Dock and 9.6 acres at the barge lightering area	See offshore total
Ground traffic[c, d]	3,681,030 trips	NA	See onshore total
Fixed-wing air traffic[c, e]	12,053 total flights To/from Willow: 11,691 To/from Alpine: 320 To/from Kuparuk: 42	NA	See onshore total
Helicopter air traffic[c]	2,437 total flights To/from Willow: 2,321 To/from Alpine: 116	NA	See onshore total
Barges and tugboats to Oliktok Dock [f]	NA	30 barge trips and 50 tugboat trips	See offshore total
Support vessels[g]	NA	285 trips	See offshore total
Project duration	30 years	Five years; included in Project construction phase	30 years
Fish-bearing waterbody setback overlap (ROP E-2)	6.8 acres of gravel footprint, 0.1 mile of gravel road, and 1.9 miles of pipelines	NA	See onshore total
Less than 500-foot pipeline-road separation (ROP E-7)	13.8 miles of pipelines and road with less than 500 feet of separation	NA	See onshore total
River setback overlap (LS K-1)	Fish (Uvlutuuq) Creek: 46.7 acres of gravel infrastructure and 3.3 miles of pipelines Judy (Iqalliqpik) Creek: 47.6 acres of gravel infrastructure and 3.8 miles of pipelines Water access pad at Lake M0112: 1.5 acres (included with Fish [Uvlutuuq] Creek total) Water access pad at Lake M1523A: 1.2 acres (included with Judy [Iqalliqpik] Creek total) Water access pad at Lake M0235: 1.3 acres (included with Fish [Uvlutuuq] Creek total)	NA	See onshore total

Project Component	Onshore Details	Offshore Details	Total
Deepwater lake setback overlap (LS K-2)	2.2 acres of gravel infrastructure and 0.2 mile of pipelines	NA	See onshore total

Note: BT1 (drill site Bear Tooth 1); BT2 (drill site Bear Tooth 2); BT3 (drill site Bear Tooth 3); BT5 (drill site Bear Tooth 5); DS2P (Kuparuk drill site 2P); GMT-2 (Greater Mooses Tooth 2); HDD (horizontal directional drilling); LS (lease stipulation); NA (not applicable); Q1 (first quarter); Q2 (second quarter); ROP (required operating procedure); VSM (vertical support member); WPF (Willow processing facility); WOC (Willow Operations Center).
[a] Multi-season ice pad locations may shift slightly from year to year depending on impacts to tundra revealed over the summer as the ice pad edges recede and are evaluated during CPAI and agency inspection.
[b] Values may not sum to totals due to rounding.
[c] Total traffic is for the life of the Project (30 years) and does not include any reclamation activity. Ground-traffic trips are one-way; a single flight is defined as a landing and subsequent takeoff; a single vessel trip is defined as docking and subsequent departure.
[d] Number of trips includes buses, light commercial trucks, short-haul trucks, passenger trucks, and other miscellaneous vehicles. Construction ground traffic also includes gravel hauling (e.g., B70/maxi dump trucks).
[e] Flights outlined are additional flights required beyond projected travel to and/or from non-Project airports (e.g., Anchorage, Fairbanks, Deadhorse); includes C-130, Twin Otter/CASA, Cessna, and DC-6 or similar aircraft.
[f] Includes sealift barges for small modules and bulk materials transiting between Dutch Harbor and Oliktok Dock.
[g] Includes crew boats, screeding barge, and other support vessels between the lightering area and Oliktok Dock.

3.2.2 Project Components

3.2.2.1 Project Facilities and Gravel Pads

Project pads will be constructed for drill sites and support infrastructure (e.g., WPF, WOC, pipeline valve pads). Pads will be constructed of gravel fill and will be a minimum of 5 feet (1.5 m) thick to maintain a stable thermal regime and to protect underlying permafrost. The average thickness and gravel fill volume needed for each pad vary depending on site-specific topography and design criteria. As the topography of the Project area is generally more variable than developments located to the east, the average pad thickness will exceed 7 feet (2.1 m) to provide a flat gravel surface above the undulating ground surface. CPAI will use insulation where practicable to reduce the average heigh, volume and acreage of gravel fill while maintaining thermal properties required to protect permafrost. Embankment side slopes will have a 2 horizontal to 1 vertical ratio (2:1). Erosion potential will be evaluated on a pad-specific basis, and embankment erosion protection measures will be designed and employed as necessary.

3.2.2.1.1 Willow Processing Facility

The WPF will house the main plant facilities for separating and processing produced multiphase fluids (e.g., oil, gas, water) and delivering sales-quality crude oil to the Trans-Alaska Pipeline System. The WPF will be approximately 20.1 miles (32.3 km) from the coast. Produced water, also processed at the WPF, will be re-injected to the subsurface formation to maintain reservoir pressure. Produced natural gas will fuel the WPF and other Project equipment (including electrical power generation), be re-injected into a producing reservoir formation to maintain reservoir pressure and be used for gas lift. During WPF startups, shutdowns, and upset conditions, natural gas may be flared; flaring may also occur during predrilling activity at drill sites Bear Tooth 1 (BT1) and 2 (BT2) to support initial well cleanout, stimulation cleanout, and well testing.

The processing equipment at the WPF will include emergency shutdown equipment, natural-gas-fired turbine generators, gas-turbine compressors, gas strippers, gas treatment facilities, heat exchangers, separators, stabilizer unit, flare system, utility systems (e.g., heating glycol, nitrogen), oil-producing vessels, pumps, pigging and metering facilities, electrical equipment, fuel supply storage tanks and dispensing facilities, tank farm, and warm storage facilities for equipment.

Additional facilities will be required to accommodate production from the GMT-2 drill site; any equipment necessary to accommodate GMT-2 production will be housed within the GMT-2 footprint and the WPF pad. The additional equipment will include the following:

- Electrically driven booster compressor to increase gas pressures for injection into the deeper GMT-2 reservoir
- Electrically driven booster pump to increase water pressure for injection into the deeper GMT-2 reservoir

3.2.2.1.2 Drill Sites

Four Bear Tooth (unit name) drill sites will be constructed: BT1, BT2, BT3, and BT5. Drill site BT5 will not be authorized for construction in BLM's ROD and authorization to construct this drill site will be deferred to Year 7 or later. Each drill site has been designed and sized to accommodate all drilling and operations facilities, wellhead shelters, drill rig movement, and material storage. Each drill site is sized to accommodate up to 80 wells at a typical 20-foot (6.1-m) wellhead spacing; the Project will have a total of 219 wells. Additional facilities typical for drill sites will include emergency shutdown equipment, fuel gas treatment equipment, well test and associated measurement facilities, chemical injection facilities, production heater and associated equipment, pig launchers and receivers, spill response equipment, transformer platforms, operations storage and stand-by tanks, pipe racks and/or manifold piping and valves, high-mast lights, and communications infrastructure (including a self-supporting tower up to 200 feet high; Section 3.2.2.3.4, *Communications*).

Project wells will use hydraulic fracturing and extended reach drilling to access the targeted hydrocarbon deposits and develop wells (Section 3.2.2.1.2.1, *Drill Site Operational Activity: Hydraulic Fracturing*). Hydraulic fracturing is a well stimulation technique that will increase the flow of oil and natural gas. Extended reach drilling is a directional drilling technique used to develop long, horizontal wells and allow a larger area to be reached from a single surface location (e.g., drill site).

Wells will be categorized as either production or injection. Production wells will generate the field's oil and gas production, whereas injector wells will inject water (i.e., treated seawater or produced water) and/or natural gas into producing formations to maintain reservoir pressure. Wells will be equipped with appropriate well safety valve systems in accordance with 20 AAC 25.265. Manifold or pipe rack piping (or both) will combine individual wellhead piping into a common gathering line through which all produced fluids will be transported to the WPF.

3.2.2.1.2.1 Drill Site Operational Activity: Hydraulic Fracturing

Hydraulic fracturing is a process used to increase the flow of fluids from a reservoir. Each production well will receive a multistage hydraulic fracturing operation like those employed at other North Slope developments. The process involves isolating well sections and pumping gelled seawater or brine mixed with a proppant (small beads of sand or human-made ceramic material) at high pressure into the formation. The high-pressure fluid creates fractures in the formation, and the proppants prevent the fracture from closing, allowing oil and gas within the formation to flow into the wellbore and ultimately to the surface. It is anticipated that each well will be hydraulically fractured one time, with approximately 12 to 20 individual fracturing locations within the well. Hydraulic fracturing operations will last approximately 6 days per well, with six wells per pad per year being fracture stimulated. Two hydraulic fracturing operations could occur concurrently, although not on the same pad; however, fracturing operations may occur simultaneously with well drilling on the same pad. Total water use for hydraulic fracturing will be approximately 14,000 to 24,000 barrels (0.6 to 1.0 million gallons [MG]) of seawater per well.

All hydraulic fracturing activity will comply with Alaska Oil and Gas Conservation Commission regulations (30 AAC 25.283).

3.2.2.1.3 Willow Operations Center

The base of operations for the Project will be the WOC, located near the WPF (but separated for safety) and adjacent to the airstrip, approximately 19.2 miles (30.8 km) from the coast. The WOC will contain utility buildings and storage facilities, including the Willow operations camp (living quarters, offices, meeting rooms, dining facilities, central control building, laboratory, medical clinic, and wellness facilities), water and wastewater treatment plants, water tanks, chemical storage, freshwater storage tanks, at least 2 Class I underground injection control disposal well(s), emergency response center (spill response shop, fire department, ambulance bay), essential and emergency generators, gas-turbine generator, hazardous waste storage, drilling shop, craft maintenance shops and tool room, fleet maintenance shop, fabrication and welding shop, warehouse, storage tents, diesel and jet fuel tanks and pump skids, drilling shop, staging areas, drill cuttings storage, operation and maintenance storage, laydown space, rolling stock parking, and a solid waste incinerator.

3.2.2.1.4 Valve Pads

Isolation valves will be installed on each side of pipeline crossings at Fish (Uvlutuuq) Creek and Judy (Iqalliqpik) Creek to minimize the potential spill impact in the event of a leak or break. To support valve infrastructure, gravel pads will be constructed on each side of the two crossings (four valve pads total). Valve pads will be located adjacent to gravel roads and will be approximately 400 to 2,000 feet (122 to 610 m) from the creeks.

3.2.2.1.5 Pipeline Pads

Four pipeline pads will be constructed to support pipeline construction and operations:

- One pipeline crossing pad will be located along the proposed import/export pipeline pads near GMT-2 to allow north–south ice road crossings. The pipelines will be placed in casing through the gravel pad embankment.
- Two new horizontal directional drilling (HDD) pads will be constructed along the Colville River near the existing Alpine Pipeline HDD where the diesel and seawater pipelines will transition from aboveground to belowground on either side of the river. Infrastructure on the gravel pads will include a rectifier (west bank only) to support cathodic protection systems equipment (i.e., anti-corrosion system) and thermosyphons (east and west banks). There may also be a small electrical and instrumentation module on the west bank.
- The Willow Pipeline (export) will tie into existing pipeline infrastructure at a new tie-in pad located along the Alpine Pipeline near Alpine CD4N. One or more truckable modules will be installed on this pad for pigging, overpressure protection, and metering equipment, as well as infrastructure to facilitate warm-up or de-inventory of the Willow Pipeline and seawater pipeline. This includes drag reducing agent tanks and equipment for injection into the sales oil pipeline system.

3.2.2.1.6 Water Source Access Pads

The Project will include five year-round water sources to support construction, drilling, and operations. Water will be sourced from lakes M0015, M0235, M0112, M1523A, and L9911. Year-round access to water source lakes will be provided via short, gravel spur roads from other Willow Project roads connecting to water source access pads (Figure 4). All water source access pads were sized to minimize the gravel-fill footprint while still allowing sufficient space for vehicles to access the water sources and safely maneuver.

3.2.2.1.7 Communications Tower Pad

The communications tower located at the WOC will be constructed on a separate pad to avoid potential interference with the airstrip and to comply with Federal Aviation Administration requirements. The pad will be adjacent to the WOC (approximately 19.2 miles [30.9 km] from the coast) and will contain communications infrastructure, including a self-supported communications tower up to 200-feet (61-m) tall (Section 3.2.2.3.4, *Communications*). All towers will have warning lights, programmed for compliance with Federal Aviation Administration regulations.

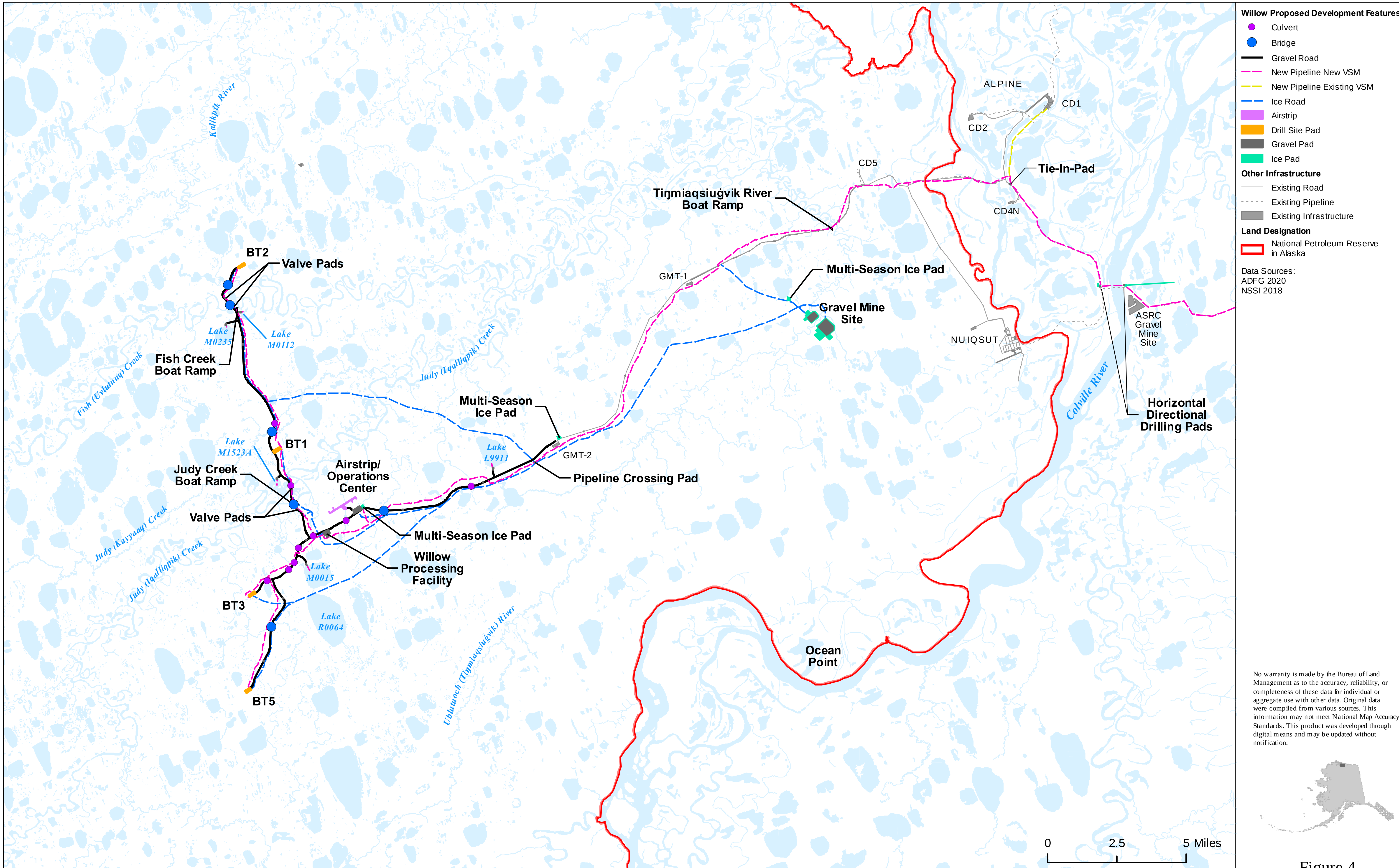

Willow Proposed Development Features
Culvert
Bridge
Gravel Road
New Pipeline New VSM
New Pipeline Existing VSM
Ice Road
Airstrip
Drill Site Pad
Gravel Pad
Ice Pad
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Land Designation
National Petroleum Reserve in Alaska
Data Sources:
ADFG 2020
NSSI 2018
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.
0
2.5
5 Miles
ALPINE
CD1
CD2
CD5
Tie-In-Pad
CD4N
Tiŋmiaqsiuġvik River Boat Ramp
GMT-1
Multi-Season Ice Pad
Gravel Mine Site
NUIQSUT
ASRC Gravel Mine Site
Horizontal Directional Drilling Pads
Colville River
BT2
Valve Pads
Kalikpik River
Lake M0235
Lake M0112
Fish Creek Boat Ramp
Fish (Uvlutuuq) Creek
Judy (Iqalliqpik) Creek
Multi-Season Ice Pad
GMT-2
Pipeline Crossing Pad
Lake L9911
BT1
Lake M1523A
Judy Creek Boat Ramp
Airstrip/ Operations Center
Valve Pads
Multi-Season Ice Pad
Willow Processing Facility
Judy (Kayyaaq) Creek
Judy (Iqalliqpik) Creek
Lake M0015
BT3
Lake R0064
BT5
Ublutuoch (Tiŋmiaqsiuġvik) River
Ocean Point

Figure 4

3.2.2.1.8 New Facilities on Existing Pads

In addition to the construction of new gravel pads, the Project will also include installation of new modules and equipment on existing gravel pads at Kuparuk River Unit (Kuparuk) central processing facility 2 (CPF2) and the Alpine processing facility located on the Alpine CD1 gravel pad, which will require a 1.0-acre expansion of the CPF2 pad to accommodate these new facilities. Modules and equipment to be installed at Kuparuk CPF2 will serve the following purposes:

- Diesel transfer tanks and pumps and pigging facilities for delivery to the Alpine processing facility (at Alpine CD1) and WPF
- Seawater transfer pumps and pigging facilities for delivery to the WPF
- Infrastructure to facilitate warm-up or de-inventory of the Willow Pipeline and seawater pipeline

Modules, equipment, and storage tanks will be installed on the Alpine CD1 pad at the Alpine processing facility for the following purposes:

- Crude oil surge drum and associated equipment to assist with pressure management of the sales-oil pipeline system
- Diesel tanks and pigging facilities to receive product from Kuparuk CPF2
- Infrastructure to facilitate warm-up or de-inventory of the Willow Pipeline and seawater pipeline

Modules, equipment, and storage tanks will be installed on the existing GMT-2 pad to support potential production from GMT-2. This option, if implemented, will include the following:

- Separation and metering equipment to measure fluids crossing the Greater Mooses Tooth-Bear Tooth unit boundary
- Chemical storage to support chemical injection into pipelines connecting GMT-2 and the Bear Tooth unit

The existing mud plant at the K-pad will be expanded on existing gravel to accommodate Willow requirements. The Alpine CD1 pad, GMT-2 pad, and K-Pad will not require expansion to accommodate the addition of the facilities described above.

3.2.2.2 Pipelines

The Project will include infield and import/export pipelines. Infield pipelines will carry a variety of products, including produced fluids, produced water, seawater, miscible injectant, and gas, between the WPF and each drill site. The Willow Pipeline will carry sales-quality crude oil processed at the WPF to a tie-in with the existing Alpine sales oil pipeline near Alpine CD4N. Other import/export pipelines will include a seawater pipeline from Kuparuk CPF2 to the WPF, seawater spur pipeline from an existing seawater pipeline to the K-Pad, a diesel pipeline from Kuparuk CPF2 to the existing processing facility at Alpine CD1, five freshwater pipelines from the freshwater source lakes to their respective water source access pads, and treated water and fuel-gas pipelines from the WPF to the WOC.

Pipeline design will conform to applicable federal and state regulations and to CPAI internal criteria. All pipelines will be hydrostatically tested prior to startup. Pipelines will be located aboveground (except at road crossings and the Colville River HDD crossing) and be nonreflective. Pipelines will be supported on horizontal support members (HSMs) placed on top of vertical support members (VSMs) spaced approximately 55 feet (16.8 m) apart. VSMs will have a typical diameter of 12 to 24 inches (30 to 61 centimeters) and a disturbance footprint of 18 to 30 inches (46 to 76 centimeters) (up to 4.9 square feet [0.5 square m]). Pipelines (including suspended cables) on new VSMs will be a minimum of 7 feet (2.1 m) above the surrounding ground surface, including in areas where new VSMs will be placed adjacent to existing Alpine pipeline racks, which may be less than 7 feet (2.1 m) above the ground surface. New pipelines that share existing VSMs and HSMs will match the existing HSM heights. Where Project pipelines will parallel existing pipelines, the new VSMs will be aligned with the existing VSMs (to the extent practicable) to avoid a “picket fence” effect. Except in disconnected locations (i.e., roadless areas), pipelines will typically parallel roadways at a distance between 500 and 1,000 feet (152 to 305 m). Pipelines will be routed an appropriate distance from occupied structures at the WOC to maintain the recommended pipeline blast radii and gas dispersion zones. This will require the pipelines between the WOC and airstrip to be greater than 1,000 feet (305 m) from the road.

At Fish (Uvlutuuq) Creek and Judy (Iqalliqpik) Creek, pipelines will be placed on structural steel supports attached to bridge girders. At smaller stream crossings, pipelines will be installed on VSMs approximately perpendicular to the channel with VSMs on each side of the crossing to avoid placing VSMs in streams to the extent practicable.

Fiber-optic communication and power cables will be suspended from the same VSMs via messenger cable and will maintain 7 feet (2.1 m) of clearance above the surrounding ground surface, except at pipeline-road crossings, where the cables will be installed in a trench beneath the road. Trenches will be excavated during winter and soils will be temporarily sidecast onto plywood, plastic sheeting, or an adjacent ice pad. Excavated material will be backfilled into the trench once the cable placing activity is complete. Trenching may also be used to bury power and communications cables within the gravel HDD pads.

3.2.2.2.1 Infield Pipelines

Infield pipelines will include the following pipelines connecting the WPF to each Project drill site and GMT-2:

- Produced fluids pipeline: Produced crude oil, gas, and water transported from each drill site to the WPF for processing
- Injection water pipeline: Seawater or produced water transported from the WPF for injection into target reservoirs to support enhanced oil recovery
- Gas pipeline: Lean gas transported from the WPF for artificial lift, pressure support, and fuel gas
- Miscible-injectant pipeline: Miscible injectant transported from the WPF for injection to support enhanced oil recovery

The infield pipeline supports will also include space to accommodate future pipelines to support possible future development in the greater Willow area. Infield pipelines from GMT-2 will be carried on the previously proposed pipeline supports between GMT-2 and the WPF.

All infield pipelines will be designed to allow pipeline inspection and maintenance between each drill site or GMT-2 and the WPF. Permanent pigging facilities will be installed for the produced fluid and injection water pipelines. Pipeline valves that can be closed in the event of an emergency will be installed on produced fluid pipelines on each side of the Judy (Iqalliqpik) Creek and Fish (Uvlutuuq) Creek crossings, allowing the section of pipeline between the valves to be isolated to minimize the potential spill impacts in the event of a leak or break.

Pipelines will be designed to minimize redundant parallel pipelines to the extent practicable. For example, infield pipelines from BT2 will tie into BT1 infield pipelines at BT1 to reach the WPF. An additional set of infield pipelines will connect BT5 to the WPF, GMT-2 to the WPF, and BT3 to the WPF. Infield pipelines will have supports placed on single VSMs, except where anchor supports are used and in expansion loops, where two VSMs per pipeline support will be used. Infield pipelines for GMT-2 will be carried on the VSMs used to support the export and import pipelines.

3.2.2.2.2 Willow Pipeline

The Willow Pipeline (sales oil transport pipeline) will carry sales-quality crude oil processed at the WPF to a tie-in with the Alpine Sales Pipeline at a new pipeline tie-in pad near Alpine CD4N. From CD4N, sales-quality oil will be transported via the existing Alpine Sales Pipeline to the Kuparuk Pipeline and onward to the Trans-Alaska Pipeline System near Deadhorse, Alaska. The Willow Pipeline will be placed on new VSMs between the WPF and the tie-in pad near Alpine CD4N. Between the WPF and the tie-in pad near Alpine CD4N, vertical loops or isolation valves will be installed on each side of the Tiŋmiaqsiuġvik River, and on each side of the segment crossing the Nigliagvik Channel, Niġliq Channel, and Lakes L9341 and L9323.

3.2.2.2.3 Other Pipelines

Other import pipelines will include seawater, diesel, freshwater, treated water, and fuel gas pipelines. The seawater pipeline will transport seawater from the Kuparuk CPF2 to the WPF for injection into the Project's target reservoirs; a seawater pipeline spur will connect an existing seawater pipeline to the mud plant on the K-Pad. The diesel pipeline will transport diesel fuel and miscellaneous refined hydrocarbon products from Kuparuk CPF2 to the Alpine processing facility at Alpine CD1; from Alpine CD1, diesel fuel will be trucked to the WPF and other locations in the Project area. The diesel pipeline will share new VSMs with the seawater pipeline except for the segment between Alpine CD4N and the Alpine processing facility at Alpine CD1 where it will be placed on existing VSMs. The new VSMs will also carry the Willow Pipeline where available. Between Kuparuk CPF2 and Alpine CD4N, vertical loops will be installed on the diesel pipeline on each side of the Miluveach River, Kachemach River, and Colville River.

The seawater and diesel pipelines will be installed beneath the Colville River using HDD. The Colville River crossing will be located near existing facilities constructed for the Alpine Sales Pipeline HDD crossing and will require one new gravel pad on each side of the river where the pipeline transitions from aboveground to belowground (Section 3.2.2.1.5, *Pipeline Pads*). Each pipeline will be approximately 60 feet (18 m) apart. Pipelines will be insulated and placed within an outer pipeline casing, which will inhibit heat transfer to permafrost, contain fluids in the event of a leak or spill, and provide structural integrity.

The HDD process will involve drilling a borehole under the river large enough to accommodate the pipeline. The HDD entry and exit locations will be set back more than 300 feet (90 m) from the riverbanks, and the total borehole length will be approximately 4,490 feet (1,370 m). The depth below the river channel bottom at the center of the HDD crossing will be approximately 70 feet (21 m). Throughout the process of drilling and enlarging the borehole, a slurry made of naturally occurring nontoxic materials (typically bentonite clay and water) will be circulated through the drilling tools to lubricate the drill bit, remove drill cuttings, and hold the borehole open. Pipeline sections will be staged and welded together to form segments long enough to pull through the entire HDD crossing once the borehole is complete.

The HDD crossing will be constructed during the winter. To support HDD drilling and pipeline installation, two HDD single-season ice pads will be constructed (approximately 42 total acres). One ice pad will be constructed on each side of the Colville River adjacent to the existing Alpine pipeline HDD gravel pads.

At each water source lake (e.g., L9911, M0015, M0112, M0235, and M1523A), two pipelines will extend from a pumphouse located on the associated water source access pad out into a deep portion of the lake on VSMs. Water pumped from the water source lakes will then be transported by truck to where it is needed in the Project area.

3.2.2.3 Other On-Land Infrastructure and Utilities

3.2.2.3.1 Ice Pads

Single-season and multi-season ice pads will be used to support construction. Single-season ice pads will be used during all years of construction to house construction camps, stage construction equipment, and support construction activities. Single-season ice pads will be used during construction at the Tiŋmiaqsiuġvik gravel mine site, at bridge crossings during gravel road and pipeline construction, at the Colville River HDD crossing, near Kuparuk drill site 2P (DS2P), and at other locations as needed near Project infrastructure. Table 3 provides a summary by year of the Project's single-season ice pads.

Table 3. Summary of Project Single-Season Ice Pads by Year (acres)

Year	Single-Season Ice Pad Area (acres)
Year 1	82.7
Year 2	152.2
Year 3	191.9
Year 4	266.0
Year 5	73.4
Year 6	8.4
Year 7	134.1
Year 8	5.3
Year 9	0.0
Year 10 – life of the Project (Year 30)	0.0
Total	**914.0**

Multi-season ice pads will be used on a limited basis to stage construction materials between winter construction seasons; this avoids the need to place gravel fill to support temporary activities. Multi-season ice pad construction uses compacted snow over a base layer of ice with a vapor barrier over the ice to prevent melting from rain and evaporation, and foam insulation and white tarps to insulate the pads. Multi-season ice pads will then be covered by rig mats. Once the multi-season pad is no longer needed, materials will be removed, and any spills or releases will be cleaned before the ice melts.

Multi-season ice pads will be built in one winter and be used over the following summer and winter before being allowed to melt; each multi-season ice pad will last no more than approximately 18 months. In areas where multi-season ice pads are required for a longer time period, each consecutive ice pad will be constructed in a slightly different location so the footprints will not overlap. Accordingly, figures showing the locations of multi-season ice pads should be viewed as portraying approximate locations rather than exact locations.

Three 10.0-acre multi-season ice pads will be used during Project construction: one near GMT-2 (winter Year 1 through spring Year 5), one near the WOC (winter Year 1 through spring Year 2), and one near the Tiŋmiaqsiuġvik Mine Site (Winter Year 1 through spring Year 3). (Note: multi-season ice pads are typically maintained and reconstructed as needed within the same footprint; however, the footprint may shift based on CPAI and agency inspection and evaluation of tundra impacts during the summer.) These pads will allow ice road, gravel mining, and other equipment to be stored on-site over the summer, which will support earlier construction starting dates the following winter, while minimizing gravel fill. Gravel will not be stored on the multi-season ice pad near the mine site.

3.2.2.3.2 Camps

Camps required to support Project construction include camps within the Project area at the WOC as well as other existing camp space (e.g., Alpine, Kuukpik Pad, Sharktooth Camp in Kuparuk). A temporary construction camp to support ice road construction for module delivery will be located on an ice pad near Kuparuk DS2P. Housing of construction workers at the Kuukpik Hotel in Nuiqsut is also possible. Camps to support drilling will be located at each drill site. The Willow Camp will support operations and be located on the WOC pad.

3.2.2.3.3 Power Generation and Distribution

Electrical power for the Project will be generated by a 98-megawatt power plant at the WPF equipped with natural gas-fired turbines. Power will be delivered to each drill site and the WOC via power cables suspended from pipeline HSMs. Following WPF startup, the power plant will also be used to power drill rigs, except during periods when power from the WPF is unreliable.

During construction and drilling, prior to completion of the permanent power supply, portable generators will provide temporary power at various locations. The portable generators will be fueled by ultra-low-sulfur diesel. Once fuel gas is available for the WPF turbines, on startup of the WPF, diesel-fired emergency backup generators will be installed at the WPF and at the Willow Camp (located at the WOC).

Portable diesel-fired emergency backup generators will be available to provide emergency power at drill sites. Permanent electric power generator sets will be fully enclosed or acoustically packaged to reduce noise emissions.

3.2.2.3.4 Communications

Communications infrastructure throughout the Project area will be provided by fiber-optic cables suspended from pipe rack HSMs. Permanent communication towers will be located on the communications tower pad near the WOC and on each drill pad (total of 5 towers). The communications towers will be up to 200 feet (61 m) tall. Permanent towers will be triangular, self-supporting lattice towers and will not use guy-wires. Temporary towers will be pile supported and may require guy-wire supports. Guy-wires will include devices to mitigate bird strikes (e.g., bird diverters). All towers will have warning lights as required by the Federal Aviation Administration for aircraft safety. Bird nesting diversion tactics may be installed on towers consistent with BLM NPR-A ROP E-9 (BLM 2022), as is practicable given the equipment layout and potential for snow and ice loading and associated concerns.

3.2.2.3.5 Potable Water

lakes L9911, M0015, M1523A, M0235, and M0112 will be the primary sources of freshwater for domestic use to supply water for drilling and operations. The water-source lakes will be accessed by gravel water-source access roads and pads (Section 3.2.2.1.6, *Water Source Access Pads*). The intake infrastructure at the water-source lakes will consist of a pumphouse sitting on the water source access pad connected to intake piping which will extend out into the deep portion of the lakes on VSMs

Freshwater will be treated in accordance with State of Alaska Drinking Water Regulations (18 AAC 80) as required for any potable drinking water system. Prior to operation of the freshwater intake system, potable water for construction and drilling camp use will be withdrawn using temporary equipment and trucked to the water plant at the temporary construction camp. Additional freshwater withdrawals from other local permitted lakes will be needed during construction (e.g., ice road, ice pad, hydrostatic pipeline testing), drilling (e.g., drilling support), and operations (e.g., dust control).

3.2.2.3.6 Seawater

Seawater to support hydraulic fracturing and injection will be sourced from the existing Kuparuk Seawater Treatment Plant at Oliktok Point. Seawater will be transported to the Project area from Kuparuk CPF2 via a new seawater pipeline (Section 3.2.2.2.3, *Other Pipelines*). A seawater pipeline spur will connect an existing seawater pipeline to the mud plant on K-Pad.

3.2.2.3.7 Domestic Wastewater

Sanitary wastes generated from camps will be hauled to the WOC wastewater treatment facility and will be disposed of in the Class I underground injection control (UIC) disposal well located at the WOC. Before UIC well establishment, treated wastewater will be hauled to another approved disposal site or discharged under the Alaska Pollutant Discharge Elimination System (APDES) General Permit (AKG-332000). Prior to the establishment of the UIC well at the WOC, domestic wastewater will be treated and either hauled to Alpine or Kuparuk (winter only) for injection in an existing UIC disposal well, or in instances where weather or conditions prevent disposal at Alpine, discharged to tundra per APDES permit conditions.

3.2.2.3.8 Solid Waste

Domestic waste (e.g., food, paper, wood, plastic) will either be incinerated on-site at the WOC or at Alpine, or if non-burnable, will be recycled or transported to a landfill facility in Deadhorse (North Slope Borough landfill), Fairbanks, or Anchorage. Incinerator ash will be stored on-site until it can be transported to an off-site landfill for disposal. Hazardous and solid waste from the Project will be managed under Alaska Department of Environmental Conservation and U.S. Environmental Protection Agency regulations, as well as under the 2022 BLM ROPs (BLM 2022).

3.2.2.3.9 Drilling Waste

Drilling wastes (e.g., drilling mud, cuttings) will be disposed of on-site through annular disposal (i.e., pumped down the well through the space between the two casing strings) and/or transported to an approved disposal well (e.g., Class I UIC disposal well at the WOC). Reserve pits will not be used by the Project, though a temporary storage cell may be constructed for staging drilling muds and cuttings prior to UIC well disposal. Produced water will be processed at the WPF and re-injected to the subsurface through injection wells as part of reservoir pressure maintenance for secondary recovery. Well work waste materials will be managed according to the Alaska Waste Disposal and Reuse Guide (CPAI and BP n.d.). In addition to waste handling and disposal regulations, the Project will be managed under the 2022 BLM ROPs (BLM 2022).

The WOC will have at least two Class I UIC disposal wells; an existing UIC well at Alpine will provide backup, as needed.

3.2.2.3.10 Fuel and Chemical Storage

Fuel and other chemicals will primarily be stored at the WPF, with additional storage at drill sites. Diesel fuel will be stored in temporary tanks on-site during construction. During drilling and operations phases, the WPF will include a fuel supply storage tank(s) and fueling station, as well as a tank farm to store methanol, crude oil flowback, corrosion inhibitor, scale inhibitor, emulsion breaker, and various other chemicals as required. Jet fuel will be stored on the airstrip apron for helicopter use; jet fuel will be delivered to airplanes by fuel trucks supplied by storage tanks located at the WOC.

Drill sites will have temporary tanks to support drilling activity, including brine tanks, cuttings and mud tanks, and a drill rig diesel-fuel tank (built into the drill rig structure). Production storage tanks at drill sites will include chemical storage tanks that may contain corrosion inhibitor, methanol, scale inhibitor, emulsion breaker, anti-foam, and diesel fuel. Portable oil storage tanks to support well and pad activities and maintenance may be present on an as-needed basis.

Fuel and oil storage will comply with local, state, and federal oil pollution prevention requirements, according to the Oil Discharge Prevention and Contingency Plan (ODPCP) and Spill Prevention Control and Countermeasures Plan. Secondary containment for fuel and oil storage tanks will be sized as appropriate to the container type and according to governing regulatory requirements (18 AAC 75 and 40 CFR 112). Fuel and chemical storage for the Project will be managed under the 2022 BLM ROPs (BLM 2022).

3.2.2.4 Water Use

Freshwater will be required for domestic use at Project camps and for ice road and pad construction and maintenance. Freshwater will also be used for hydrostatic pipeline testing with specific volumes required varying based on pipeline diameter and segment length. Potable water estimates are based on a demand of 100 gallons per person per day.

Depending on ice road purpose and use, ice road widths will be 35 feet (11 m), 50 feet (15 m), 60 feet (18 m), or 70 feet (21 m); the volume of freshwater required to construct 1.0 mile (1.6 km) of these ice roads is approximately 1.0 MG, 1.4 MG, 2.5 MG, and 2.0 MG, respectively. (Note: the 60-foot-wide ice roads are heavy-haul ice roads that will be used to support sealift module delivery to the Project area.) Approximately 0.25 MG of freshwater is used to construct 1 acre of ice pad. (Note: multi-season ice pads are individually engineered based on geographic and seasonable variables; 0.25 MG of water per acre of multi-season ice pad is used as high-level estimate for multi-season ice pad construction.) Water for ice roads and pads will be withdrawn from lakes near the construction activities consistent with BLM ROP B-2 (BLM 2022), as allowed by Alaska Department of Natural Resources water rights and temporary water use authorizations; fish habitat permits from ADF&G will be obtained where necessary. Some water for construction of the Colville River crossing may come from the Colville River.

Freshwater will be required for domestic use at drill rig camps (100 gallons of potable water per person per day) and during drilling activities. Drilling water requirements are estimated to be 0.4 MG per rig per month for each of the two drill rigs. Prior to WPF startup, freshwater will be used for hydraulic fracturing. Hydraulic fracturing will require approximately 1.0 MG of water per well prior to WPF startup; after WPF startup, hydraulic fracturing will use seawater.

Freshwater for drilling may be withdrawn from lakes near the Project area using a temporary triplex pump and truck connection, as allowed by temporary water use authorization and fish habitat permits, where necessary.

The Project will use 1,735.9 MG of freshwater over the 30-year Project life. Table 4 provides a summary of freshwater consumption by Project phase and year and season.

Table 4. Summary of Freshwater Use by Project Phase and Year and Season (millions of gallons)

Year (Season)	Construction[a]	Drilling[b]	Operations[c]	Total
2020 Year 0 to Year 1 (winter)	72.3	0.0	0.0	**72.3**
Year 1 (summer)	1.1	0.0	0.0	**1.1**
Year 1 to Year 2 (winter)	127.4	0.0	0.0	**127.4**
Year 2 (summer)	3.2	0.0	0.0	**3.2**
Year 2 to Year 3 (winter)	238.3	0.0	0.0	**238.3**
Year 3 (summer)	10.3	0.0	0.0	**10.3**
Year 3 to Year 4 (winter)	327.6	15.5	0.0	**343.1**
Year 4 (summer)	13.3	31.0	0.0	**44.3**
Year 4 to Year 5 (winter)	238.9	31.9	0.0	**270.8**
Year 5 (summer)	20.7	32.8	0.9	**54.4**
Year 5 to Year 6 (winter)	31.7	8.8	1.8	**42.3**
Year 6 (summer)	3.1	8.8	4.3	**16.2**
Year 6 to Year 7 (winter)	217.5	8.8	3.2	**229.5**
Year 7 (summer)	1.9	8.8	5.1	**15.8**
Year 7 to Year 8 (winter)	19.7	6.8	4.1	**30.6**
Year 8 (summer)	2.2	4.8	5.1	**12.1**
Year 8 to Year 9 (winter)	0.2	4.8	4.1	**9.1**
Year 9 (summer)	0.0	4.8	5.1	**9.9**
Year 9 to Year 10 (winter)	0.0	4.8	4.1	**8.9**
Year 10 (summer)	0.0	4.8	5.1	**9.9**
Year 10 to Year 11 (winter)	0.0	2.4	4.1	**6.5**
Year 11 (summer)	0.0	0.0	5.1	**5.1**
Year 11 to Year 12+ (19 winters)	0.0	0.0	77.9	**77.9**
Year 12+ (19 summers)	0.0	0.0	96.9	**96.9**
Total	**1,329.4**	**179.6**	**226.9**	**1,735.9**

Note: "+" indicates annual use to the end of the Project life (Year 30) for operations.
[a] Construction phase will include ice road construction (1.0 million gallons [MG] per mile for 35-foot-wide road, 1.4 MG for 50-foot-wide road, 2.5 MG for 60-foot-wide heavy-haul road, and 2.0 MG per mile for 70-foot-wide road), ice pad construction (0.25 MG per acre), dust suppression, hydrostatic testing, and domestic camp supply (100 gallons per person per day).
[b] Drilling phase will include drilling water (0.4 MG per drill rig per month), hydraulic fracturing (1.0 MG per well prior to Willow Processing Facility startup), and domestic camp supply (100 gallons per person per day).
[c] Operations phase will include dust suppression and domestic camp supply (100 gallons per person per day).

During construction, seawater will be used for ballast water to support barge delivery to Oliktok Dock. After WPF startup, seawater will be used for hydraulic fracturing of production and injection wells, for drilling, and for reservoir injection to support enhanced oil recovery. Hydraulic fracturing is expected to require approximately 1.0 MG of seawater per well. Drilling is expected to require approximately 1.0 MG of seawater per drilling rig per month. Enhanced oil recovery will require approximately 2.1 to 3.8 MG of seawater per day beginning in Year 5.

3.2.2.5 Gravel Mine Sites

The Project will develop a project-specific gravel mine site in the Tiŋmiaqsiuġvik area to provide the approximately 4.45 million cubic yards of gravel needed to construct the Project in the Willow Project area. The new gravel source in the Tiŋmiaqsiuġvik area will be approximately 4 to 5 miles (6.4 to 8 km) southeast of the Greater Mooses Tooth 1 (GMT-1) development (Figure 1). Gravel resources west of the Colville River are not common; the Tiŋmiaqsiuġvik Mine Site is the closest identified gravel source to the Willow area. The mine site footprint will overlap the Ublutuoch (Tiŋmiaqsiuġvik) River 0.5-mile (0.8-km) setback (LS K-1 in BLM 2022). Gravel for road and pad upgrades to support the sealift module delivery within the Kuparuk area will come from existing mine sites located in Kuparuk.

Additional gravel fill (approximately 118,700 cubic yards) will be required to improve Oliktok Dock and along Oliktok Road to widen curves for transporting sealift modules. Gravel for these dock and road upgrades will be sourced from existing mine sites in the Kuparuk area (e.g., Mine Site C, Mine Site E), which are closer than the Tiŋmiaqsiuġvik Mine Site (Figure 1). Mine Site E and Mine Site C have undergone ESA consultation (USFWS 2015a, 2019a, 2020b) and are not assessed in this BA.

3.2.2.5.1 Tiŋmiaqsiuġvik Mine Site Description

Two mine site cells (Mine Site Area 1 will have an approximate excavation area of 90.5 acres, and Mine Site Area 2 will have an approximate excavation area of 28.9 acres) within the Tiŋmiaqsiuġvik area (located approximately 20 miles [32.1 km] from the WOC) were evaluated by CPAI for the potential to supply some or all of the gravel required to construct the Project. At this time, CPAI believes development of both mine site cells will be required to provide a sufficient quantity of gravel for the Project's construction. The gravel mine will be accessed seasonally via ice road; no permanent gravel road will be constructed to the mine site cells. Mining will occur over five winter construction seasons to support Project construction.

The mine site layout will be designed to maximize access to the most suitable construction materials while minimizing the horizontal disturbance to the surface (i.e., footprint). Removal of overburden and gravel mining will proceed as material is needed for construction. Mine site excavation will begin with the removal of overburden followed by the removal of suitable gravel material over five winter construction seasons to support an eight-year construction phase.

Mining disturbance will generally occur incrementally over the construction phase; however, early removal of overburden in the initial construction season may occur to facilitate gravel production in subsequent years. Overburden will be stockpiled on single-season ice pads after which it will be removed from the ice pad and placed in the excavated area to begin initial mine site rehabilitation. Overburden will not be stored on multi-season ice pads. In the following construction seasons, CPAI may conduct initial rehabilitation of previously mined areas using overburden removed from newly mined areas to minimize the overall disturbance footprint. The maximum final mine site excavation area will be approximately 119.4 acres.

To support gravel mining operations, a single 10-acre multi-season ice pad (Winter Year 1 through spring Year 3) and approximately 188 acres (total) of single-season ice pads will be constructed at the Tiŋmiaqsiuġvik mine site (127 acres at Mine Site Area 1 and 61 acres at Mine Site Area 2) (Figure 4). The ice pads may be used for the following:

- Storing gravel mining equipment over the summer
- Housing construction equipment
- Stockpiling organic overburden
- Stockpiling inorganic overburden1

[1] Pending additional mine site design and sequencing, over-summer storage of some organic and inorganic overburden on some portion of the 188 acres of seasonal ice pads may be required. Timing and specific acreage of ice pads for over-summering overburden will be determined through future engineering. Reclamation of areas affected by over-summer ice pads is addressed in the final mine site rehabilitation plan.

- Providing a mine-site perimeter

The overburden storage areas are sized to accommodate approximately one-third of the total anticipated overburden quantity generated from the mine and assume stockpile heights of 30 feet (9.1 m), side slopes of 3:1, and a material expansion factor of 30%. Following the second winter season of mining activities, the inorganic and organic overburden material will be removed from the seasonal ice pad and placed in the excavated area to begin mine site rehabilitation and to minimize the overall mine site footprint. Overburden stockpiling will only be needed for approximately 2 years of mine development. Mining disturbance will occur incrementally over the construction phase; for example, only those areas necessary to extract gravel for the first and second winter construction seasons will be disturbed during initial mining activities. In subsequent construction seasons, all overburden removed will be placed within the mine site excavation(s) to minimize the disturbance footprint and begin initial mine site rehabilitation. Pumping within the mine site pits will be necessary to maintain a lowered water level throughout mining operations. Pumped water will be discharged through a diffuser onto tundra close to the Ublutuoch (Tiŋmiaqsiuġvik) River, just upstream from the confluence with Bill's Creek, and/or to tundra close to Bill's Creek, just upstream from its confluence with the Ublutuoch (Tiŋmiaqsiuġvik) River.

Overburden material will be used to create berms (approximately 5-feet [1.5-m] tall and 15-feet [4.6-m] wide at the top) around the perimeter of each mine site area; the perimeter berms will be installed around the entire area to be mined rather than the portion of the mine to be actively mined in a particular season. Surface water flow into mine sites has historically caused accelerated thermal erosion and thaw degradation as the water flow channel cuts into thaw sensitive overburden and ice wedges. These perimeter berms will prevent surface water flow into the mine (minimizing the amount of dewatering necessary), help maintain the thermal stability of adjacent permafrost, safeguard the stability of the mine site walls during mine operation, and provide a safety feature for local residents. The perimeter berms will be fully constructed within the first season of mining at each site and will remain in place through the reclamation process.

3.2.2.5.2 Tiŋmiaqsiuġvik Mine Site Rehabilitation

When the mines sites are no longer needed as a gravel source, they will be rehabilitated and allowed to fill with water. The rehabilitated sites will include a deepwater area. Overburden material will be used in the finish grading of the mine. A Mine Site Rehabilitation Plan has been developed in coordination with the BLM.

Based on agency guidance and review of historical North Slope mine site rehabilitation efforts, the goal of mine site rehabilitation will be to protect and stabilize permafrost and adjacent tundra and create a deepwater area at the center of the rehabilitated mine site cells. Previous North Slope efforts to create shallow water habitat and littoral shelves have had a long history of limited success despite intensive effort and energy to provide specific habitat. Because the Tiŋmiaqsiuġvik Mine Site will not have an all-season gravel access road, relevant agencies agreed that mine site rehabilitation should focus on site stability versus engineered habitat features.

Rehabilitation efforts will begin once excavation has progressed enough to provide room for overburden placement within the excavated area. Once mine site rehabilitation begins, the perimeter berms will be incrementally expanded into thermal berms. The thermal berms will fill the mine excavation side slopes and tie into the perimeter berms, providing an additional thermal barrier to promote stability of the mine walls. Once the mine site reclamation efforts are complete, the mine site walls would have 3:1 slopes. The mine site cells will be allowed to naturally fill with water (e.g., precipitation, meltwater).

All overburden placement areas will be subject to thaw settlement. The degree of settlement is expected to be highly variable and difficult to predict or control, due to factors that include material gradation, overburden ice content, thermal exposure, and submerged depth. Settlement of overburden after initial placement along the mine site walls may result in limited shallow-water areas, which may develop into waterfowl or shorebird habitat, depending on the final water surface elevation and overburden thaw consolidation.

There will be no constructed hydraulic connection to the mine site from any adjacent stream; the construction of a stream connection channel would require a deep and wide excavation through existing tundra, which could lead to additional thaw degradation. Mine site recharge is expected to occur naturally via precipitation and collection of meltwater from snow drifts within the mine area. Full mine site recharge is expected to take one decade or longer. Plant cultivation treatments will only use seeds or live materials from indigenous plant species that have been collected from local populations. In August or September of the third growing season after mining is complete, the perimeter berms will be seeded with suitable indigenous species based on the moisture regime; this 3-year waiting period is intended to allow time for the residual overburden to stabilize and allow for a preliminary assessment to be completed prior to seeding. Revegetation species will likely include water sedge (*Carex aquatilis*) and tall cottongrass (*Eriophorum angustifolium*) for wet areas, entire-leaf mountain avens (*Dryas integrifolia*) and willow (*Salix* spp.) for moist areas, and river beauty (*Epilobium latifolium*) for dry areas. Additionally, locally collected plugs of aquatic emergent grass pendant grass (*Arctophila fulva*) may be transplanted in areas that become permanently flooded.

The maximum depth is expected to be approximately 70 feet (21.3 m), with most being greater than 30 feet (9.1 m) in depth. No plant cultivation treatments will occur in deepwater areas because they are expected to be too deep to support rooted vegetation.

Summer access to the mine site will occur by helicopter. Following the completion of mining activity and rehabilitation efforts, all equipment and waste materials will be removed. Waste materials will be taken to a permitted disposal location. CPAI will continue to monitor the mine site rehabilitation for 2 years after rehabilitation activities are completed and until the site has filled with water to the desired elevation for erosion and thermal degradation.

3.2.2.6 Erosion Control

The Project will follow a Facilities Erosion Control Plan, which will outline procedures for operation, monitoring, and maintenance of various erosion control methods. The Facilities Erosion Control Plan will contain Project snow removal and dust control measures. Snow removal plans will include the use of snow-blowing equipment to minimize gravel carryover to the tundra and the placement of cleared snow in designated areas. Snow push areas will be determined annually, based on avoiding areas of thermokarst, proximity to waterbodies, and evaluating how the area looks based on the previous years' activities. The Willow Dust Control Plan (CPAI 2020) includes gravel road watering guidelines to minimize dust impacts to tundra. A Stormwater Pollution Prevention Plan will describe management of surface water drainage for the Project pads.

3.2.2.7 Access to the Project Area

Access to the Willow area from Alpine, Kuparuk, or Deadhorse will occur via ground transportation over ice roads, or by fixed-wing aircraft or helicopter. Access from Alpine will also include travel over existing gravel roads. The large modules comprising the processing facilities at the WPF and drill sites will be delivered to the North Slope by sealift barge. Barge off-loading will be at the existing Oliktok Dock. Sealift modules will be staged at an existing gravel pad near Oliktok Point until the following winter, and they will then be transported to the Willow area via existing gravel and task-specific ice road.

3.2.2.7.1 Ice Roads

Ice roads will be used during Project construction to support gravel placement and pipeline construction, for lake access, and to access the Tiŋmiaqsiuġvik gravel mine site. Separate ice roads will be used for pipeline construction, gravel placement, and general traffic to address safety considerations. Ice road construction typically begins in November or December, with vehicle access via ice road depending on the ice road season opening and closing dates and the distance from existing infrastructure. The usable ice road season for the Project is expected to be shorter than that of the Kuparuk and Alpine operations due to the logistical challenges of constructing a remote ice road. (Alpine Resupply Ice Road can be constructed from either end, which takes less time.) The Project's usable ice road season is expected to be 90 days (approximately January 25 through April 25). Typical ice roads will be at least 6 inches (15.2 centimeters) thick with a 35- to 70-foot-wide (10.7- to 21.3-m-wide) surface, depending on its use (e.g., general traffic, pipeline construction). A typical gravel hauling ice road will have a 50-foot-wide (15.2-m-wide) surface; ice roads required for sealift module hauling will be 60-foot-wide (18.3-m-wide) surface. (Note: all ice road routes presented in the Willow MDP Supplemental EIS and BA are estimations; final alignments will be determined through optimization and impact minimization prior to the start of Project construction.) Table 5 summarizes Project ice road use.

Table 5. Summary of Project Ice Roads by Year

Year	Ice Road Length (miles)	Ice Road Area (acres)
Year 1	32.6	181.4
Year 2	42.0	338.9
Year 3	98.1	743.0
Year 4	146.9	1,051.1
Year 5	87.6	694.6
Year 6	12.6	106.9
Year 7	83.7	566.5
Year 8	7.9	67.0
Year 9	0.0	0.0
Year 10 – Year 30	0.0	0.0
Total	**511.4**	**3,749.4**

During the Project's drilling and operations phases, the Project will use the annual Alpine Resupply Ice Road to support equipment moves and Project resupply. As this ice road is constructed annually to support the Alpine development, this ice road is not considered in the analysis of the Willow MDP Supplemental EIS or BA.

Following the end of the ice road season, all ice road stream crossings will be breached or slotted, and ice built up artificially at crossings (e.g., ice or snow ramps) will be removed to match the static water elevation. Following spring breakup, work crews will pick up litter (known as stick picking) to remove any anthropogenic materials.

3.2.2.7.2 Gravel Roads

All-season gravel roads (30.3 total miles) will connect Project drill sites to the WPF and to the existing gravel roads associated with the GMT and Alpine developments. Gravel roads will be designed to maintain the existing thermal regime and will be a minimum of 5 feet (1.5 m) thick (average of 7 feet [2.1 m] thick due to topography) and have 2:1 side slopes. Road widths will vary by road purpose or type and location as follows:

- Roads to the water source access pads, airstrip, and boat ramps will be 24 feet (7.3 m) wide at the surface with an average toe-to-toe width of approximately 53 feet (16.2 m).
- Roads to BT3 and B5 will be 24 feet (7.3 m) wide at the surface with an average toe-to-toe width of approximately 53 feet (16.2 m).
- The access road from GMT-2 to the Project area will be 32 feet (9.8 m) wide at the surface with an average toe-to-toe width of approximately 61 feet (18.6 m).
- Roads to BT1 and BT2 will be 32 feet (9.8 m) wide at the surface with an average toe-to-toe width of approximately 61 feet (18.6 m).

Roads will include subsistence tundra access ramps located at roadway pullouts; the location of these ramps will be based on community input, but they will generally be placed every 2.5 to 3.0 miles (4.0 to 4.8 km). These ramps will allow community members to access the area for subsistence use.

When possible, roads will be constructed at least 500 feet (152 m) from pipelines to minimize caribou (*Rangifer tarandus*) disturbance and prevent excessive snow accumulation from snowdrifts, but no more than 1,000 feet (305 m) from roads to aid in visual pipeline inspection from the road. There are additional mitigation measures for wildlife, including caribou, which give wildlife the right-of-way near roads. These are described in CPAI's Willow Project Vehicle Traffic Plan.

3.2.2.7.2.1 Bridges

Bridges will be designed to maintain a bottom chord clearance of 4 feet (1.2 m) above the 100-year design-flood elevation or at least 3 feet (0.9 m) above the highest documented flood elevation, whichever is higher. Additionally, the Judy (Iqalliqpik) Creek and Fish (Uvlutuuq) Creek bridges will be designed to maintain bottom chord clearance of at least 13 feet (4.0 m) above the 2-year open-water design flood elevation to provide vessel clearance. Water surface elevations will be analyzed considering snow and ice impacts as well as open water. Design analysis will be based on observations and measurements and modeled conditions (e.g., ice or snow affects), and will vary from stream to stream based on site-specific conditions.

Shorter, single-span bridges will be designed, where practicable, to avoid the placement of piers in main channels. Each bridge will be designed to accommodate drill rig movement (i.e., 32 feet wide [9.8 m], removable guardrails). Multi-span bridges will be constructed on steel-pile pier groups placed approximately 40 to 70 feet (12.2 to 21.3 m) apart, with sheet-pile abutments located above ordinary high water at each end of the bridge. Bridges will range from 40 to 420 feet (12.2 to 128.0 m) in length.

3.2.2.7.2.2 Culverts

Culverts will be designed, constructed, and maintained to ensure fish passage and stream flow. Culverts will be placed in roads to maintain natural surface drainage patterns; culverts at stream or swale crossings will be placed perpendicular to the road, where feasible. Culvert size, design, and layout will be determined based on site-specific conditions to pass the 50-year flood event with a headwater elevation not exceeding the top of the culvert (headwater: diameter of 1 or less). Typical culverts will be steel pipe pile. Culverts will extend approximately 2 feet past the toe of the slope and have a minimum 3 feet (0.9 m) of covers (dependent on pipe material, wall size, and loading), or slightly less in insulated sections. Neighboring culverts will be spaced a minimum of 3 feet (0.9 m) between outer walls to provide for proper gravel compaction and load distribution.

Fish-passage culverts will be placed where required (as designated by the ADF&G). Preliminary cross-drainage culvert locations will be based on aerial imagery; final culvert design, number, and locations will be determined based on field conditions noted by direct observation. The estimated spacing of cross-drainage culverts is one every 1,000 feet (305 m); 160 cross-drainage culverts are estimated for the Project. Fish passage culverts will be designed with at least one of the culverts in the battery having the invert embedded 20% below grade, situated in the deepest part of the stream channel. Fish passage culverts will be backfilled to match existing grade (20% of culvert diameter) to provide conditions similar to a stream bed within the culvert. Fish passage culverts will be either corrugated steel plate or steel pipe pile. Baffles may be added on a site-specific basis and in consultation with permitting agencies.

Culverts will be installed per the final design prior to breakup during the first construction season; however, additional culverts may be placed after breakup as site-specific needs are further assessed with regulatory agencies.

3.2.2.7.2.3 Boat Ramps

CPAI will construct up to three boat ramps to support local subsistence use as part of its mitigation efforts. A boat ramp will be constructed to provide access to the Ublutuoch (Tiŋmiaqsiuġvik) River (along the gravel road between Alpine CD5 and GMT-1), and up to two additional boat ramps providing access to Judy (Iqalliqpik) Creek and Fish (Uvlutuuq) Creek may be constructed (a final decision depends on community input) (Figure 4). Boat ramps accessing Judy (Iqalliqpik) and Fish (Uvlutuuq) creeks would use short access roads connecting to Project gravel roads.

Based on preliminary design, the boat ramps will be approximately 375-feet (114-m) long and each will include a pad with space for vehicles to turnaround and provide parking for approximately 10 trucks with trailers. The ramp footprint will vary by location and terrain but will be approximately 1.2 acres. The acreage below ordinary high water is estimated to be 0.4 acre. The boat ramps will be accessed via a short gravel road with a surface width of 24 feet (7.3 m) and a total gravel footprint of 2.5 acres. The total gravel footprint will be approximately 1.8 to 2.1 acres per boat ramp for a total of 5.9 acres for all three ramps; each ramp will require approximately 20,000 cubic yards of gravel to construct (approximately 61,000 cubic yards total). The Ublutuoch (Tiŋmiaqsiuġvik) River boat ramp would be constructed during the first year of Project construction and the boat ramps at Judy (Iqalliqpik) Creek and Fish (Uvlutuuq) Creek would be constructed within 2 years of constructing the BT1 and BT2 access roads, respectively, after site visits and input from local stakeholders. Pile driving is not anticipated as being required to construct the boat ramps. The boat ramp will be designed and constructed to avoid impacts on the movement of fish and fish habitat in consultation with BLM and ADF&G. The need for erosion control will be evaluated through additional community input during the final design process.

3.2.2.7.3 Airstrip and Associated Facilities

Year-round access to the Project area from Alpine, Kuparuk, Deadhorse, or other locations will be provided by aircraft. Aircraft will support the transportation of work crews, materials, and equipment to and from the Project. Air access will be supported by a 5,700-foot-long (1,737-m-long) × 200-foot-wide (61-m-wide) gravel airstrip located near the WOC. The airstrip location is constrained by several factors to ensure the safety of aircraft taking off and landing at the airstrip, including adequate clearance around structures. The airstrip will be capable of supporting Hercules C-130, DC-6, Otter, CASA, and Bombardier Q400 aircraft, or similar. Additional airstrip facilities will include an air traffic advisory center and approach lighting with airstrip module lighting pads. Trenching may be required to bury power and communications cables between the WOC and airstrip, and along the airstrip between modules and lighting components.

Aircraft will maintain minimum altitudes consistent with ROP F-1 (BLM 2022), except during takeoffs and landings or when doing so could endanger human life or violate safe flying practices. Aircraft flight paths will be routed to avoid the airspace above Nuiqsut to the extent practicable.

Fueling and chemical deicing of aircraft are planned on the airstrip apron; chemical deicing of the runway is not anticipated. The airstrip and associated facilities are approximately 19 miles (30.6 km) from the coast.

Helicopters will be used to support Project construction, ongoing environmental studies, ice road permit compliance, and to a lesser extent, drilling and operations. Helicopter support for future exploration, including exploration wellhead inspections and debris cleanup (i.e., stick picking or litter clean-up) from winter exploration activities is not part of the Project.

3.2.2.7.4 Barge Delivery

Barges will be used to deliver large sealift modules (anticipated to weigh up to 4,000 tons [3,630 metric tons]) for the WPF and drill sites, as well as other bulk construction materials (e.g., pipe, VSMs) to the North Slope. Transit routes to Oliktok Dock will follow existing marine transportation routes (Figure 3). Bulk materials weighing less than 550 tons will be transferred to the Project area via the annual Alpine Resupply Ice Road; large sealift modules will be transported to the Project area over existing Kuparuk gravel roads and task-specific ice roads (Section 3.2.2.7.1, *Ice Roads*).

Barges will make deliveries to Oliktok Dock during four open-water seasons; no regular use of barges is planned during the Project's drilling and operations phases. Barges will make deliveries in the summers of Year 2, Year 3, Year 4, and Year 6 (for a total of 4 years). After delivery by barge to Oliktok Dock, bulk materials and modules will be stored on an existing 12-acre gravel pad approximately 2 miles south of Oliktok Dock. The following winter, the materials will be transported to the Project area. Barge traffic is detailed in Section 3.2.2.7.5, *Traffic*.

3.2.2.7.4.1 Barge Lightering and Screeding

To facilitate module and materials delivery, CPAI will use a 9.6-acre offshore barge lightering[2] area in water approximately 10 feet (3.0 m) deep and 2.3 nautical miles (4.3 km) from Oliktok Dock (Figure 3). During lightering, the barges will be grounded on the seafloor, which will require screeding (i.e., redistributing and contouring of the existing marine sediments) of the lightering area. Screeding is typically accomplished by dragging a metal plate fixed to a screed barge to move the sediments in a leveling operation. The amount of material moved is generally small and localized; no sediments will be removed from the water, and no new fill material will be added. A backhoe may be used to assist where required; however, the bucket will not be raised above the water surface during the operation.

Following the barge grounding and cargo transfer to the lightering barge, the lightering barge will be grounded in front of Oliktok Dock for offload. To prevent pressure points on the barge hull during the grounding, approximately 2.5 acres of marine area in front of Oliktok Dock will also be screeded prior to the first barge delivery each year.

Screeding will occur each barge delivery year (Year 2, Year 3, Year 4, and Year 6) in the summer shortly before the barges arrive and will take approximately 1 week to complete. The bathymetry of the screeding area will be measured each year to confirm the seafloor surface is acceptable to the barge operator.

3.2.2.7.5 Traffic

Anticipated Project traffic (ground, air, and vessel) is summarized in Tables 6, 7, and 8. Table 6 describes traffic for the Project by year; Table 7 estimates onshore traffic projections by hour and day; and Table 8 details traffic by month and year. There will be an estimated total of 12,053 fixed-wing flights, 2,437 helicopter flights, and 30 barge trips to support the Project over its 30-year life.

[2] Lightering is the process of transferring cargo between vessels to reduce a vessel's draft, allowing it to enter shallower waters found at some docks or ports. The water depth at Oliktok Dock is approximately 8 feet, which is too shallow to accommodate the draft depth of a fully loaded sealift barge. As a result, a portion of the load on each barge willbe lightered onto an empty barge to allow for transport to the dock.

Table 6. Summary of Project Traffic by Type and Year

Year	Ground[a]	Fixed-Wing to/from Alpine[b,c]	Fixed-Wing to/from Willow[c]	Fixed-Wing to/from Kuparuk[b,c]	Helicopter to/from Alpine[b,d]	Helicopter to/from Willow[d]	Barges between Dutch Harbor and Oliktok Dock[e]	Tugboats between Dutch Harbor and Oliktok Dock[f]	Support Vessels between Oliktok Dock and Lightering Area[g]
Year 0	0	0	0	0	25	0	0	0	0
Year 1	55,300	0	60	0	50	0	0	0	0
Year 2	136,425	0	121	31	25	25	6	9	66
Year 3	285,969	6	75	167	0	82	8	12	88
Year 4	369,094	4	35	743	0	82	13	20	106
Year 5	648,055	14	14	700	8	82	0	0	0
Year 6	256,136	4	0	733	0	82	3	9	25
Year 7	452,842	14	14	722	8	82	0	0	0
Year 8	159,538	0	0	625	0	82	0	0	0
Year 9	113,327	0	0	452	0	82	0	0	0
Year 10	114,240	0	0	456	0	82	0	0	0
Year 11 to Year 30	1,090,112	0	0	7,063	0	1,640	0	0	0
Total	**3,681,039**	**42**	**320**	**11,691**	**116**	**2,321**	**30**	**50**	**285**

Note: Ground trips are defined as one-way; a single fixed-wing or helicopter flight is defined as a landing and subsequent takeoff; a single vessel trip is defined as a docking and subsequent departure.

[a] Includes buses, light commercial trucks, short-haul trucks, passenger trucks, and other miscellaneous vehicles. Ground transportation also includes gravel hauling operations (i.e., B70/maxi dump trucks).

[b] Only includes flights to support Willow Project.

[c] Fixed-wing aircraft includes C-130, DC-6, Twin Otter/CASA, Q400, Cessna, or similar.

[d] Typical helicopters include A-Star and 206 Long Ranger models, though other similar types of helicopters. Helicopter use includes support for Project ice roads, pre-staged boom deployment, hydrology and other environmental studies, and agency inspection during all phases of Project development. Helicopter flights in Year 0 will occur in the fourth quarter and will support the start of Project construction in first quarter of Year 1.

[e] Includes sealift barges for all modules and bulk materials.

[f] Includes tugboats accompanying sealift barges.

[g] Includes crew boats, screeding barge, and other support vessels.

Table 7. Estimated Onshore Project Detailed Traffic Rates

Traffic Type	Number of Trips – High End of Range	Number of Trips – Low End of Range
Ground traffic total trips	**3,681,039 (total)**	**NA**
Vehicles per hour Year 1through Year 10[a] (winter)	150.1	11.4
Vehicles per hour Year 1through Year 10[a] (spring)	104.2	7.6
Vehicles per hour Year 1 through Year 10[a] (summer)	14.3	3.8
Vehicles per hour Year 1 through Year 10[a] (fall)	12.0	1.2
Vehicles per hour Year 11 through Year 30[b] (winter)	9.4	NA
Vehicles per hour Year 11 through Year 30[b] (spring)	7.4	NA
Vehicles per hour Year 11 through Year 30[b] (summer)	3.7	NA
Vehicles per hour Year 11 through Year 30[b] (fall)	3.7	NA
Fixed-wing total trips to/from Willow	**11,691 (total)**	**NA**
Landings per day Year 2 through Year 10[a] (winter)	4.0	0.2
Landings per day Year 2 through Year 10[a] (spring)	2.8	0.1
Landings per day Year 2 through Year 10[a] (summer)	0.9	<0.1
Landings per day Year 2 through Year 10[a] (fall)	0.8	<0.1
Landings per day Year 11 through Year 30[b] (winter)	1.5	NA
Landings per day Year 11 through Year 30[b] (spring)	1.2	NA
Landings per day Year 11 through Year 30[b] (summer)	0.6	NA
Landings per day Year 11 through Year 30[b] (fall)	0.6	NA
Fixed-wing total trips to/from Alpine	**320 (total)**	**NA**
Landings per day Year 1 through Year 7[a, c, d] (winter)	0.7	0.1
Landings per day Year 1 through Year 7[a, c, d] (spring)	0.5	0.1
Landings per day Year 1 through Year 7[a, c, d] (summer)	0.1	<0.1
Landings per day Year 1 through Year 7[a, c, d] (fall)	<0.1	<0.1
Fixed-wing total trips to/from Kuparuk	**42 (total)**	**NA**
Landings per day Year 3 through Year 7[a] (winter)	0.1	0.1
Landings per day Year 3 through Year 7[a] (spring)	0.1	0.1
Landings per day Year 3 through Year 7[a] (summer)	<0.1	<0.1
Landings per day Year 3 through Year 7[a] (fall)	0.0	0.0
Helicopter total trips to/from Willow	**2,321 (total)**	**NA**
Landings per day Year 2 through Year 10[a] (winter)	0.0	0.0
Landings per day Year 2 through Year 10[a] (spring)	0.4	0.4
Landings per day Year 2 through Year 10[a] (summer)	0.5	0.2
Landings per day Year 2 through Year 10[a] (fall)	0.0	0.0
Landings per day Year 11 through Year 30[b] (winter)	0.0	NA
Landings per day Year 11 through Year 30[b] (spring)	0.4	NA
Landings per day Year 11 through Year 30[b] (summer)	0.5	NA
Landings per day Year 11 through Year 30[b] (fall)	0.0	NA

Traffic Type	Number of Trips – High End of Range	Number of Trips – Low End of Range
Helicopter total trips to/from Alpine	**116 (total)**	**NA**
Landings per day Year 0 through Year 10[a] (winter)	0.0	0.0
Landings per day Year 0 through Year 10[a] (spring)	0.4	0.2
Landings per day Year 0 through Year 10[a] (summer)	0.3	0.1
Landings per day Year 0 through Year 10[a] (fall)	0.4	0.0

Note: NA (not applicable, no range for this value); < (less than). Trips are one way. A single flight is a landing and subsequent takeoff; a single vessel trip is a docking and subsequent departure. Per-hour values assume traffic will be equally distributed over 24-hour periods for the provided time range; per-day values assume traffic will be equally distributed for each day of the year or month. Seasons are defined as: Summer (June, July, August, September); Fall (October, November); Winter (December, January, February, March); and Spring (April, May). Totals may not match other total traffic values due to rounding. Because traffic rates vary by year, the range of values (high and low) over different Project phases are presented; zero value years are excluded from the minimum value for the given range.

[a] Time period covers Willow Project construction and includes concurrent well drilling and 3 years of Project operations (i.e., production at the Willow processing facility).

[b] Time period covers the operations phase of the Project following Project construction and drilling efforts.

[c] Alpine airstrip will not be used by the Willow Project in Year 6.

[d] No fixed wing flights to Alpine or Kuparuk after Year 7, once the Willow airstrip is operational.

Table 8. Detailed Onshore Project Traffic by Season

Season[a] and Year	Ground[b]	Fixed-Wing to/from Alpine[c,d]	Fixed-Wing to/from Willow[d]	Fixed-Wing to/from Kuparuk[c,d]	Helicopter to/from Alpine[c,e]	Helicopter to/from Willow[e]
Fall Year 0	0	0	0	0	25	0
Winter Year 1	33,180	36	0	0	0	0
Spring Year 1	11,060	12	0	0	12	0
Summer Year 1	11,060	12	0	0	38	0
Fall Year 1	0	0	0	0	0	0
Winter Year 2	92,126	82	21	0	0	0
Spring Year 2	31,554	28	7	0	25	0
Summer Year 2	11,055	10	2	0	0	25
Fall Year 2	1,690	2	0	0	0	0
Winter Year 3	190,285	51	113	0	0	0
Spring Year 3	64,885	17	39	0	0	25
Summer Year 3	27,321	6	14	6	0	57
Fall Year 3	3,478	1	2	0	0	0
Winter Year 4	239,564	23	482	0	0	0
Spring Year 4	83,863	8	169	0	0	25
Summer Year 4	36,492	3	73	4	0	57
Fall Year 4	9,176	1	19	0	0	0
Winter Year 5	435,966	9	434	9	0	0
Spring Year 5	152,570	5	158	5	0	25
Summer Year 5	41,978	0	77	0	8	57
Fall Year 5	17,541	0	32	0	0	0
Winter Year 6	150,105	0	426	0	0	0
Spring Year 6	54,487	0	158	0	0	25
Summer Year 6	36,794	0	106	4	0	57
Fall Year 6	14,750	0	43	0	0	0
Winter Year 7	307,146	9	414	9	0	0
Spring Year 7	105,931	5	154	5	0	25
Summer Year 7	27,750	0	108	0	8	57
Fall Year 7	12,016	0	47	0	0	0
Winter Year 8	93,935	0	368	0	0	0
Spring Year 8	34,118	0	134	0	0	25
Summer Year 8	21,886	0	86	0	0	57
Fall Year 8	9,599	0	38	0	0	0
Winter Year 9	56,207	0	224	0	0	0
Spring Year 9	22,848	0	91	0	0	25
Summer Year 9	22,848	0	91	0	0	57
Fall Year 9	11,424	0	46	0	0	0
Winter Year 10	57,120	0	228	0	0	0
Spring Year 10	22,848	0	91	0	0	25
Summer Year 10	22,848	0	91	0	0	57
Fall Year 10	11,424	0	46	0	0	0
Winter Year 11-Year 30[f]	547,912	0	3,543	0	0	0
Spring Year 11-Year 30	216,880	0	1,408	0	0	500
Summer Year 11-Year 30	216,880	0	1,408	0	0	1,140
Fall Year 11-Year 30	108,440	0	704	0	0	0
Total[g]	**3,681,039**	**320**	**11,691**	**42**	**116**	**2,321**

Note: Ground trips are defined as one-way; a single fixed-wing or helicopter flight is defined as a landing and subsequent takeoff; a single vessel trip is defined as a docking and subsequent departure.

[a] Seasons are defined as: Summer (June, July, August, September); Fall (October, November); Winter (December, January, February, March); and Spring (April, May).

[b] Includes buses, light commercial trucks, short-haul trucks, passenger trucks, and other miscellaneous vehicles. Ground transportation also includes gravel hauling operations (i.e., B70/maxi dump trucks).
[c] Only includes flights to support Willow Project.
[d] Fixed-wing aircraft includes C-130, DC-6, Twin Otter/CASA, Q400, Cessna, or similar.
[e] Typical helicopters include A-Star and 206 Long Ranger models, though other similar types of helicopters may be used to support the Project. Includes support for Project ice roads, pre-staged boom deployment, hydrology and other environmental studies, and agency inspection during all phases of the Willow Project. Helicopter flights in Year 0 will occur in the fourth quarter and will support the start of project construction in first quarter of Year 1.
[f] Includes December Year 10.
[g] Totals may not match other total traffic values due to rounding.

3.2.2.8 Oliktok Dock and Other Improvements or Modifications to Existing Infrastructure

Oliktok Dock was originally constructed in the early 1980s and has supported North Slope activity in the area continuously since its establishment. To accommodate the 25-foot-high (7.6-m-high) side-shell sealift barges the Project will use, CPAI will need to raise the existing dock surface approximately 6 feet (1.8 m) by adding structural components, including two new 50-ton bollards at the dock face, and a gravel ramp. All modifications to the dock will be within the existing footprint.

After delivery to Oliktok Dock, the sealift modules will be moved to and stored on the existing 12.0-acre pad located approximately 2 miles south of the dock. The staging area pad is currently approximately 3 to 4 feet (0.9 to 1.2 m) thick. In the area where the modules will be stored, the pad will be improved with new gravel to bring the minimum thickness up to 5 feet (1.5 m). Rig mats will be installed on the surface to provide further structural support for module storage. No changes will be made to the existing pad footprint. Modules will be skirted until they are transferred in winter to prevent drifting snow from piling up beneath them.

The 2-mile-long (3.2-km-long) gravel road from Oliktok Dock to the staging area pad averages approximately 3 feet (0.9 m) thick and will be modified to at least 5 feet (1.5 m) thick to support the summer transfer of the sealift modules to this location. This improvement will require 40,300 cubic yards of gravel and will increase the road footprint by less than 0.1 acre. An estimated 12 culverts will be extended within this roadway segment to accommodate the thicker road section.

The sealift modules will be transferred from the staging area pad to a temporary ice pad near DS2P during the winter using existing gravel roads and will not require additional gravel thickness to support the loads. However, CPAI has identified some curves that will need to be widened to accommodate the turning radius of the 200-foot-long (61.0-m-long) self-propelled module transporters (SPMTs). Approximately 5.0 acres of additional gravel fill will be placed along the existing gravel road to widen the identified curves within the Kuparuk area. Culverts will be extended as needed. This gravel fill will be placed during summer using material acquired from an existing Kuparuk mine site (e.g., Mine Site C or Mine Site E).

Other materials delivered by barge (i.e., not sealift modules) will also be stored on the existing 12.0-acre gravel pad approximately 2 miles south of Oliktok Dock and transported to the Willow area in the winter over existing Kuparuk gravel roads and the existing annual Alpine Resupply Ice Road.

3.2.2.9 Module Transport Ice Road and Colville River Crossing

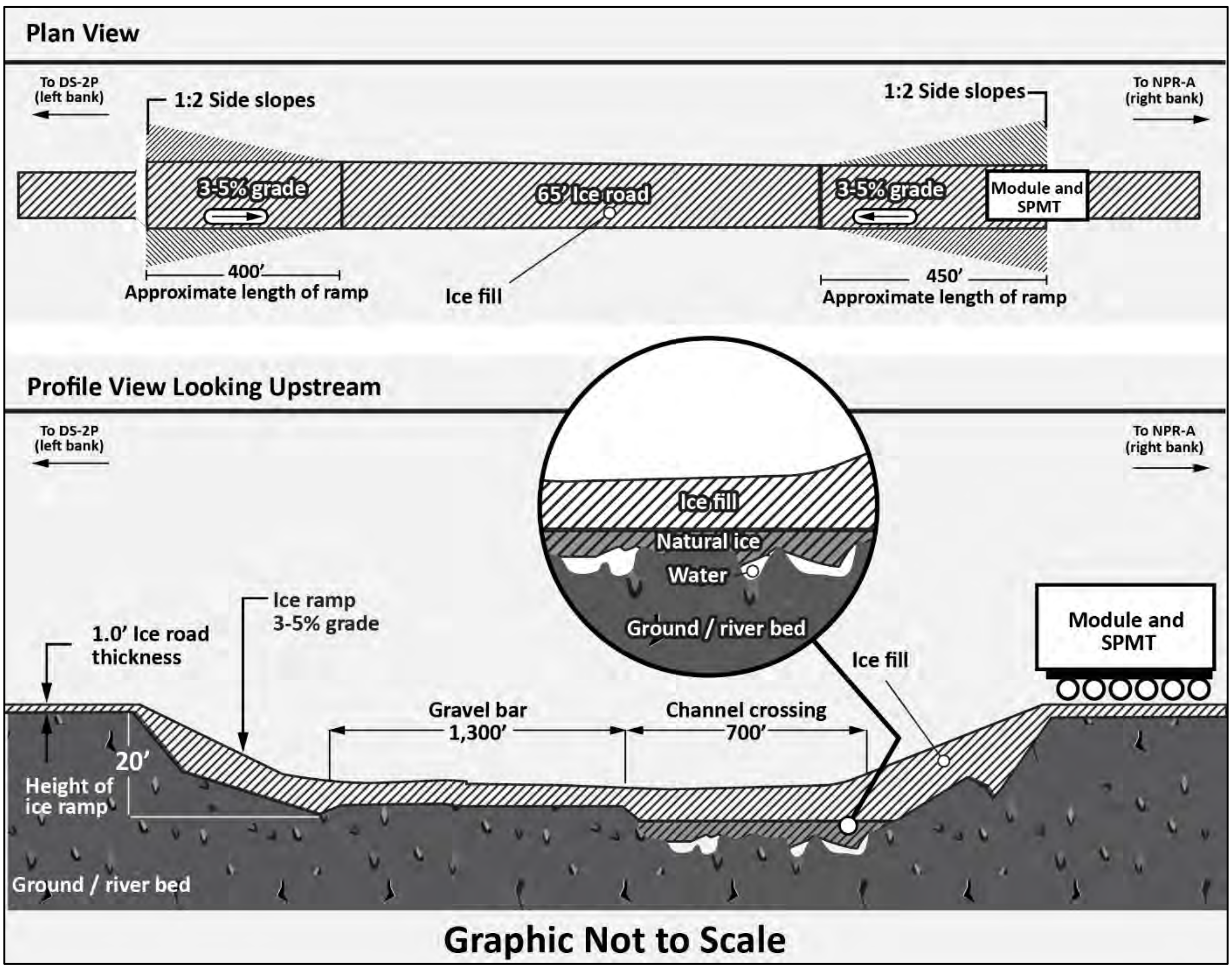
In the January following each sealift module delivery, the modules will be transported using SPMTs from the staging pad near Oliktok Dock along existing gravel roads to a temporary staging ice pad near DS2P (Figure 1). The modules will then travel on a heavy-haul ice road to GMT-2, crossing the Colville River on a grounded ice bridge near Ocean Point (Figure 1). From GMT-2 to the WPF, modules will be transported over the Project gravel access road.

The Colville River crossing location near Ocean Point was selected based on engineering factors, including the following:

- Maximum allowable ice road grades for SPMT travel
- Assumed SPMT dimensions of 27 feet wide × 200 feet long (8.2 m wide × 61.0 m long)
- Suitable Colville River crossing location (as described below)

The 60-foot-wide (18.3-m-wide), 40.1-mile-long (64.5-km-long) heavy-haul ice road for module transport will be constructed from both the east and west ends at DS2P and GMT-2, respectively. The two segments will meet at the Colville River crossing near Ocean Point where an engineered ice crossing will be constructed to provide sufficient load-carrying capacity to support the sealift modules and SPMTs. The grounded-ice[3] crossing (Figure 5) will be approximately 1 river mile downstream (south) of Ocean Point (as defined on U.S. Geological Survey topographic quadrangle A3 – Harrison Bay). The specific crossing location was selected based on favorable conditions for hydrology, topography, and bathymetry. The crossing location was also sited far enough upstream from the Colville River Delta (CRD) to minimize potential impacts to fish passage.

The Colville River ice crossing will be approximately 2,800 feet (853 m) long from top of bank to top of bank (approximately 700 feet (215 m) long from edge of water to edge of water), and 65 feet (20 m) wide at the travel surface. The approach and departure ramps at the riverbanks may be wider depending on the amount of fill ice required to construct them. The total ice thickness of the ramp and crossing will range up to 7.1 feet (2.2 m) from the river bottom (natural ice thickness in this area varies and was 0.5 to 6.2 feet (0.2 to 1.9 m) thick in April 2019).



Source: CPAI 2019

[3] For the purposes of this BA, "grounded ice" refers to an ice crossing the river channel that is primarily frozen fast to the riverbed. However, it is anticipated there will be some pockets of free water present that are narrower than the length of the SPMT, which therefore will bear minimal load from the module and SPMT.

Figure 5. Colville River Ice Crossing at Ocean Point

3.2.3 Spill Prevention and Response

Facilities will be designed to mitigate spills with spill prevention measures and spill response capabilities. Spill prevention and response measures to be used during construction, drilling, and operations will be outlined in a Project ODPCP and Spill Prevention Control and Countermeasures Plan, consistent with NPR-A ROP A-3 (BLM 2022). CPAI will implement a pipeline maintenance and inspection program and an employee spill-prevention training program to further reduce the likelihood of spills. Production facility design will include provisions for secondary containment for hydrocarbon-based and hazardous materials. If a spill occurs on a pad, the fluid will remain on the pad, unless the spill is near the pad edge or exceeds the retention capacity of the pad. Fuel transfers near pad edges will be limited to the extent practicable to mitigate this risk.

3.2.3.1 Spill Prevention

CPAI will design and construct pipelines to comply with state, federal, and local regulations. Pipelines will be constructed of high-strength steel and will have wall thicknesses in compliance with or exceeding regulatory requirements. Pipeline welds will be validated using nondestructive testing (e.g., radiography, ultrasonic) during pipeline construction to ensure their integrity, and the pipelines will be hydrostatically tested prior to operation. The production fluids, water injection, seawater, and export pipelines will fully accommodate pigs for cleaning and corrosion inspection.

CPAI will use two methods of leak detection for the seawater and diesel pipeline crossings under the Colville River:

1. Leak detect mass balance (primary)
2. Optical leak detection (secondary within the pipeline carrier casing)

To further minimize the risk of a pipeline leak under the Colville River, the diesel and seawater pipelines will be installed inside high-strength casing pipes. The simultaneous failure of both a pipeline and the casing is highly unlikely. If fluids leak from the pipelines, they will be captured within the space between the outer wall of the pipelines and the inner walls of the casing rather than reaching the subsurface river environment. To prevent external corrosion, the casing pipes and pipeline will be protected by an abrasion-resistant coating, in accordance with industry standards.

CPAI will maintain a corrosion control and inspection program that includes ultrasonic inspection, radiographic inspection, coupon monitoring, metal loss detection and geometry pigs, and infrared technology. The inspection programs are American Petroleum Institute Standard 570-based programs that focus inspection efforts on areas with the greatest spill potential.

3.2.3.2 Spill Response

The Project's ODPCP will demonstrate readily accessible inventories of fit-for-purpose oil spill response equipment, and personnel will be available at Project facilities. In addition, a state-registered primary response action contractor will provide trained personnel to manage spill response(s).

Threats to rivers and streams from a possible pipeline spill will be minimized by quickly intercepting, containing, and recovering spilled oil near the waterway crossing point once detected. Valves will be installed on each side of pipeline crossings at Fish (Uvlutuuq) Creek and Judy (Iqalliqpik) Creek, which will isolate produced fluids pipelines on either side of the creeks to minimize the potential spill impact in the event of a pipeline leak or break. Spill response equipment will be pre-staged at strategic locations across the Project area for rapid deployment, as outlined in the Project's ODPCP. During summer, pre-staged containment booms will be placed at strategic locations near selected river channels. Pre-deployed booms may also be placed within select stream channels to mitigate a spill, should one occur. During the summer, spill containment equipment will likely be staged or deployed using helicopters or boats. If a spill occurs, response measures could include helicopter and watercraft (e.g., jetboats, airboats) use to access affected areas.

3.2.3.3 Spill Training and Inspections

CPAI provides regular training for its employees and contractors on preventing oil or hazardous material spills, in addition to other environmental and certification classes. The CPAI Incident Management Team participates in regularly scheduled training programs and conducts spill response drills in coordination with federal, state, and local agencies. Employees are encouraged to participate in the North Slope Spill Response Team, and as part of the team, members receive regularly scheduled spill response training to ensure the continuous availability of skilled spill responders on the North Slope.

CPAI is required to conduct visual examinations of pipelines and facility piping at least monthly during operations. CPAI will conduct aerial overflights as necessary to allow both visual and infrared inspection using aircraft or from the ground using handheld systems. Infrared technology can detect warm spots (i.e., oil) in low-light conditions or when other circumstances (e.g., light fog, drifted snow) limit visibility. CPAI will also conduct regular visual inspections of facilities and pipelines from gravel roads and aircraft (for sections of pipelines not paralleled not paralleled by gravel roads [i.e., more than 1,000 feet of separation]).

3.2.4 Willow Project Abandonment and Reclamation

The abandonment and reclamation of Project facilities will be determined at or before the time of abandonment. The Abandonment and Reclamation Plan will be subject to input from federal, state, and local authorities, as well as private landowners. Abandonment and reclamation may involve the removal of gravel roads and pads or leaving these in place for alternative purposes. Revegetation of abandoned facilities could be accomplished by seeding with native vegetation or through natural colonization. If gravel is reclaimed, it could be used for other development projects. Reclamation standards will be determined by the BLM authorized officer prior to the time of reclamation.

Depending on the types of abandonment and reclamation activities that occur, summer road and air traffic levels will be similar to those experienced during construction activities but at potentially lower intensity levels and for shorter durations.

3.3 Dates and Duration

Timing of the 30-year Project is based on several factors, including permitting and other regulatory approvals, Project sanctioning by CPAI, and the purchase and fabrication of long-lead time components. CPAI will construct the Project over approximately 8 years beginning in Project Year 1. The WPF is anticipated to come online in Year 6 (first oil from BT1, BT2, and BT3 production). Production from BT5 could begin as early as Project Year 9; this represents the earliest construction date for BT5. Development drilling results at BT1, BT2, and BT3 will provide information that could extend the BT5 construction duration. The schedule is based on the current best available information, and the schedule may be modified as detailed design progresses or as circumstances require. Operations will run to the end of the Project’s field life, which is estimated to be Year 30.

3.3.1 Construction Phase

Gravel mining and placement will be conducted almost exclusively during winter. Prepacking snow and constructing ice roads to access the Tiŋmiaqsiuġvik gravel mine site and gravel road and pad locations will occur in December and January (or as soon as conditions allow), with ice roads assumed to be available for use by February 1. The schedule anticipates typical weather conditions and is subject to change based on annual conditions.

Gravel for infrastructure associated with the initial construction (BT1, BT2, BT3, connecting roads, WPF, WOC, and airstrip) will be mined and placed during winter (January through April) for the first 4 to 5 years of construction. One additional winter season of gravel mining and placement will occur to construct BT5 and associated roads beginning in Year 7 (at the earliest).

Gravel roads and pads will be built following the construction of ice roads. Gravel conditioning and compaction will occur during the summer (typically July to October) to expose, thaw, and dewater deeper layers and re-compact the gravel. Culvert locations will be identified and installed per the final design during the first construction season prior to spring breakup. Bridges will be constructed during winter from ice roads and ice pads. Once gravel pads are completed, on-pad facilities will be constructed. Modules for the WPF, BT1, BT2, and BT3 will be delivered by barge to Oliktok Dock during summer Year 4 and moved to the Project area the following winter. Modules for BT5 will be delivered via a second sealift barge trip to Oliktok Dock in summer Year 6 and moved to the Project area the following winter. Other materials delivered by barge will arrive in the summers of Year 2, Year 3, Year 4, and Year 6.

Pipelines will be installed during winter from ice roads. VSM locations will be surveyed and drilled, and then VSMs and HSMs will be assembled and installed using a sand slurry fill. Alternatively, engineering design may require VSMs to be driven into an undersized hole using a vibratory hammer. The pipelines will be placed, welded, tested, and then installed on pipe saddles atop the HSMs. The Colville River HDD pipeline crossing will be completed during the Year 4 winter construction season. Pipeline installation will take between 1 and 4 years per pipeline type, depending on pipeline length and location.

The subsistence boat ramp along the Tiŋmiaqsiuġvik River will be constructed in the first Project construction seasons. Subsistence boat ramps at Judy (Iqalliqpik) Creek and Fish (Uvlutuuq) Creek will be constructed after site visits and input from local stakeholders and within 2 years of constructing the BT1 and BT2 access roads, respectively. Boat ramp construction methods will be similar to the construction methods described for other gravel placement. Construction will occur primarily in winter, with gravel seasoning and compaction occurring over the following summer season.

Gravel haul and placement to modify Oliktok Dock will occur in summer Year 2. Around mid-July during each summer open-water season, before sealift barge arrival and after the risk of ice encroachment has passed, screeding will occur at Oliktok Dock and in the barge lightering area.

3.3.2 Drilling Phase

Drilling is planned to begin in Year 4 at BT1. The two drill rigs will be mobilized to the Project area, and drilling will begin prior to completion of the WPF and drill site facilities. The approximately 18 to 24 months of pre-drilling activities will allow the WPF to be commissioned immediately following its construction. It is assumed wells will be drilled consecutively from BT1 to BT3 and BT5; however, CPAI will determine the timing and order of drilling based on economics and drill rig availability. Drilling is anticipated to take 7 years.

Drilling will include the use of hydraulic fracturing techniques. Hydraulic fracturing will use seawater (sourced from the existing Kuparuk Seawater Treatment Plant) following WPF startup and will occur only in the initial stage of well drilling to stimulate flow at the production and injection wells.

3.3.3 Operations Phase

Following initial drilling and WPF startup, typical operations will consist of well operations and production. Production will begin in Year 6. Well maintenance operations and routine drilling activities will occur intermittently throughout the life of the Project. CPAI’s standard operations and maintenance practices will be implemented for this Project phase.

3.4 Minimization, Avoidance, and Mitigation

The following sections describe measures BLM and the applicant (i.e., CPAI) will take to prevent adverse effects to listed species, or to limit adverse effects to predictable levels that will not jeopardize the continued existence of listed species or destroy or adversely modify critical habitat.

3.4.1 Proponent’s Design Features to Minimize and Avoid Impacts

CPAI has included Project design features (Appendix A, *Design Features to Avoid and Minimize Impacts*) that directly or indirectly prevent adverse effects to polar bears, listed eiders, or northern sea otters, and minimize the destruction or adverse modification of critical habitat. These features are intended to accomplish the following:

- Reduce the overall Project footprint (i.e., direct impacts from facilities)
- Reduce potential human health impacts (especially those relating to air quality and subsistence)
- Reduce impacts to wildlife, subsistence resources (especially caribou), and subsistence use areas
- Reduce risks related to spills or other accidental releases
- Reduce effects to water resources and floodplains, including marine habitat

Specifically, design features numbers 2, 4, 5, 6, 8, 10, 12, 15, 17, 18, 22, and 109 will help minimize potential impacts to polar bear critical habitat and listed eider nesting and near-shore habitat use. Design features numbers 47, 49, 62, 63, 64, and 90 will help reduce human-polar bear interactions, thereby reducing potential human-polar bear conflicts. Design features numbers 9, 37, 41, 42, 51, 52, 53, and 75 will help minimize impacts to listed eiders. Design features numbers 48, 55, 69, 73, 84, 92, 95, 96, and 97 will help minimize impacts to both listed eiders and polar bears.

3.4.2 Applicable Existing Lease Stipulations and Required Operating Procedures

Table 9 summarizes existing NPR-A IAP LSs and ROPs that will apply to the Project and are intended to mitigate impacts to wildlife from development activity (BLM 2022). The LSs and ROPs will reduce impacts to marine habitat, subsistence hunting areas, and the environment associated with the construction, drilling, and operation of oil and gas facilities. Full text of the requirements is provided in BLM (2022).

LSs and ROPs that directly or indirectly prevent adverse effects to polar bears, listed eiders, or northern sea otters and minimize the potential destruction or adverse modifications of critical habitat are listed below.

ROPs A-1, A-2, A-3, and A-8 will help reduce human-polar bear interactions, thereby reducing potential human-polar bear conflicts and possible lethal take. ROPs A-3, A-4, A-5, A-7, E-5, E-12, and L-1 will help decrease the potential impacts to polar bear critical habitat and listed eider nesting and near-shore habitat use. ROP C-1 is intended to protect polar bear denning habitat, while ROPs E-9, E-10, E-11, E-18, and E-20 will help minimize impacts to listed eiders. ROPs E-19, F-1, and M-1 and LS K-6, will indirectly help minimize impacts to both polar bears and listed eiders.

Table 9. Summary of Applicable Existing Lease Stipulations and Required Operating Procedures Intended to Mitigate Impacts to Species and Habitats Protected by the Endangered Species Act

LS or ROP	Description or Objective	Requirement/Standard
ROP A-1	Protect the health and safety of oil and gas field workers and the general public by disposing of solid waste and garbage in accordance with applicable federal, State, and local law and regulations.	Areas of operation shall be left clean of all debris.
ROP A-2	Minimize impacts on the environment from non-hazardous and hazardous waste generation. Encourage continuous environmental improvement. Protect the health and safety of oil field workers and the general public. Avoid human-caused changes in predator populations.	Lessees/permittees shall prepare and implement a comprehensive waste management plan for all phases of exploration and development, including seismic activities. The plan shall be submitted to the AO for approval, as part of a plan of operations or other similar permit application. Waste generation shall be addressed in the following order of priority: 1) prevention and reduction, 2) recycling, 3) treatment, and 4) disposal. The plan shall consider the following requirements: a. The plan shall identify precautions that are to be taken to avoid attracting wildlife to food and garbage. b. Requirements prohibit the burial of garbage. Users shall have a written procedure to ensure that the handling and disposal of putrescible waste will be accomplished in a manner that prevents the attraction of wildlife. All putrescible waste shall be incinerated, backhauled, or composted in a manner approved by the AO. All solid waste, including incinerator ash, shall be disposed of in an approved waste-disposal facility. The burial of human waste is prohibited. c. BLM requires all pumpable solid, liquid, and sludge waste be disposed of by injection in accordance with EPA, DEC, and AOGCC regulations and procedures. d. BLM prohibits wastewater discharges or disposal of domestic wastewater into bodies of water, including wetlands, unless authorized by a National Pollutant Discharge Elimination System or State permit.
ROP A-3	Minimize pollution through effective hazardous-materials contingency planning.	A hazardous materials emergency contingency plan shall be prepared before transportation, storage, or use of fuel or hazardous substances. The plan shall include a set of procedures to ensure prompt response, notification, and cleanup in the event of a hazardous substance spill or threat of a release. The plan shall include a list of resources available for response. In addition, contingency plans shall include requirements to: a. Provide refresher spill-response training to NSB and local community spill-response teams on a yearly basis b. Plan and conduct a major spill-response drill annually c. Develop spill prevention and response contingency plans and participate in the North Slope Subarea Contingency Plan for Oil and Hazardous Substances Discharges/Releases for the NPR-A operating area.

LS or ROP	Description or Objective	Requirement/Standard
ROP A-4	Minimize the impact of contaminants on fish, wildlife, and the environment, including wetlands, marshes, and marine waters, as a result of fuel, crude oil, and other liquid chemical spills. Protect subsistence resources and subsistence activities. Protect public health and safety.	Before initiating any oil and gas or related activity or operation, develop a comprehensive spill prevention, control, and countermeasure plan per 40 CFR 112. The plan shall consider the following requirements: a. Sufficient oil-spill-cleanup materials shall be stored at all fueling points and vehicle-maintenance areas and shall be carried by crews on all overland moves. b. Fuel and other petroleum products and other liquid chemicals shall be stored in proper containers at approved locations. Fuel, petroleum products, and other liquid chemicals that in total exceed 1,320 gallons shall be stored within an impermeable lined and diked area or within approved alternate storage containers. Within 500 feet (152 meters) of waterbodies, fuel containers are to be stored within appropriate containment. c. Liner material shall be compatible with the stored product and capable of remaining impermeable during typical weather extremes expected throughout the storage period. d. Permanent fueling stations shall be lined or have impermeable protection. e. All fuel containers shall be marked with the responsible party's name, product type, and year filled or purchased. f. Notice of any reportable spill (as required by 40 CFR 300.125 and 18 AAC 75.300) shall be given to the authorized officer as soon as possible, but no later than 24 hours after occurrence. g. All oil pans (i.e., “duck ponds”) shall be marked with the responsible party’s name.
ROP A-5	Minimize the impact of contaminants from refueling operations on fish, wildlife, and the environment.	Refueling of equipment within 500 feet (152 meters) of the active floodplain of any waterbody is prohibited. Fuel storage stations shall be located at least 500 (152 meters) feet from any waterbody with the exception that small caches (up to 210 gallons) for motorboats, float planes, ski planes, and small equipment.
ROP A-7	Minimize the impacts to the environment of disposal of produced fluids recovered during the development phase on fish, wildlife, and the environment.	Discharge of produced water in upland areas and marine waters is prohibited.
ROP A-8	Minimize conflicts resulting from interaction between humans and bears during oil and gas activities.	Lessees will prepare and implement bear-interaction plans to minimize conflicts between bears and humans. These plans shall include measures to: a. Minimize attraction of bears to the drill sites. b. Organize layout of buildings and work sites to minimize human-bear interactions. c. Warn personnel of bears near or on work sites and identify proper procedures to be followed. d. Establish procedures, if authorized, to discourage bears from approaching the work site. e. Provide contingencies in the event bears do not leave the site or cannot be discouraged by authorized personnel. f. Discuss proper storage and disposal of materials that may be toxic to bears. g. Provide a systematic record of bears on the work site and in the immediate area.
ROP A-9	Reduce air quality impacts.	All operations (vehicles and equipment) that burn diesel fuels must use “ultra-low sulfur” diesel as defined by the DEC, Division of Air Quality.

LS or ROP	Description or Objective	Requirement/Standard
ROP A-10	Prevent unnecessary or undue degradation of the lands and protect health.	This measure includes the following elements: a. BLM may require a project proponent to provide a minimum of one year of baseline ambient air monitoring data for any pollutants of concern. If BLM determines baseline monitoring is required, this pre-analysis data must meet DEC and EPA air monitoring standards and cover the year prior to the submittal. b. BLM may require monitoring for the life of the project, depending on the potential air emissions' magnitude, proximity to a federal Class I area, Class II area, or population center, proximity to a non-attainment or maintenance area, meteorological or geographic conditions, existing air quality conditions, existing area development, or issues identified during the project's NEPA analysis. c. For an application to develop a potential substantial air pollutant emission source, the proponent shall prepare an emissions inventory that includes quantified emissions of regulated air pollutants from all direct and indirect sources related to the proposed project. d. For an application to develop a potential substantial air pollutant emission source, BLM may require the proponent to provide an emissions reduction plan. e. For an application to develop a potential substantial air pollutant emission source, the AO may require air quality modeling analyzing the project's direct, indirect or cumulative impacts to air quality. The modeling shall compare predicted impacts to all applicable local, State, and federal air quality standards and increments, as well as other scientifically defensible significance thresholds. f. BLM may require air quality mitigation measures and strategies within its authority, in addition to regulatory requirements and proponent committed emission reduction measures. g. If ambient air monitoring indicates project-related emissions are causing or contributing to impacts that would cause undue degradation, exceedances of NAAQS, or fail to protect health, the AO may require changes to reduce emissions. h. Publicly available reports on air quality baseline monitoring, emissions inventory, and modeling results shall be provided by the project proponent to the NSB and to local communities and Tribes.

LS or ROP	Description or Objective	Requirement/Standard
ROP C-1	Protect grizzly bear, polar bear, and marine mammal denning and/or birthing locations.	a. Grizzly bear dens: Cross-country use of vehicles, equipment, and oil and gas activity is prohibited within 0.5 mile (0.5 km) of occupied grizzly bear dens, unless protective measures are approved by BLM. b. Polar bear dens: Cross-country use of vehicles, equipment, and oil and gas activity is prohibited within 1 mile of known or observed polar bear dens, unless alternative protective measures are approved by BLM. c. To limit disturbance around known polar bear dens, implement the following: 1. Onshore activities in known or suspected polar bear denning habitat during the denning season (approximately November to April) must make efforts to locate occupied polar bear dens. All observed or suspected polar bear dens must be reported to USFWS prior to the initiation of activities. 2. Permittees must observe a 1-mile operational exclusion zone around all known polar bear dens during the denning season (or until the female and cubs leave the areas). Should previously unknown occupied dens be discovered, work must cease and USFWS must be contacted for guidance. Potential actions may range from cessation or modification of work to conducting additional monitoring. 3. Use the den habitat map developed by USGS. 4. Restrict activity timing to limit disturbance around dens. d. To limit disturbance of activities to seal lairs in the nearshore area (< 9.8-foot [3-meter] water depth): 1. Prior to the initiation of winter seismic surveys on marine ice, the permittee will conduct a sound source verification test approved by BLM and NMFS. 2. For all activities: i. Maintain airborne sound levels of equipment below 100 db re 20 μPa at 66 feet (20 meters). ii. On-ice operations after May 1 will employ a full-time protected species observer on vehicles to ensure that all basking seals are avoided by vehicles by at least 500 feet and will ensure that all equipment with airborne noise levels are operating at distances from observed seals that allow for the attenuation of noise to levels below 100 decibels. iii. Sea ice trails must not be greater than 12-feet (3.7-meters) wide. iv. No unnecessary equipment or operations will be placed or used on sea ice.

LS or ROP	Description or Objective	Requirement/Standard
ROP C-2	Protect stream banks, minimize compaction of soils, and minimize the breakage, abrasion, compaction, or displacement of vegetation.	a. Ground operations shall be allowed only when frost and snow cover are sufficient to protect the tundra. Ground operations shall cease when the spring snowmelt begins (approximately May 15); the exact dates will be determined by the AO. b. Low-ground-pressure vehicles shall be used for on-the-ground activities off ice roads or pads. c. Bulldozing of tundra mat and vegetation, trails, or seismic lines is prohibited. d. To reduce the possibility of ruts, vehicles shall avoid using the same trails for multiple trips unless necessitated by serious safety or superseding environmental concern. e. The location of ice roads shall be designed and located to minimize compaction of soils and the breakage, abrasion, compaction, or displacement of vegetation. Offsets may be required to avoid using the same route or track in the subsequent year. f. Motorized ground-vehicle use within the Colville River Special Area associated with overland moves, seismic work, and any similar use of heavy equipment shall be minimized within an area that extends 1 mile west or northwest of the bluffs of the Colville River.
ROP C-3	Maintain natural spring runoff patterns and fish passage, avoid flooding, prevent streambed sedimentation and scour, protect water quality, and protect stream banks.	Crossing of waterway courses shall be made using a low-angle approach. Crossings that are reinforced with additional snow or ice (“bridges”) shall be removed, breached, or slotted before spring breakup. Ramps and bridges shall be substantially free of soil and debris.
ROP E-2	Protect fish-bearing waterbodies, water quality, and aquatic habitats.	Permanent oil and gas facilities are prohibited within 500 feet (152 meters) of fish-bearing waterbodies (as measured from the ordinary high water mark). Essential pipeline and road crossings will be permitted on a case-by-case basis.
ROP E-3	Maintain free passage of marine and anadromous fish and protect subsistence use and access to subsistence hunting and fishing.	Linear infrastructure that connects to the shoreline (e.g., causeways, docks) is prohibited in river mouths or deltas. Artificial gravel islands and permanent bottom-founded structures are prohibited in river mouths or active stream channels on river deltas.
ROP E-5	Minimize impacts of the development footprint.	Facilities shall be designed and located to minimize the development footprint. Issues and methods to be considered include: a. Use of maximum extended-reach drilling for production drilling. b. Sharing facilities with existing development. c. Collocation of all oil and gas facilities, except airstrips, docks, and seawater-treatment plants, with drill pads. d. Integration of airstrips with roads. e. Use of gravel-reduction technologies (e.g., insulated or pile-supported pads). f. Coordination of facilities with infrastructure in support of offshore development. Note: Where aircraft traffic is a concern, consideration shall be given to balancing gravel pad size and available supply storage capacity with potential reductions in the use of aircraft to support oil and gas operations.

LS or ROP	Description or Objective	Requirement/Standard
ROP E-8	Minimize the impact of mineral materials mining activities on air, land, water, fish, and wildlife resources.	Gravel mine site design and reclamation will be in accordance with a plan approved by the AO. The plan shall consider: a. Locations outside the active flood plain. b. Design of gravel mine sites within active flood plains to serve as water reservoirs for future use. c. Potential use of the site for enhancing fish and wildlife habitat. d. Potential storage and reuse of sod/overburden for the mine site or at other disturbed sites on the North Slope.
ROP E-9	Avoidance of human-caused increases in populations of predators of ground nesting birds.	a. Lessee shall use best available technology to prevent facilities from providing nesting, denning, or shelter sites for ravens, raptors, and foxes. The lessee shall provide the AO with an annual report on the use of facilities by ravens, raptors, and foxes as nesting, denning, and shelter sites. b. Feeding wildlife is prohibited.
ROP E-10	Minimize bird collisions with infrastructure, especially during migration and inclement weather.	Flagging of structures (e.g., elevated utility lines, guy wires) shall be required to minimize bird collision. All facility external lighting shall be designed to direct artificial exterior lighting inward and downward or be fitted with shields to reduce reflectivity in clouds and fog conditions.
ROP E-11	Minimize impacts on bird species, particularly those listed under the Endangered Species Act and BLM special status species, resulting from direct or indirect interaction with infrastructure.	Before the approval of infrastructure construction, the following studies shall be conducted, and recommended design elements shall be incorporated. *Special Conditions in Spectacled and/or Steller's Eiders Habitats:* a. BLM requires submittal of a minimum of 3 years of site-relevant survey data before authorization of construction, if such construction is within spectacled and Steller's eider habitats. BLM will evaluate adequacy of survey data and ecological mapping to determine if ground-based nest surveys are required. Information gained from these surveys shall be used to make infrastructure siting decisions. b. If spectacled and/or Steller's eiders are determined to be present within the proposed development area, the applicant shall work with USFWS and BLM early in the design process to site roads and facilities in order to minimize impacts to nesting and brood-rearing eiders and their habitats. *Special Conditions in Yellow-billed Loon Habitats:* The permittee shall determine and submit to BLM information on yellow-billed loon habitat presence within a project area using the most current data and analysis results from research conducted within the NPR-A. a. If yellow-billed loon habitat is determined to be present within the project area, BLM will require submittal of a minimum of 3 years of site-relevant survey data of lakes greater than 25 acres within 1 mile (1.6 km) of the proposed infrastructure. b. The design and location of infrastructure must minimize. The default standard mitigation shall be a minimum 0.5-mile (0.8 km) buffer around all recorded nest sites and shall be up to 1 mile, where feasible. Lakes with yellow-billed loon occupancy shall also include a minimum 1,625-foot (495-meter) buffer around the shoreline. Development would generally be prohibited within buffers; BLM would consider waivers or modifications to this requirement if no other feasible option exists.

LS or ROP	Description or Objective	Requirement/Standard
ROP E-12	Use ecological mapping as a tool to assess wildlife habitat before development of permanent facilities to conserve important habitat types during development.	An ecological land classification map of the development area shall be developed before approval of facility construction. The map will integrate geomorphology, surface form, and vegetation at a scale, level of resolution, and level of positional accuracy adequate for detailed analysis of development alternatives.
ROP E-18	Avoid and reduce temporary impacts to productivity from disturbance near Steller's and/or spectacled eider nests.	Ground-level activity (by vehicle or on foot) within 656 feet (200 meters) of occupied Steller's and/or spectacled eider nests from June 1 through August 15, will be restricted to existing thoroughfares, such as pads and roads. Construction of permanent facilities, placement of fill, alteration of habitat, and introduction of high noise levels within 656 feet (200 meters) of occupied Steller's and/or spectacled eider nests will be prohibited. In cases in which oil spill response training is proposed to be conducted within 656 feet (200 meters) of shore in riverine, marine, or inter-tidal areas, BLM will work with USFWS to schedule the training at a time that is not a sensitive nesting/brood-rearing period or require that nest surveys be conducted in the training area prior to a decision on approving the training.
ROP E-19	Provide information to be used in monitoring and assessing wildlife movements during and after construction.	GIS-compatible shape-files of all new infrastructure construction shall be provided to the AO. Infrastructure includes all gravel roads and pads, facilities built on pads, pipelines and independently constructed powerlines.
ROP E-20	Minimize the impacts on bird species from direct interaction with aboveground utility infrastructure.	a. To reduce the possibility of birds colliding with aboveground utility lines, such lines would either be buried in access roads or suspended on VSMs. Exceptions are limited to the following situations: 1. Overhead utility lines may be allowed when located entirely within the boundaries of a facility pad. 2. Overhead utility lines may be allowed when engineering constraints at the specific and limited location make it infeasible to bury or connect the lines to a VSM. 3. Overhead utility lines may be allowed in situations when human safety would be compromised by other methods. b. To reduce the likelihood of birds colliding with them, communication towers would be located on existing pads and as close as possible to buildings or other structures and on the east or west side of buildings or other structures, if possible. Support wires would be avoided to the extent practicable. If support wires are necessary, they would be clearly marked along their entire length to improve visibility to low-flying birds. c. Design of other utility infrastructure, such as wind turbines, would be evaluated under a specific development proposal. d. The permittee shall comply with current industry-accepted practices for raptor protection on power lines, such as the most recent Avian Power Line Interaction Committee suggested practices.

LS or ROP	Description or Objective	Requirement/Standard
ROP F-1	Minimize the effects of low-flying aircraft on wildlife, subsistence activities, and local communities.	The lessee shall ensure that aircraft used for permitted activities maintain altitudes according to the following guidelines (Note: This ROP is not intended to restrict flights necessary to survey wildlife. Flights necessary to gain this information will be restricted to the minimum.): a. Aircraft shall maintain an altitude of at least 1,500 feet (460 meters) above ground level when within 0.5 mile (0.8 km) of cliffs identified as raptor nesting sites from April 15 through August 15. b. Aircraft shall maintain an altitude of at least 1,000 (305 meters) feet above ground level over caribou winter ranges from December 1 through May 1. c. Land user shall submit an aircraft use plan as part of an oil and gas development proposal. The plan shall address strategies to minimize impacts to subsistence hunting and associated activities. d. Proposed aircraft use plans should be reviewed by appropriate federal, State, and borough agencies. Adjustments, including suspension of all flights, may be required by the AO if resulting disturbance is determined to be unacceptable. e. The number of takeoffs and landings to support oil and gas operations with necessary materials and supplies should be limited to the maximum extent possible. f. Use of aircraft, especially rotary wing aircraft, near known subsistence camps and cabins or during sensitive subsistence hunting periods (spring goose hunting and fall caribou and moose hunting) should be kept to a minimum. g. Aircraft used for permitted activities shall maintain an altitude of at least 2,000 feet (610 meters) above ground level over the Teshekpuk Lake Caribou Habitat Area from May 20 through August 20. Aircraft use by oil and gas lessees in the Goose Molting Area should be minimized from May 20 through August 20. h. Aircraft used for permitted activities shall maintain an altitude of at least 2,000 feet (610 meters) above ground level over the Utukok River Uplands Special Area from May 20 through August 20. i. Hazing of wildlife by aircraft is prohibited. Pursuit of running wildlife is hazing. j. Fixed-wing aircraft used as part of a BLM-authorized activity along the coast shall maintain minimum altitude of 2,000 feet (610 meters) when within a 0.5 mile (0.8 km) of walrus haulouts. Helicopters used as part of a BLM-authorized activity along the coast shall maintain minimum altitude of 3,000 feet (915 meters) and a 1.0-mile (1.6-km) buffer from walrus haulouts. k. Aircraft used as part of a BLM-authorized activity along the coast and shore fast ice zone shall maintain minimum altitude of 3,000 feet (915 meters) when within 1.0 mile (1.6 km) of all listed marine mammal species.
LS G-1	Ensure long-term reclamation of land to its previous condition and use.	Prior to final abandonment, land used for oil and gas infrastructure shall be reclaimed to ensure eventual restoration of ecosystem function. The leaseholder shall develop and implement an abandonment and reclamation plan approved by BLM. The plan shall describe short-term stability, visual, hydrological, and productivity objectives and steps to be taken to ensure eventual ecosystem restoration to the land's previous hydrological, vegetative, and habitat condition.

LS or ROP	Description or Objective	Requirement/Standard
ROP H-3	Minimize impacts to sport hunting and trapping species and to subsistence harvest of those animals.	Hunting and trapping by lessee's/permittee's employees, agents, and contractors are prohibited when persons are on "work status." Work status is defined as the period during which an individual is under the control and supervision of an employer. Work status is terminated when the individual's shift ends and he/she returns to a public airport or community (e.g., Fairbanks, Barrow, Nuiqsut, or Deadhorse). Use of lessee/permittee facilities, equipment, or transport for personal access or aid in hunting and trapping is prohibited.
LS K-1	*River Setbacks* Minimize the disruption of natural flow patterns and changes to water quality; the disruption of natural functions resulting from the loss or change to vegetative and physical characteristics of floodplain and riparian areas; the loss of spawning, rearing or over-wintering habitat for fish; the loss of cultural and paleontological resources; the loss of raptor habitat; impacts to subsistence cabin and campsites; the disruption of subsistence activities; and impacts to scenic and other resource values. *Colville River Special Area Management Plan—Protection 1* Minimize the loss of arctic peregrine falcon nesting habitat in the Colville River Special Area.	*River Setbacks* Permanent oil and gas facilities, including gravel pads, roads, and pipelines, are prohibited in the streambed and adjacent to the rivers listed below. On a case-by case basis, essential pipeline and road crossings will be permitted through setback areas. a. Colville River: A 2-mile (3.2-km) setback from the boundary of NPR-A where the river determines the boundary along the Colville where BLM-manages both sides of the river up through T5S, R30W, U.M. Above that point to the juncture of Thunder and Storm creeks, the setback is 0.5 mile (0.8 km). b. Fish (Uvlutuuq) Creek: A 3-mile (4.8-km) setback from the creek downstream from the eastern edge of section 31, T11N, R1E., U.M. and a 0.5-mile (0.8 km) setback farther upstream. c. Judy (Kayyaak) Creek: A 0.5-mile (0.8-km) setback. d. Ublutuoch (Tiŋmiaqsiugvik) River: a 0.5-mile (0.8-km) setback. *Colville River Special Area Management Plan—Protection 1* To minimize the direct loss of arctic peregrine falcon nesting habitat and to protect nest sites in the Colville River Special Area, the following protective measures apply: Permanent oil and gas facilities, including gravel pads, roads, and pipelines, are prohibited in the streambed and adjacent to the rivers listed below. On a case-by-case basis, essential pipeline and road crossings will be permitted through setback areas.
LS K-6	*Coastal Area Setbacks* Protect coastal waters and their value as fish and wildlife habitat (including, but not limited to, that for waterfowl, shorebirds, and marine mammals), minimize hindrance or alteration of caribou movement within caribou coastal insect-relief areas; protect the summer and winter shoreline habitat for polar bears, and the summer shoreline habitat for walrus and seals; prevent loss of important bird habitat and alteration or disturbance of shoreline marshes; and prevent impacts to subsistence resources and activities.	a. Drill pads and central processing facilities would not be allowed in coastal waters or on islands between the northern boundary of the NPR-A and the mainland, or in inland areas within 1 mile (1.6 km) of the coast. Other facilities necessary for oil and gas production within NPR-A that necessarily must be within this area (e.g., barge landing, seawater treatment plant, or spill response staging and storage areas) would not be precluded. Lessees/permittees shall consider the practicality of locating facilities that necessarily must be within this area at previously occupied sites such as various Husky/USGS drill sites and Distant Early Warning-Line sites. Before conducting open water activities, the lessee shall consult with the Alaska Eskimo Whaling Commission, NSB, and local whaling captains associations to minimize impacts to subsistence whaling activities. b. Marine vessels used as part of a BLM-authorized activity shall maintain a 1-mile buffer from the shore when transiting past an aggregation of seals, Steller's sea lions, or walruses using a terrestrial haulout. Marine vessels shall not conduct ballast transfers or discharge any matter into the marine environment within 3 miles of the coast, except when necessary for the safe operation of the vessel.

LS or ROP	Description or Objective	Requirement/Standard
ROP L-1	Protect stream banks and water quality; minimize compaction and displacement of soils; minimize the breakage, abrasion, compaction, or displacement of vegetation; protect cultural and paleontological resources; maintain populations of, and adequate habitat for birds, fish, and caribou and other terrestrial mammals; and minimize impacts to subsistence activities.	On a case-by-case basis, BLM may permit low-ground-pressure vehicles to travel off of gravel pads and roads during times other than those identified in ROP C-2a. Permission for such use would only be granted after an applicant has: a. Submitted studies satisfactory to the AO of the impacts on soils and vegetation of the specific low-ground-pressure vehicles to be used. b. Submitted surveys satisfactory to the AO of subsistence uses of the area as well as of the soils, vegetation, hydrology, wildlife and fish (and their habitats), paleontological and archaeological resources, and other resources as required by the AO. c. Designed and/or modified the use proposal to minimize impacts to the AO’s satisfaction. Design steps to achieve the objectives may include, timing restrictions, shifting of work to winter, rerouting, and not proceeding when certain wildlife are present or subsistence activities are occurring. At the discretion of the AO, the plan for summer tundra vehicle access may be included as part of the spill prevention and response contingency plan.
ROP M-1	Minimize disturbance and hindrance of wildlife, or alteration of wildlife movements through the NPR-A.	Chasing wildlife with ground vehicles is prohibited. Particular attention will be given to avoid disturbing caribou.

Source: BLM 2022.
Note: AO (authorized officer); AOGCC (Alaska Oil and Gas Conservation Commission); BLM (Bureau of Land Management); DEC (Alaska Department of Environmental Conservation); EPA (U.S. Environmental Protection Agency); km (kilometer); LS (lease stipulation); NAAQS (National Ambient Air Quality Standards); NEPA (National Environmental Policy Act); NMFS (National Marine Fisheries Service); NPR-A (National Petroleum Reserve in Alaska); NSB (North Slope Borough); ROP (required operating procedure); USFWS (U.S. Fish and Wildlife Service); USGS (U.S. Geological Survey).

Due to technical constraints, some Project facilities will require deviations from existing LSs or ROPs. Deviations that will affect ESA species will include those to ROPs E-2, E-5, and E-11 and LS K-1. The Project includes road and pipeline crossings of fish-bearing waterbodies (including one or more of the waterbodies protected in LS K-1 and ROP E-2). As a result, it is not possible in all instances to avoid encroachment within 500 feet (152 m) of every waterbody. The Project will also place new VSMs along existing pipeline corridors due to pipe rack capacity limits (deviation to ROP E-5); the Project will separate the Project airstrip from roads due to Federal Aviation Administration regulations and operational safety concerns based on incident history at the Alpine integrated airstrip. Lastly, the Project will cross the default BLM standard mitigation disturbance setback of 1 mile (1.6 km) around recorded nest sites for yellow-billed loons and 500-meter (1,625-feet) setback of the shoreline of nest lakes (deviation to ROP E-11).

3.4.3 Polar Bear Mitigation Measures

CPAI is committing to the following polar bear mitigation measures for the duration of the Willow Project (Sections 3.4.3.1 and 3.4.3.2). These measures include all the mitigation measures that CPAI would typically be required to implement under MMPA authorizations for both incidental take and take by deterrence (i.e., intentional, non-lethal take) to Project activities, where CPAI’s implementation of these measures does not depend on future MMPA authorization.

Existing Beaufort Sea ITRs have strived to minimize disturbance and take to polar bears through mitigation, monitoring, and reporting measures that have been implemented for more than 20 years. Current mitigation measures typically required for activities in the central Beaufort Sea are described in Appendix B, *Mitigation, Monitoring, and Reporting Requirements for the Beaufort Sea Incidental Take Regulations*. The Project will operate under Letters of Authorization from existing ITRs and possible future ITRs. BLM will work with USFWS to minimize disturbance and take of polar bears under established MMPA authorizations.

The current Beaufort Sea ITRs (86 FR 42982) describe mitigation, monitoring, and reporting requirements for oil and gas operators, such as CPAI, that are applied to active oil field operations in the central Beaufort Sea. The Beaufort Sea ITRs encompass the range of the Southern Beaufort Sea (SBS) polar bear stock, which also uses the action area and have been important in mitigating impacts to polar bears from oil and gas activities. The general mitigation, monitoring, and reporting requirements of oil and gas operators from the 2022 NPR-A IAP ROD are presented in Section 3.4.2, *Applicable Existing Lease Stipulations and Required Operating Procedures*. These are used in this document as a foundation, or starting point, from which to work towards minimizing the disturbance of polar bears as a result of the Project. Using established mitigation measures will allow the BLM and operators, who are familiar with them, to understand the level of requirements and effort necessary to begin to minimize industry impacts on polar bears in the action area. Current ITRs, and if promulgated, future ITRs in the action area would also ensure that negligible impacts to a small number of polar bears would occur.

3.4.3.1 Measures to Avoid and Minimize Potential Polar Bear Incidental Harassment

The following measures will be employed to avoid and minimize potential polar bear incidental harassment:

1. Project activities will be conducted in accordance with CPAI's *Polar Bear Avoidance and Interaction Plan* (June 2021). A copy of this plan will be kept on-site and will be available for reference by all Project personnel. A copy of the current plan is on file with BLM and USFWS.
2. All employees, contractors, and personnel performing activities for the Willow Project will observe and carry out all applicable terms and conditions set forth in 50 CFR 18 subpart J, which are provided in Appendix B, *Mitigation, Monitoring, and Reporting Requirements for the Beaufort Sea Incidental Take Regulations*. Monitoring reports will be submitted to BLM and USFWS Marine Mammals Management Office (MMM) via email at fw7_mmm_reports@fws.gov.
3. All personnel will limit encounters with polar bears by being observant of approaching polar bears and by allowing polar bears to pass unhindered when possible.
4. If a polar bear interaction escalates into a life-threatening situation, MMPA section 101(c) allows, without specific authorization, the take (including lethal take) of a polar bear if such taking is necessary for self-defense or to save the life of a person in immediate danger. Such taking will be reported to USFWS and BLM as soon as possible, but no later than 48 hours after the incident.
5. Work activities will not take place within 1.0 mile (1.6 km) of known polar bear dens without prior authorization. Two polar bear aerial infrared den detection surveys of all denning habitat within 1.0 mile (1.6 km) of human activity will be conducted during the maternal denning period (November to mid-April). Should occupied dens be identified within 1.0 mile (1.6 km) of Project activities at any time, work in the area will cease and BLM and USFWS MMM will be contacted.
6. Vessel operators will maintain the maximum distance possible and take every precaution to avoid harassment of concentrations of polar bears. Vessels will reduce speed and maintain a minimum 0.5-mile (805-m) operation exclusion zone around groups of 12 or more polar bears observed on ice.
7. BLM and USFWS will be notified of changes to the Project, including changes to activities, locations, or methods, prior to implementation.

3.4.3.2 Measures to Avoid and Minimize Potential Polar Bear Deterrence

The following measures will be employed to avoid and minimize potential polar bear deterrence:

1. Project activities will be conducted in accordance with CPAI's Polar Bear Avoidance and Interaction Plan (June 2021). A copy of this plan will be kept on site and be available for reference by all Project personnel. A copy of this plan is on file with BLM and USFWS.
2. CPAI will ensure that only trained and qualified personnel are assigned the task of polar bear deterrence. Prior to initiation of activities, a list of trained personnel responsible for deterrence and a description of their training will be submitted to USFWS MMM.
3. Should firearms be used for polar bear deterrence, CPAI will ensure that personnel comply with all laws and regulations regarding the carry and use of firearms.

4. Within 48 hours of occurrence, CPAI or its designated agent, will document and report to USFWS MMM all instances involving polar bear deterrence activities. A final report of all polar bear deterrence activities will be submitted to BLM and USFWS MMM. Reports will be submitted to BLM and USFWS MMM via email at fw7_mmm_reports@fws.gov.
5. Appropriate deterrence techniques will include use of (but not limited to), bear monitors, airhorns, electric fences, bear spray, acoustic recordings, vehicles, and projectiles (e.g., beanbags, rubber bullets, “cracker” shells, “bangers”, and “screamers”). Deterrence techniques must not cause the injury or death of a polar bear. Any injury or death of a polar bear will be reported to BLM and USFWS MMM as soon as possible but no later than 48 hours after the incident.
6. Prior to conducting a deterrence activity, CPAI will:
    a. Make a reasonable effort to reduce or eliminate attractants.
    b. Secure the site, notify supervisor, and mover personnel to safety.
    c. Ensure the polar bear has escape route(s).
    d. Ensure communication with all personnel.
7. When conducting a deterrence activity, CPAI will:
    a. Never deter a polar bear for convenience or to aid Project activities. The safety and welfare of the polar bear is second only to the safety and welfare of humans in a deterrence situation.
    b. Shout at the polar bear before using projectiles or other techniques.
    c. Begin with the lowest level of force or intensity that is effective and increase the force or intensity of the technique, or use additional techniques, only as necessary to achieve the desired result.
8. After a deterrence event, CPAI will:
    a. Monitor the polar bear’s movement (to ensure no return).
    b. Notify supervisor and personnel when it is safe to resume work.
    c. Submit a report to USFWS MMM within 48 hours.

3.4.3.3 Denning Habitat Mitigation Strategy

As discussed previously in this BA, mitigating and minimizing human impacts to denning polar bears is an important aspect of working in polar bear denning habitat. Under the authority of the MMPA, USFWS uses a proactive and reactive approach to decrease the potential for conflicts with denned polar bears from the oil and gas industry in active oil fields (Perham 2012). This system is designed to build on historical, real-time, and localized information to develop a flexible, comprehensive approach to limit conflicts between industrial activities and denning bears. The strategy is designed to address potential den and human conflicts by locating and avoiding maternal polar bear dens. Both proactive and reactive measures can incorporate additional new and innovative measures that would be applied on a case-by-case basis. BLM is committed to working under this mitigation strategy and placing an effort on minimizing impacts to denning polar bears.

3.4.3.3.1 Proactive Tools

Proactive measures are used to find maternal dens prior to the initiation of industry activities. The USFWS works with industry to highlight potential localized denning areas during the initial planning stages of industrial activities, such as the construction of exploration pads and ice roads. No single mitigation measure is completely effective at detecting bear dens; however, a combination of tools can be used to maximize the detection of dens. If a polar bear den is identified through proactive measures, CPAI and USFWS will maintain regular and open communication regarding the den site during the denning period. Additionally, USFWS and CPAI will provide training to field personnel to report any sightings or signs of polar bears. Examples of proactive tools includes, but is not limited to:

1. Regulatory and industry information-sharing meetings prior to the winter season to effectively plan den detection surveys
2. Radio-telemetry surveys for radio-collared bears and satellite-collared bear locations in the action area from the United State Geological Survey (USGS)

3. Polar bear denning habitat maps developed by USGS; habitat maps help define high-quality habitat in action area
4. Den detection surveys, which can be infrared imagery surveys (either aerial or handheld) or scent-trained dog surveys

3.4.3.3.2 Reactive Tools

In some cases, polar bears select den sites in areas where initially there was no development, or they were not detected through proactive measures. As the site is developed and industry activity increases, the bear may become more susceptible to disturbance. When a bear emerges from a known den near industry facilities, or if a polar bear emerges from an unknown den during ongoing industrial activities, reactive measures are implemented. These mitigation measures are maintained until the female naturally abandons the den site. The reactive measures below have been applied to den sites in the past. Examples of reactive tools includes, but is not limited to:

1. Restricted activities within 1 mile (1.6 km) of the den
2. 24-hour den monitoring using a camera and/or bear monitors
3. Altered or modified airport traffic patterns to avoid flying over a known den site
4. Altered flight altitudes for aircraft; at least 1,500 feet (457 m) above the surface for all aircraft within 1 mile of an occupied den
5. Ice road or snow trail closures; for closures, various measures can be implanted, such as reducing traffic to essential traffic only, maintaining checkpoints on both sides of the den site to control traffic in the area, and reducing traffic speed limits on the ice roads to 15 miles per hour (24 km per hour) near the den site

3.4.3.4 Polar Bear Conservation Management Plan

Further, BLM will continue to support actions presented in the Polar Bear Conservation Management Plan (USFWS 2016b) and follow its guidelines when conducting Project activities. The Conservation Management Plan strategy describes the following conservation activities:

1. Limit global atmospheric levels of greenhouse gases to levels appropriate for supporting polar bear recovery and conservation, primarily by reducing greenhouse gas emissions
2. Support international conservation efforts through the Range States relationships
3. Manage human-bear conflicts
4. Collaboratively manage subsistence harvests
5. Protect denning habitat
6. Minimize risks of contamination from spills
7. Conduct strategic monitoring and research

3.4.4 Compensatory Mitigation Plan for the Fill of Wetlands and Other Waters of the U.S.

A compensatory mitigation plan was developed for the Willow Project in October 2020. There are no mitigation banks or in-lieu fee programs with service areas that are authorized to operate in the Willow Project area. Permittee responsible mitigation (PRM) was proposed as the only available option to provide compensatory mitigation for the fill of wetlands and other Waters of the U.S. Mitigation site selection was conducted to determine PRM project availability. Credit calculations were conducted using U.S. Army Corps of Engineers (USACE) functional assessment and credit-debit methodologies. Construction of proposed rehabilitation projects would use a phased approach and monitoring would be conducted under a long-term management plan.

For site selection, CPAI examined potential wetland enhancement and preservation projects that would occur within the same watershed as the Willow Project, support aquatic resource functions, benefit the community of Nuiqsut, and ensure economic and logistical practicability. No onsite alternatives for compensatory mitigation were available due to the undeveloped nature of the area and land ownership constraints. The ten-digit hydrologic unit code watersheds have experience 0.24% overall disturbance from previous activities and no watershed would exceed 0.62% disturbance with the Willow Project.

Under PRM, three projects were proposed to offset impacts to aquatic resources. The projects included enhancement of 209.1 acres of palustrine wetlands and preservation of 800 acres of pristine Arctic Coastal Plain (ACP) wetlands at Cape Halkett. In addition to the proposed PRM, voluntary culvert repair would be completed in Nuiqsut to enhance 11.8 acres of Waters of the U.S. abutting the Nigliq Channel of the Colville River.

The two wetland enhancement projects would provide Nuiqsut and Anaktuvuk Pass Subsistence Trail tundra rehabilitation. Summer all-terrain vehicle use for subsistence activities in both communities has crated rutting and damage to vegetation, soils, hydrology, and aesthetics in wetlands. An open cell, semi-rigid geogrid material will be installed to provide a more resilient trail surface. Disturbed tundra wetland functions would be enhanced through the use of a single, geogrid-constructed trail.

The Cape Halkett preservation area would preserve lands in one of two areas through the use of a site protection instrument, limiting allowable activities to subsistence use or other non-disturbance activities. The exact location of the 800-acre preservation area would be determined in consultation with USACE and the landowner. The site protection instrument would be a deed restriction or conservation easement if a third-party holder can be identified. Wetlands in these two areas are ecologically valuable and high functioning, in areas of potential future development activity, and connected to lands preserved for other compensatory mitigation projects.

Under the voluntary Nuiqsut culvert repair project, four culverts in Nuiqsut would be replaced to better convey water from a beaded stream to the Colville River. The culvert repair project would be supported on a voluntary basis as a site protection instrument could not be ensured for all adjacent property parcels. No mitigation credits were requested by CPAI for the culvert replacement project.

The 2017 USACE North Slope Rapid Assessment Method was used to determine credits and the 2016 USACE Alaska Credit-Debit Methodology was used to calculate offsets for impacts to aquatic resources. The 209.1 acres of wetland enhancement for subsistence trail improvements resulted in 59.6 mitigation credits. The remaining credits needed to offset project impacts would come through preserving land at Cape Halkett. Using the 2016 USACE Alaska Credit-Debit Methodology, preserving 107 acres at Cape Halkett would provide 90.6 mitigation credits. The compensatory mitigation plan applied several ratios for determining mitigation credits based on the proposes 800 acres of preservation as an alternative credit calculation.

Compensatory mitigation projects would be completed in a phased approach coincident with Willow Project construction. Long-term management and maintenance would be conducted under a long-term management plan, with local community control. Monitoring would occur pre-construction and every year at the end of the growing season for 3 years for wetland enhancement projects and during pre-construction and at 5 and 10 years for the preservation project.

3.4.5 Other Mitigation

The mitigation measures below have typically been included in recent ESA consultations and Incidental Take Authorizations (ITAs) for oil and gas activities in the U.S. Arctic:

1. General mitigation measures:
    a. Implement food handling and waste management procedures to avoid creating attractants.
    b. Schedule work to avoid the nesting period when possible, especially in areas known to support high densities of listed eiders.
    c. Avoid areas with high use by listed species where possible.
    d. Facilitate coordination of work to reduce duplication of trips and efforts in the same areas.
    e. Conduct pre-construction polar bear den surveys using FLIR. Avoid construction within 1 mile of active dens.

2. Marine activities (i.e., barge transit route, support vessel route):
    a. Conduct a visual scan of the area prior to deploying any vessels or equipment. If marine mammals are in the area, then the deployment will be delayed until the marine mammals leave.
    b. If marine mammals enter the activity area during the vessel or equipment deployment, all activity near the protected species will stop and not resume until marine mammals have departed the area.

4.0 Description of the Species and Their Critical Habitat

4.1 Summary of Species Analyzed

Table 10 summarizes the listed species and critical habitat under USFWS jurisdiction that are addressed in this BA.

Table 10. Listed Species Likely to Occur in the Action Area

Species	Status	Designated Critical Habitat	Population Estimate
Northern sea otter (*Enhydra lutris kenyoni*)	Threatened	Yes	Southwest Alaska Stock: 54,771[a]
Polar bear (*Ursus maritimus*)	Threatened	Yes	Southern Beaufort Sea Stock: 907[b] Chukchi/Bering Sea Stock: 2,937[c]
Spectacled eider (*Somateria fischeri*)	Threatened	Yes	6,401 birds[d] (estimated on the Arctic Coastal Plain)
Steller's eider (*Polysticta stelleri*)	Threatened	Yes	308 birds[e] (estimated on the Arctic Coastal Plain)

Note: Action area defined in Section 3.1, *Definition of Action Area*.
[a] USFWS 2014
[b] Bromaghin, McDonald et al. 2015
[c] Regehr, Hostetter et al. 2018
[d] Dunham, Osnas et al. 2021, as referenced in USFWS 2021
[e] USFWS 2019

4.1.1 Species Considered but Not Analyzed

Though the range of short-tailed albatross (*Phoebastria albatrus*) overlaps with the action area, it has an estimated world population of 5,900 birds (USFWS 2018a) and is relatively rare in the action area. They may occasionally be observed in the Bering Sea (and one or two birds have been sighted in the Chukchi Sea (Day, Gall et al. 2013). Short-tailed albatross display tolerance for vessels at sea, sometimes following fishing vessels to forage and are seen behind ships "surfing" the wind. Primary threats identified in the recovery plan for short-tailed albatross are catastrophic changes to breeding islands (volcanic eruptions, landslides, typhoons), climate change, ocean regime shifts affecting prey, bycatch mortality related to fisheries, contamination, and ocean pollution (USFWS 2008b). Shipping is not described as a primary threat. Based on the rarity of this bird in the action area, its tolerance for ship traffic, the limited number of vessels and transits required for the Project, the Project is not expected to affect the short-tailed albatross, and this species is not analyzed in the BA.

4.2 Polar Bear

4.2.1 Population

The action area is populated by the SBS and Chukchi/Bering Sea (CBS) stocks of polar bears, which are classified as depleted under the MMPA and listed as threatened under the ESA (USFWS 2008a). Polar bears occur in low densities throughout their range, and life-history characteristics including high longevity, late maturity, and few offspring, as well as remote habitat, contribute to difficulty in obtaining accurate abundance estimates (USFWS 2021c, 2021d).

The SBS and CBS populations have experienced substantial depletion because of overharvest in the 1960s, and have since undergone periodic cycles of growth and decline (USFWS 2010b). Bromaghin, McDonald et al. (2015) estimated the SBS stock to be composed of 907 animals in 2010, based on consistent population declines since 1986 (USFWS 2017). In 2010, the USFWS reported a CBS stock population estimate of 2,000 individuals based on extrapolation of aerial survey and den detection data collected during the late 1990s; however, updated population modeling performed by Regehr et al. (2018) estimated an abundance of 2,937 bears (95% confidence interval [CI] = 1,552–5,944).

The SBS stock abundance is believed to be steadily declining because of negative impacts of sea ice loss on habitat availability and body condition (USFWS 2017). Although the CBS stock has experienced additional pressure from high harvest rates in Russia (Regehr, Hostetter et al. 2018; USFWS 2010b), recent work by Regehr, Hostetter et al. (2018) demonstrates average-to-high reproductive parameters for the CBS stock since 1986, which suggests the population may be experiencing a productive trend.

4.2.2 Distribution

Polar bears are unevenly distributed throughout the circumpolar Arctic and are most often located on the annual ice over the waters of the continental shelf where their main prey, ringed seals (*Phoca hispida*), is most abundant (Amstrup, Stirling et al. 1986; Pilfold, Derocher et al. 2012; Stirling and Derocher 2007). Polar bear distribution in most areas varies annually and seasonally with the extent of sea ice cover and availability of prey.

The SBS stock of polar bears ranges west to east along the North Slope from Point Hope, Alaska, to south of Banks Island and east of the Baillie Islands, Canada (Muto, Helker et al. 2017; Figure 6). The CBS stock is distributed on coastal areas and pack ice ranging from Chauniskaya Bay in the Eastern Siberian Sea to the Colville Delta in northeast Alaska (USFWS 2010b). Depending on annual pack ice extent, the CBS stock extends into the SBS range at its southern boundary (Garner, Knick et al. 1990). Polar bear movements throughout their range are closely linked to the annual patterns of ice formation and retreat (USFWS 2017). The SBS and CBS stocks spend most of the year (fall, winter, and spring) near the coast, then move farther offshore to pack ice during the summer (Durner, Amstrup et al. 2004).

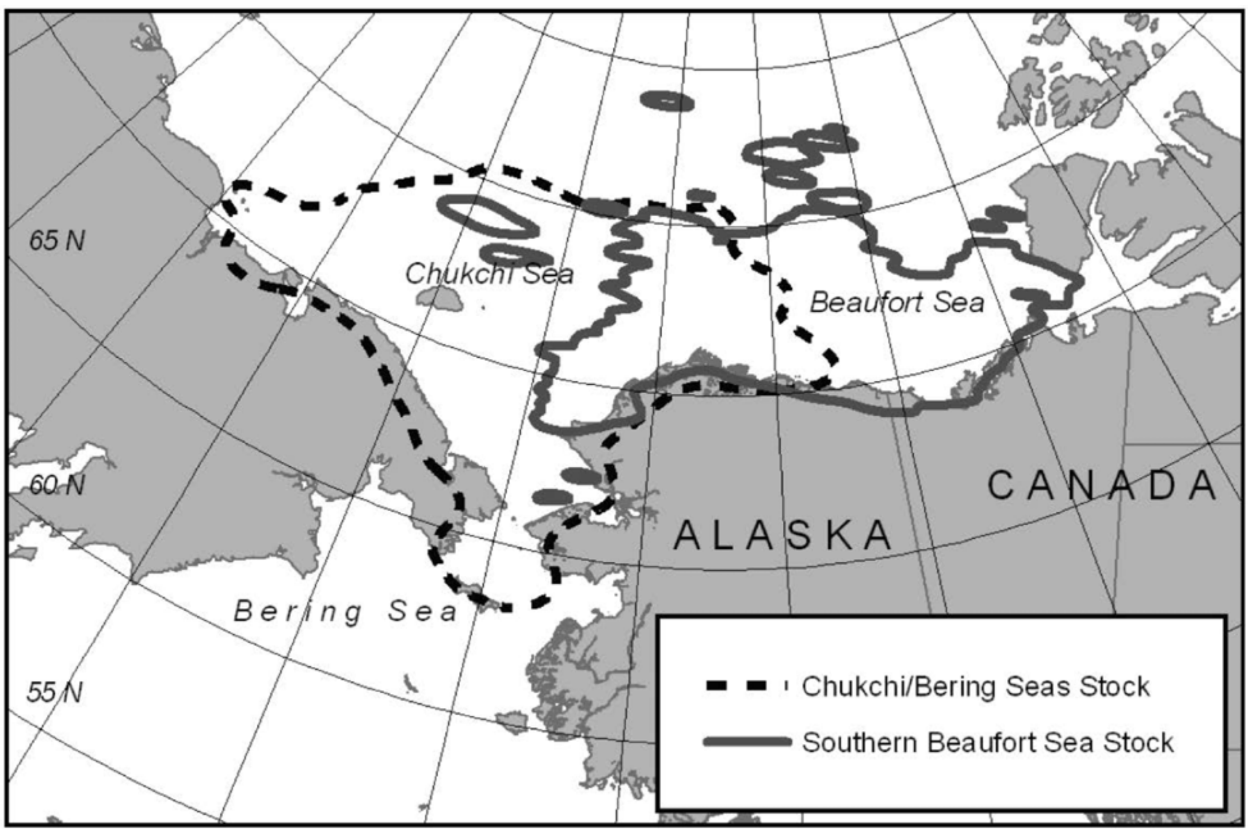


Figure 6. Distribution of the Southern Beaufort Sea and Chukchi/Bering Seas Polar Bear Populations

Source: USFWS 2010b

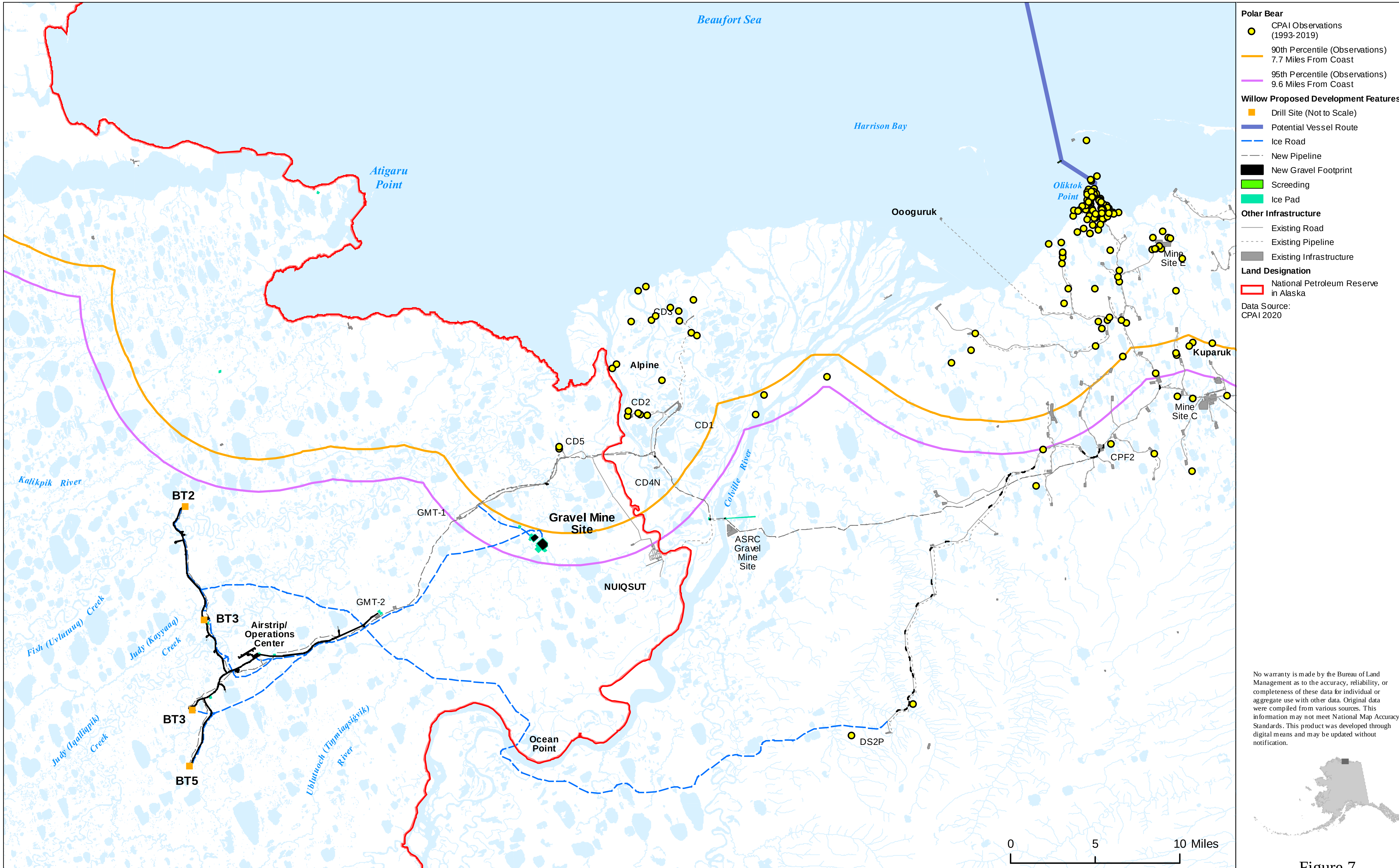

Beaufort Sea
Harrison Bay
Atigaru Point
Oliktok Point
Oooguruk
Alpine
CD2
CD3
CD1
CD5
CD4N
Kuparuk
Mine Site E
Mine Site C
CPF2
Gravel Mine Site
ASRC Gravel Mine Site
NUIQSUT
GMT-1
GMT-2
BT2
BT3
BT5
Airstrip/ Operations Center
Ocean Point
DS2P
Kalikpik River
Fish (Uvlutuuq) Creek
Judy (Kayyaaq) Creek
Judy (Iqalliqpik) Creek
Ublutuoch (Tinmiaqsiġvik) River
Colville River
0 5 10 Miles
Polar Bear
CPAI Observations (1993-2019)
90th Percentile (Observations) 7.7 Miles From Coast
95th Percentile (Observations) 9.6 Miles From Coast
Willow Proposed Development Features
Drill Site (Not to Scale)
Potential Vessel Route
Ice Road
New Pipeline
New Gravel Footprint
Screeding
Ice Pad
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Land Designation
National Petroleum Reserve in Alaska
Data Source: CPAI 2020
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 7

On the North Slope, polar bears typically use areas close to the coast, as is evidenced by the designation of terrestrial denning critical habitat within 5 miles of the coast (described further in Section 4.2.5, *Critical Habitat)*. Between Utqiaġvik and the Kavik River (east of Prudhoe Bay), 95% of dens occupied by radio-collared bears were located within 5 miles (8 km) of the coast (Durner, Douglas et al. 2009); historical reports of dens found by other methods demonstrate that some females den farther inland (Durner, Fischbach et al. 2010; Seaman 1981). Polar bear observations documented from existing CPAI operations on the North Slope from 1993 through 2019 are shown in Figure 7. The figure shows that 90% of observations were 7.7 miles from the coast (12.4 km) and 95% of observations were 9.6 miles (15.4 km) from the coast.

4.2.3 Habitat

4.2.3.1 Foraging Habitat

Polar bears are apex predators of the Arctic marine ecosystem (USFWS 2017), and most of their annual diet is composed of ringed seal, bearded seal (*Erignathus barbatus*), and spotted seal (*Phoca largha*) (Bentzen, Follmann et al. 2007). Polar bears are opportunistic feeders and generally seek out platforms of ice concentrated above 50% for hunting grounds (Bromaghin, McDonald et al. 2015). Stable isotope analyses have reported presence of bowhead whale (*Balaena mysticetus*) in polar bear diet, indicative of shore-based/scavenging dietary adaptions (Bentzen, Follmann et al. 2007).

Polar bears are opportunistic feeders and feed on a variety of other foods and carcasses including beluga whale (*Delphinapterus leucas*), Arctic cod (*Arctogadus glacialis*), Canada goose (*Branta canadensis*) and their eggs, walrus (*Odobenus rosmarus*), and bowhead whale (Derocher, Wiig et al. 2000). Lunn and Stenhouse (1985) report possible cannibalism among polar bears. Derocher, Lunn et al. (2004) and Rode et al. (2014) hypothesized that prey availability to polar bears may be altered from reduced prey abundance, changes in prey distribution, and changes in sea ice availability as a platform for hunting seals. Increasing numbers of polar bears have been observed near sites at Kaktovik and Cross Island where subsistence-harvested bowhead whale carcasses are present. These discarded whale carcasses may provide a substantial proportion of the annual energy requirements for polar bears (Schliebe, Evans et al. 2006).

4.2.3.2 Breeding and Denning Habitat

Female polar bears are sexually mature at 4 to 5 years of age, and prime reproductive age is between 5 and 20 years (USFWS 2017). Breeding takes place annually between March and June, and approximately two cubs are born mid-winter (USFWS 2017).

Pregnant females typically excavate dens in October and November in drifted snow on land, pack ice, and shorefast sea ice (Amstrup and Gardner 1994). Successful denning requires accumulation of sufficient snow for den construction and maintenance; research indicates that snowdrifts at least 4.9 feet (1.5 m) deep are necessary to successfully maintain a den throughout the denning season (Liston, Perham et al. 2016). Therefore, a key characteristic of denning habitat is a topographic feature that catches snow on the leeward side in the autumn and early winter (Durner, Amstrup et al. 2003; Liston, Perham et al. 2016). Durner, Amstrup et al. (2003) examined 22 dens on the coastal plain of northern Alaska and found the dens were located on, or associated with, pronounced landscape features that were easily distinguished from the surrounding terrain in the summer and caught snow in early winter.

Most polar bear dens in Alaska occur relatively close to the coast along the coastal bluffs and riverbanks of the mainland, on barrier islands, or on the drifting pack ice (Amstrup and Gardner 1994; Durner, Amstrup et al. 2006; Durner, Amstrup et al. 2003; Durner, Fischbach et al. 2010; Durner, Simac et al. 2013). Between Utqiaġvik (Barrow) and the Kavik River (east of Prudhoe Bay), 95% of dens occupied by radio-collared bears were located within 5 miles (8 km) of the coast (Durner, Douglas et al. 2009); historical reports of dens documented by other methods demonstrate some females den farther inland (Durner, Fischbach et al. 2010; Seaman 1981).

In the Beaufort Sea, pregnant females are faithful to substrate (e.g., pack ice, land-fast ice, land) and to the general geographic area of previous dens. Historically, approximately 50% of females denned on the pack ice (Amstrup and Gardner 1994); however, the distribution of dens in the Beaufort Sea is changing, likely in response to changing sea ice conditions. Fischbach et al. (2007) found that the proportion of dens on pack ice declined from 62% between 1985 and 1994, to 37% between 1998 and 2004, and among pack ice dens, fewer occurred in the western Beaufort Sea after 1998. Reproductive success was higher for females that denned on land, which may contribute to the increased rate of land-based denning (Rode, Olson et al. 2018). Predicted declines and large seasonal swings in habitat availability and distribution may impose greater impacts on pregnant females seeking denning habitat or leaving dens with cubs than on any other age group (Durner, Douglas et al. 2007). The location of historical dens in the action area is shown in Figure 8 (Durner, Amstrup et al. 2020; Durner, Fischbach et al. 2010).

Potential terrestrial denning habitat is defined as a topographic feature at least 4.3 feet (1.3 m) in height and having at least an 8-degree slope, which provides conditions for drifting snow (Durner, Simac et al. 2013). Potential terrestrial denning habitat has been mapped in some of the action area and is shown in Figure 8 (Blank 2012; Durner, Amstrup et al. 2001; Durner, Amstrup et al. 2003; Durner, Simac et al. 2013; USGS 2005). Much of the area in the southeast extent of Figure 8 (east of the Colville River) has not been mapped for potential terrestrial denning habitat. There are 1,785.2 acres of mapped potential terrestrial denning habitat in the action area.

4.2.4 Hearing

There is limited information on the hearing of polar bears. Using evoked auditory potentials, Nachtigall et al. (2007) measured the in-air hearing of three polar bears. Measurements were not obtainable at 1 kilohertz (kHz), and best sensitivity was found in the range from 11.2 to 22.5 kHz. Behavioral testing of hearing indicates that polar bears can hear down to at least 14 hertz (Hz) and up to 25 kHz, with the best sensitivity between 8 and 14 kHz (Owen and Bowles 2011).

4.2.5 Critical Habitat

Sea ice is a year-round critical component of polar bear habitat that provides a platform from which to hunt and feed; seek mates, breed, and den; and travel to terrestrial denning areas and/or across large swaths of area (Stirling and Derocher 1993). The USFWS designated critical habitat for polar bears along approximately 187,157 square miles (484,374 square km) of the Alaskan coast and adjacent waters, effective January 2011 (USFWS 2010a; 75 FR 76086). The ruling was litigated in 2013, but the designation was reinstated by the Ninth Circuit Court of Appeals in 2016. Polar bear dens, critical habitat, and potential terrestrial denning habitat in the onshore action area are shown in Figure 8. The U.S. Air Force Oliktok Long Range Radar Site is exempted from critical habitat designation; this includes Oliktok Dock, but not the nearshore area adjacent to the dock, where the screeding will occur.

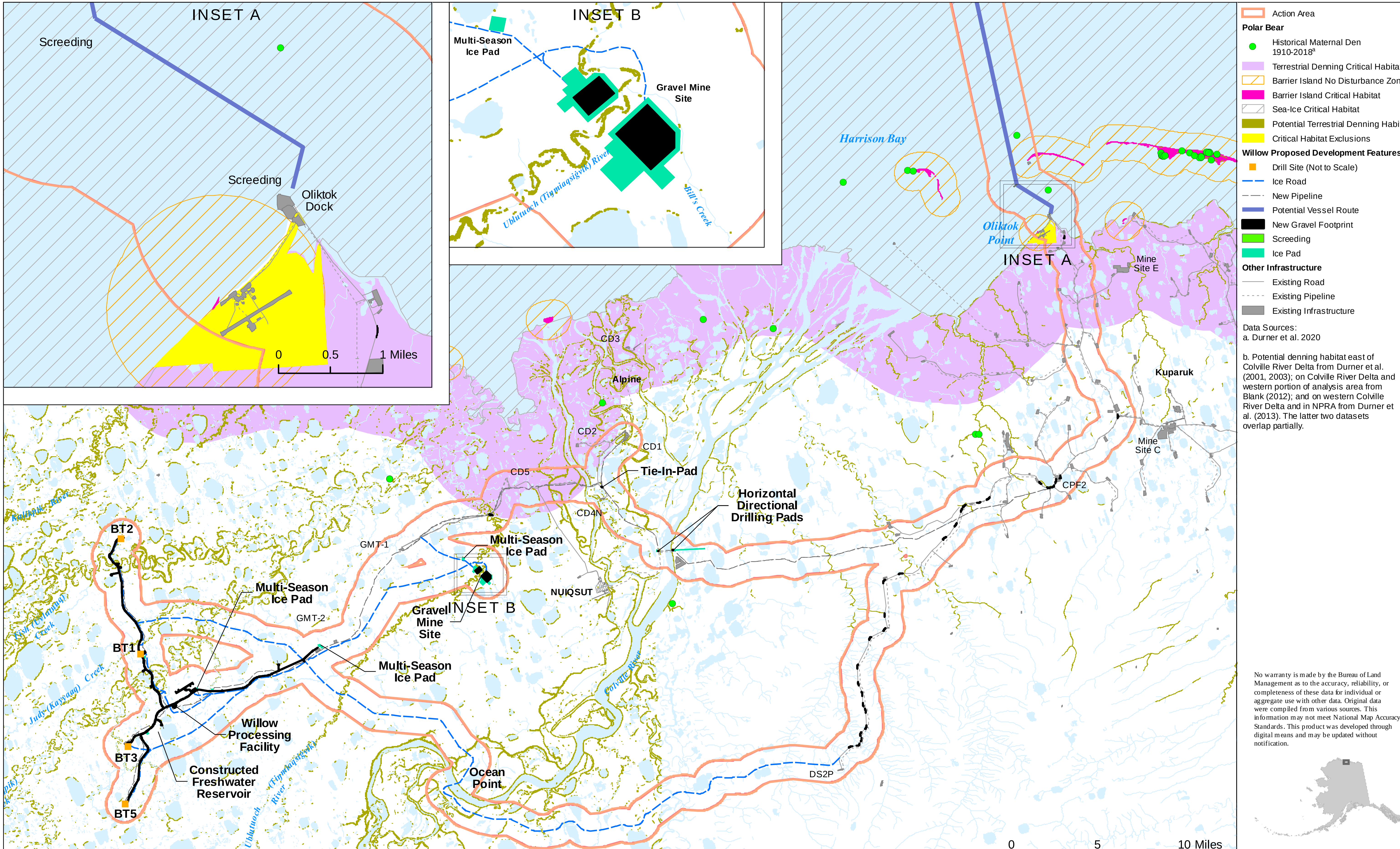

INSET A
Screeding
Screeding
Oliktok Dock
0
0.5
1 Miles
INSET B
Multi-Season Ice Pad
Gravel Mine Site
Ublutuoch (Tiŋmiaqsiġvik) River
Bill's Creek
Harrison Bay
Oliktok Point
INSET A
Mine Site E
CD3
Alpine
CD2
CD1
CD5
Tie-In-Pad
Horizontal Directional Drilling Pads
CD4N
Multi-Season Ice Pad
GMT-1
NUIQSUT
Gravel Mine Site
INSET B
Multi-Season Ice Pad
GMT-2
Multi-Season Ice Pad
BT2
BT1
BT3
BT5
Willow Processing Facility
Constructed Freshwater Reservoir
Ocean Point
DS2P
CPF2
Kuparuk
Mine Site C
Colville River
Judy (Iqalliqpik) Creek
Fish (Uvlutuuq) Creek
Kalikpik River
Ublutuoch (Tiŋmiaqsiġvik) River
0
5
10 Miles
Action Area
Polar Bear
Historical Maternal Den 1910-2018[a]
Terrestrial Denning Critical Habitat
Barrier Island No Disturbance Zone
Barrier Island Critical Habitat
Sea-Ice Critical Habitat
Potential Terrestrial Denning Habitat[b]
Critical Habitat Exclusions
Willow Proposed Development Features
Drill Site (Not to Scale)
Ice Road
New Pipeline
Potential Vessel Route
New Gravel Footprint
Screeding
Ice Pad
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Data Sources:
a. Durner et al. 2020
b. Potential denning habitat east of Colville River Delta from Durner et al. (2001, 2003); on Colville River Delta and western portion of analysis area from Blank (2012); and on western Colville River Delta and in NPRA from Durner et al. (2013). The latter two datasets overlap partially.
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 8

4.2.5.1 Primary Constituent Elements

The USFWS considers primary constituent elements (PCEs) when designating critical habitat. PCEs are characterized by "physical and biological features that are essential to the conservation of a given species and that may require special management considerations or protection" and may include 1) space for individual and population growth (normal behavior); 2) nutritional and physiological requirements (food, water, air, light, minerals, etc.); 3) cover or shelter; and 4) breeding sites (e.g., reproduction, rearing of offspring) protected from disturbance or that are of historic geographical and ecological distributions of species (50 CFR 424.12). The PCEs for polar bears are defined in 50 CFR Part 17 and result in designation of the following critical habitat units (USFWS 2010a; 75 FR 76086):

1. Unit 1: Sea Ice Critical Habitat. The sea ice habitat considered essential for polar bear conservation is located over the continental shelf at depths of 984 feet (300 m) or less. The barge route overlaps this unit (Figure 8), but the barge will transit through this area in the summer when there is no sea ice.
2. Unit 2: Terrestrial Denning Habitat Critical Habitat. Terrestrial denning habitat includes topographic features such as coastal bluffs and riverbanks, with suitable macrohabitat characteristics. Aspects of the Project overlap this unit, as shown on Figure 8. There are 1,785.2 acres of this habitat in the action area. Between the Kavik River and Utqiaġvik, terrestrial denning critical habitat occurs within 5 miles (8 km) of the mainland coast.
3. Unit 3: Barrier Island Critical Habitat. Barrier islands, coastal spits, and 1 mile (1.6 km) around these features (no-disturbance zone) make up habitat used for denning, refuge from human disturbance, and movements along the coast to access maternal denning and optimal feeding habitat. Aspects of the Project overlap this unit and the 1-mile (1.6-km) no disturbance zone buffer, as shown on Figure 8. There are 2,721.8 acres of this unit and the 1-mile (1.6-km) no disturbance zone buffer in the action area.

4.3 Northern Sea Otter

4.3.1 Population

The barge transit route originates in Dutch Harbor, Unalaska, within the range of the Southwest Alaska distinct population segment (Southwest DPS) of northern sea otters. The Southwest DPS was listed as threatened under the ESA in 2005 (USFWS 2005; 70 FR 46366, August 9, 2005) and classified as a strategic stock under the MMPA (USFWS 2014). The Southwest DPS has an estimated population size of 54,771 (USFWS 2014), and trends of decline and recovery vary across the stock's range. Overall, the stock has declined by 56% to 68% since the mid-1980s (Burn and Doroff 2005), and by 70% in the Aleutian archipelago since 1992 (Estes, Tinker et al. 2005); however, populations inhabiting the Kodiak Archipelago, eastern coast of the Alaska Peninsula (form Castle Cape to Cape Douglas), and Kamishak Bay have shown no signs of decline (Burn and Doroff 2005; USFWS 2014).

The Southwest DPS Recovery Plan was published in 2013 (USFWS 2013e), as well as a 5-year stock review in which the USFWS recommended no change in population status (USFWS [2013b, 2013d] ; 78 FR 24767). Evidence suggests that increased predation by killer whales is primarily responsible for ongoing population declines and remains a threat to the stock's recovery (Estes, Tinker et al. 2005; Estes, Tinker et al. 1998; USFWS 2013f). Although the current population size is below historic levels, the Southwest DPS is believed to have a high potential for recovery (USFWS 2013f, 2014).

4.3.2 Distribution

Northern sea otters occur in nearshore coastal waters along the U.S. north Pacific Rim from the Aleutian Islands to California (USFWS 2014). The Southwest DPS is along the western shore of lower Cook Inlet (Figure 9); throughout the Alaska Peninsula and Bristol Bay coasts; and along the Aleutian, Barren, Kodiak, and Pribilof islands (USFWS 2014).

Northern sea otters are non-migratory and occur year-round in nearshore coastal waters, typically within 131.2 feet (40 m) of depth to maintain consistent access to benthic foraging habitat (Riedman and Estes

1990). Although individuals can cover long distances, greater than (>) 160 miles (>100 km), movement is generally restricted by geography, energy requirements, and social behavior, and individuals tend to remain within a home range of less than (<) 11.6 square miles (<30 square km; Riedman and Estes 1990; Garshelis and Garshelis 1984). Sea otter movement is also affected by tidal patterns, wind patterns, and inclement weather. Storm conditions often cause otters to seek shelter in protected bays, inlets, or lees; however, in calmer conditions, otters may be sighted farther from the shore (Kenyon 1969). If transiting though open water, otters may be seen rafting together (Schneider 1976).

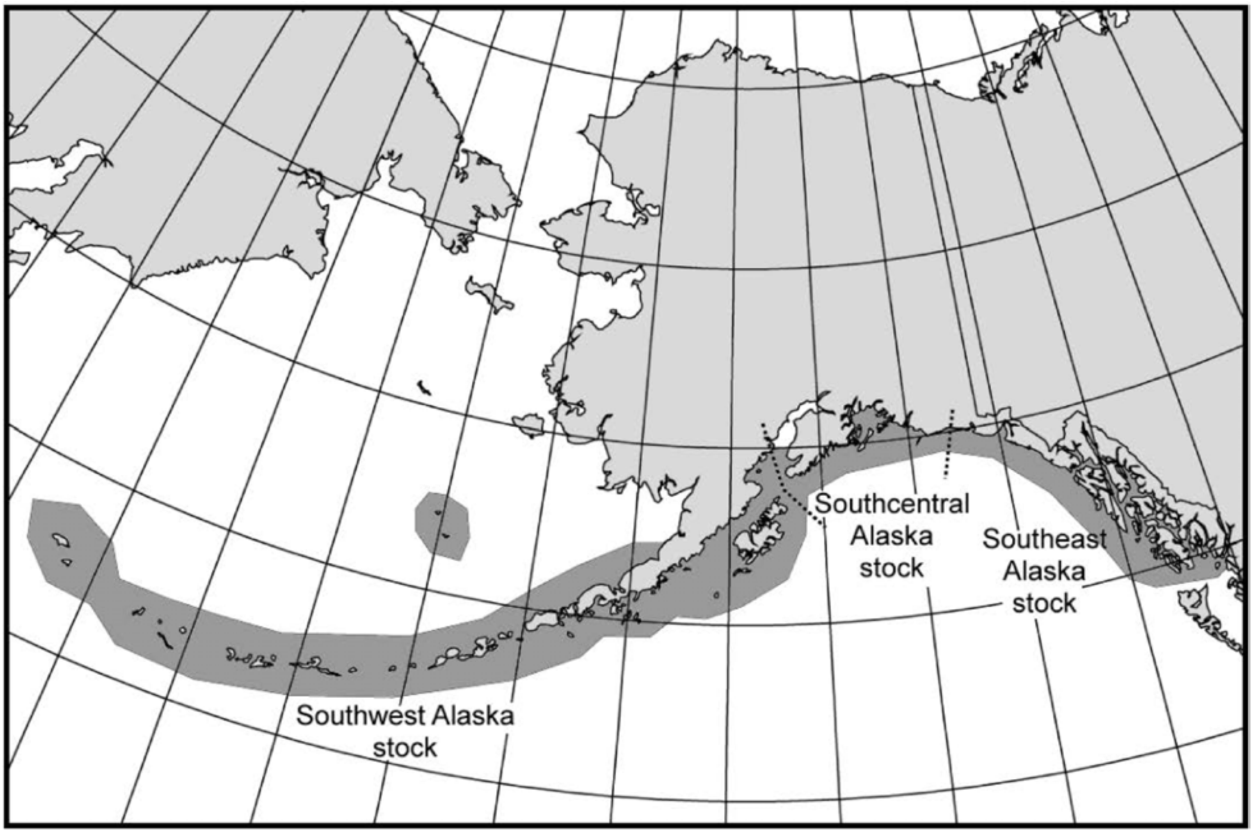


Figure 9. Northern Sea Otter Distribution in Alaska
Source: USFWS 2014

4.3.3 Habitat

4.3.3.1 Foraging Habitat

Sea otters forage in nearshore waters at depths of approximately 131.2 feet (40 m). They spend approximately 40% of their daily activity foraging, and feed primarily on benthic invertebrates. Doroff and Badajos (2010) found that Kachemak Bay sea otter diet composition consisted of approximately 41% mussels, 32% crabs, and 12% clams, and their diet was shown to shift in the fall season to include a higher proportion of mussels and clams (75% to 80% of their diet). Pacific razor clams (*Siliqua patula*) occur in intertidal zones and are found throughout Kenai Peninsula beaches. Red sea cucumbers (*Cucumaria miniate*) and sea urchins (*Strongylocentrotus* spp.), found among shell debris, are also important otter prey.

4.3.3.2 Breeding and Pupping Habitat

Sea otters maintain and defend breeding territories as a primary reproductive strategy, and attractive territories are associated with increased reproductive success (Pearson, Packard et al. 2006). Male sea otters establish breeding territories in resource-rich areas; high-quality territories generally exhibit a high ratio of shoreline edge and numerous foraging sites for females (Pearson, Packard et al. 2006). Mating occurs throughout the year, but most pups are born in springtime. Because lactation is highly energetically demanding, time rearing pups is spent in sheltered nearshore areas with readily available resources (Cortez, Goertz et al. 2016). Literature indicates that northern sea otters rely on nearshore areas for breeding and rearing pups, and positive relationships between shoreline complexity and female and pup sea otter density have been noted, which may be attributable to the high amounts of protection (USFWS 2009).

4.3.4 Hearing

Sea otters have similar hearing thresholds in-air and under water to eared seals (Family Otariidae), and the underwater audiogram shows the typical mammalian U-shape (Ghoul and Reichmuth 2014). Sea otter hearing sensitivity is similar to that of sea lions (Ghoul and Reichmuth 2014), where sea lion in-air hearing range is 0.250 to 30 kHz, with a region of best hearing sensitivity from 5 to 14.1 kHz (Mulsow and Reichmuth 2010). The range of best hearing was from 1 to 16 kHz. Higher-hearing thresholds indicating poorer sensitivity were observed for signals below 16 kHz and above 25 kHz (Kastelein, van Schie et al. 2005)).

Ghoul and Reichmuth (2016) suggest that although sea otters are adapted to an aquatic lifestyle, they retain in-air hearing sensitivity comparable to terrestrial carnivores. In-water hearing sensitivity is reduced in comparison to other amphibious marine mammals (e.g., pinnipeds), and sea otters lack the ability to detect sounds imbedded in background noise, as seen in other marine carnivores. However, additional data are needed to improve the understanding of the sea otter’s hearing ability.

4.3.5 Critical Habitat

The USFWS announced critical habitat of the northern sea otter Southwest DPS on October 8, 2009. Critical habitat includes approximately 5,855 square miles (15,164 square km), all in Alaska (USFWS 2009; 74 FR 51988). For management purposes, the USWFS designated five management units as critical habitat: 1) Western Aleutian; 2) Eastern Aleutian; 3) South Alaska Peninsula; 4) Bristol Bay; and 5) Kodiak, Kamishak, Alaska Peninsula (Figure 10). The critical habitat units are defined by the PCEs (Section 4.2.5.1, *Primary Constituent Elements*).

Critical habitat management Unit 2, Eastern Aleutian, is the only unit that overlaps the action area (Figure 10). The critical habitat defined within the unit is characterized as all the nearshore marine environment ranging from the mean high tide line to the 65.6-foot (20-m) depth contour, as well as waters occurring within 328.1 feet (100 m) of the mean high tide line (74 FR 51988).

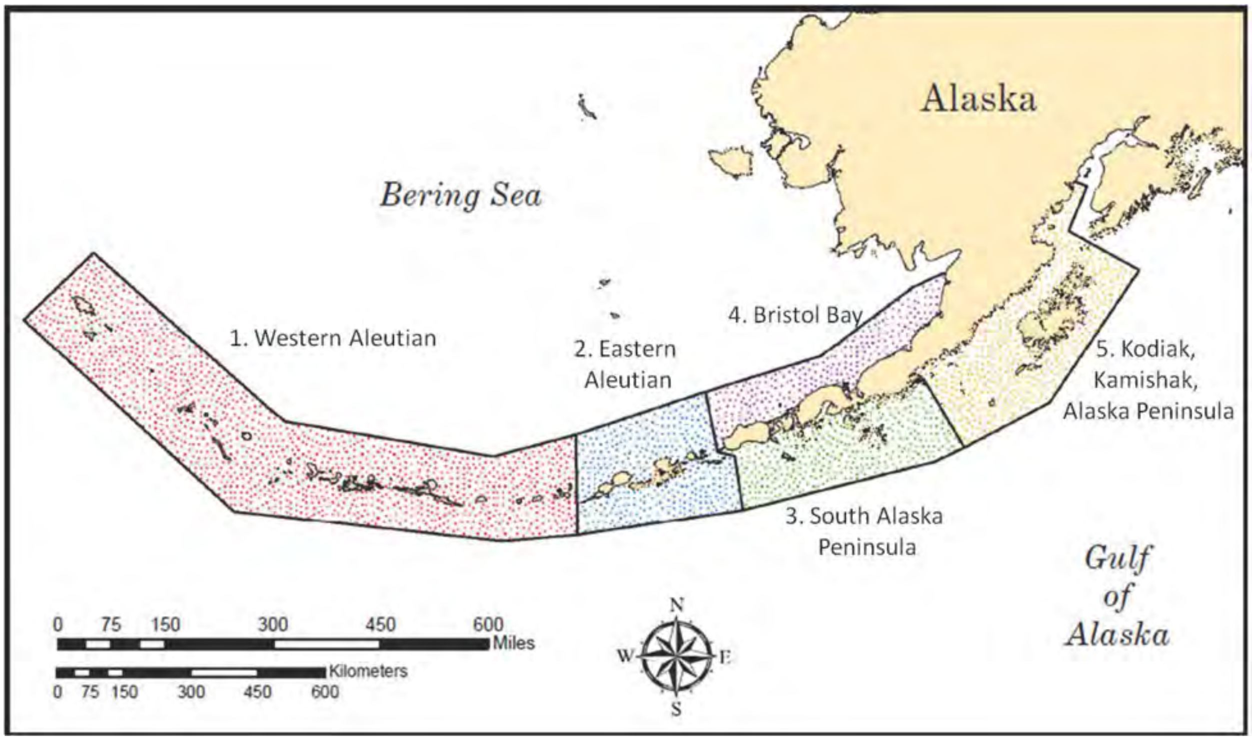


Figure 10. Designated Critical Habitat Units for the Northern Sea Otter
Source: USFWS 2009

4.3.5.1 Primary Constituent Elements

The USFWS's determination of the PCEs for the Southwest DPS of northern sea otter and the status of each PCE in the action area are listed and summarized below. Management Unit 2, Eastern Aleutian, contains all the PCEs essential for the conservation of the Southwest DPS of northern sea otter (74 FR 51988).

1. PCE 1: Shallow, rocky areas where marine predators are less likely to forage, which are waters less than 6.6 feet (2 m) in depth. PCE 1 occurs within the action area associated with the barge transit route; however, Project activities will have negligible impacts on this PCE.
2. PCE 2: Nearshore waters that may provide protection or escape from marine predators, which are those within 328 feet (100 m) from the mean high tide line. PCE 2 occurs within the action area associated with the barge transit route; however, Project activities will have negligible impacts on this PCE.
3. PCE 3: Kelp forests that provide protection from marine predators, which occur in waters less than 65.6 feet (20 m) in depth. PCE 3 occurs within the action area associated with the barge transit route; however, Project activities will have negligible impacts on this PCE.
4. PCE 4: Prey resources within the areas identified by PCEs 1, 2, and 3 that are present in sufficient quantity to support the energetic requirements of the species. PCE 4 occurs within the action area associated with the barge transit route; however, Project activities will have negligible impacts on this PCE.

4.4 Spectacled Eider

4.4.1 Population

The three primary spectacled eider breeding populations are in 1) northern Alaska on the ACP, 2) western Alaska on the Yukon-Kuskokwim Delta, and 3) eastern Russia (Figure 11). The spectacled eider was listed as a threatened species under the ESA in May 1993 (58 FR 27474). The listing was prompted by declines in the western Alaska breeding population and indications of a decline on the North Slope. The spectacled eider is also protected under the Migratory Bird Treaty Act of 1918.

The entire world population of spectacled eiders is believed to winter in the Bering Sea south of Saint Lawrence Island (Figure 11) (Petersen, Larned et al. 1999). Total estimates of 363,030 in 1997 (Larned and Tiplady 1997) and 374,792 in 1998 (Larned and Tiplady 1999) are similar to estimates of 369,122 in 2010, indicating a stable global population over this 14-year period (Larned, Bollinger et al. 2012). A lower estimate of 305,261 in 2009 was discounted because satellite telemetry data showed movements north of the survey area at the time of the survey.

Annual estimates of pre-breeding spectacled eiders from aerial surveys of the entire ACP (Figure 13) are highly variable, obscuring any definitive trends (Larned, Stehn et al. 2012). USFWS estimates the current abundance of the ACP breeding population to be more than 3,500 individuals (USFWS 2021e). Based on aerial survey data collected during 2007–2019 and using a space-state model that accounted for annual variation in detection, Dunham et al. (2021) estimated the mean abundance estimate of spectacled eiders breeding on the ACP to be 6,401 birds (95% CRI: 3,766–9,750). Using the same aerial survey data, two other recent analyses (Amundson, Flint et al. 2019; USFWS 2021e) estimate the current breeding population to be 5,408 and 5,244 eiders, respectively. The growth rate for spectacled eiders on the ACP has been stable to decreasing since annual aerial surveys began in 1992. The long-term average growth rate was most recently estimated to be 0.995 (95% CI: 0.982–1.008) using a population viability analysis derived from an integrated population model (IPM-PVA; USFWS 2021); however, this estimate was not significantly different from equilibrium (1.0). Dunham et al (2021) also estimated that the population growth rate of the ACP population during 2007–2019 was not statistically different from constant (rate = -0.005; 95% CRI: -0.092–0.082). ABR estimated that the growth rate of spectacled eiders in the northeastern NPR-A during 2006–2020 was 1.02, and also not statistically significant ($P = 0.60$ [Shook, Parrett et al. 2020]). The surveys in the northeastern NPR-A included most of the Willow area and all of the Greater Mooses Tooth and CD-5 areas (Figure 13). Surveys from 2017–2019 in the Willow area were not included in the growth rate estimate for the northeast NPR-A because the densities in the Willow study area were low and could negatively bias the estimate. Within the adjacent CRD study area, data from 28 years of surveys showed a positive growth rate of 1.014, which likewise was not statistically significant (R2 = 0.007, P = 0.28) (Parrett, Obritschkewitsch et al. 2022).

Spectacled eiders arrive on the ACP breeding grounds in late May to early June. Numbers of breeding pairs peak in mid-June and decline 4 to 5 days later when males begin to depart from the breeding grounds (Anderson and Cooper 1994; Anderson, Stickney et al. 1995; Bart and Earnst 2005; Smith, Byrne et al. 1994). Mean clutch size reported from studies on the CRD were 4.3 (Bart and Earnst 2005) and 4.1 (Johnson, Shook et al. 2018). Clutch size near Utqiaġvik has averaged 4.1 ±0.4 to 5.1 ± 0.3 eggs during 2013–2019 (Graff 2016, 2018, 2021; Safine 2015). The incubation period averages 22 to 24 days (in Petersen, Grand et al. 2000), and hatching occurs from late June to late July (Graff 2016; Seiser and Johnson 2018; Warnock and Troy 1992). Young fledge (become flight capable) approximately 50 to 55 days after hatching, and females with broods move from freshwater to marine habitats just prior to or after fledging (Safine 2011).

Figure 11. Spectacled Eider Distribution in Alaska and Russia
Source: USFWS 2013b
Notes: Breeding (nesting) areas (red) are used May through September. Molting areas (green) are used July through October. Wintering area (yellow) is used October through April. The full extent of molting and wintering areas is not known and may extend beyond the boundaries shown.

Nest success for spectacled eider is highly variable and greatly influenced by predators. In arctic Russia, apparent nest success ranged from <2% to 27%, with predation by foxes, gulls, and jaegers believed to be the causes of failure (Pearce, Esler et al. 1998; Solovyeva, Vartanyan et al. 2018). The same predators take eider and other waterbird nests on the ACP, with the addition of snowy owl (*Bubo scandiacus*), bald eagle (*Haliaeetus leucocephalus*), golden eagle (*Aquila chrysaetos*), brown bear (*Ursus arctos*), wolverine (*Gulo gulo*), and common raven (*Corvus corax*) (Johnson, Parrett et al. 2015; Johnson, Wildman et al. 2008; Petersen, Grand et al. 2000; Safine 2013). Apparent nesting success for spectacled eiders in 1991 (Prudhoe Bay), from 1993 to 1995 and from 2005 to 2007 (CRD), and from 1993 to 2019 (Kuparuk) averaged 25%, 39%, and 38%, respectively (Attanas and Shook 2020; Johnson, Parrett et al. 2008; Warnock and Troy 1992). The highest apparent nesting success reported in oil fields was 92% in 2005 in the Kuparuk oil field following a winter of fox trapping (Anderson, Ritchie et al. 2005). Nest survival probability (including laying and incubation) for spectacled eiders in the study area near

Utqiaġvik, where arctic fox (*Alopex lagopus*) control was conducted, was 19% to 72% from 2009 to 2019 (Graff 2016, 2018, 2021; Safine 2011, 2012, 2013, 2015).

Fledging success is likewise variable, affected by predation pressure and relative size (mass) of ducklings. Brood survival (probability that at least one duckling will fledge from a brood) in the Utqiaġvik study area averaged 76% (95% CRI: 63%–82%; Rizzolo 2020) during 2011–2012. On the Yukon-Kuskokwim Delta, brood survival averaged 55%at the Kashunuk River site and 85% at the Kigigak Island site (Flint, Grand et al. 2016). Duckling survival (the proportion of hatched young that survive until 30 days post-hatch) averaged 45% at the Kashunuk River and 67% at Kigigak Island (Flint, Grand et al. 2016). Duckling survival was positively correlated to duckling mass, indicating duckling survival was influenced by habitat quality as well as predation (Flint, Morse et al. 2006).

4.4.2 Distribution

The spectacled eider breeds primarily along coastal areas of western and northern Alaska and eastern Russia, and winters in the Bering Sea (Petersen, Grand et al. 2000; USFWS 2021e) (Figure 11). Pre-breeding aerial surveys on the ACP between 1992 and 2016 (ACP Aerial Waterbird Population Survey) indicate that the highest concentrations of spectacled eiders during pre-breeding and breeding occur in coastal regions, within approximately 60 miles (100 km) of the coast between Admiralty Bay and Wainwright, and northwest and northeast of Teshekpuk Lake (Amundson, Flint et al. 2019) (Figure 12).

The density of pre-nesting spectacled eiders in ABR’s northeastern NPR-A study area, which includes the Willow study area, has been consistently low (Figure 13).During 1999–2014, the mean density was 0.10 birds per square mile (0.04 indicated birds per square km) (Johnson, Parrett et al. 2015). More recently, in ABR’s Willow and Greater Mooses Tooth study areas (smaller study areas within ABR’s northeastern NPR-A study area), pre-nesting spectacled eiders occur in even lower densities than in the entire northeastern NPR-A study area. Surveys conducted in the Willow and Greater Mooses Tooth areas (at 50% coverage) during 2017–2021 (Figure 13) estimated a mean indicated total density of 0.024 birds per square mile (0.007 birds per square km) (Rozell, Obritschkewitsch et al. 2022). The long-term mean density of ABR’s Willow and northeastern NPR-A study areas combined is 0.07 indicated birds per square mile (0.03 indicated birds per square km). The density of spectacled eiders from the combined Willow and northeastern NPR-A surveys is approximately 5% to 25% of densities found on the CRD study area (Parrett, Obritschkewitsch et al. 2022) and the entire ACP. USFWS aerial surveys of the ACP exhibit similarly low densities in the Willow area relative to coastal areas to the north and east (Amundson, Flint et al. 2019). Spectacled eiders may nest in low numbers in appropriate habitat within the Willow area. Three spectacled eider nests were found in a wetland approximately 5 miles (8 km) northeast of BT2 (Figure 14) during ground-based nest surveys in 2001 (Burgess, Johnson et al. 2002). No spectacled eider nests were found during ground-based nest searches of the Willow area in 2020 or 2021 (Attanas, Orion et al. 2022; Rozell, Obritschkewitsch et al. 2022). Data from both ABR and ACP Aerial Waterbird Population surveys suggest that spectacled eiders nest in higher densities near the coast (Amundson, Flint et al. 2019; Parrett, Obritschkewitsch et al. 2022), and several nests have been found annually in or near the action area along the existing Kuparuk road system (Figure 15) (Attanas and Shook 2020; Morgan and Attanas 2016, 2018; Stickney, Attanas et al. 2015).

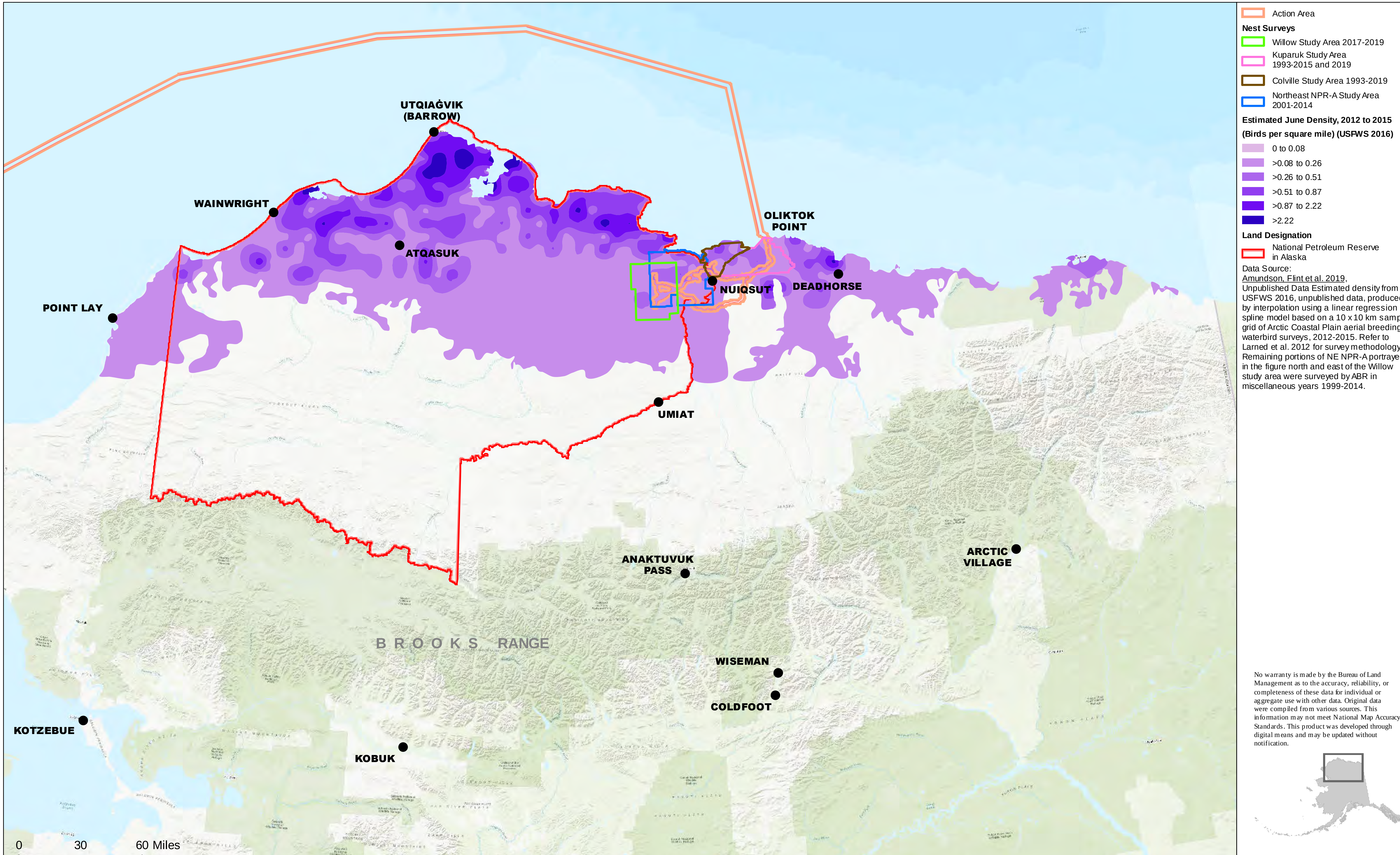

UTQIAĠVIK (BARROW)
WAINWRIGHT
ATQASUK
POINT LAY
OLIKTOK POINT
NUIQSUT
DEADHORSE
UMIAT
ANAKTUVUK PASS
ARCTIC VILLAGE
B R O O K S RANGE
WISEMAN
COLDFOOT
KOTZEBUE
KOBUK
0 30 60 Miles
Action Area
Nest Surveys
Willow Study Area 2017-2019
Kuparuk Study Area 1993-2015 and 2019
Colville Study Area 1993-2019
Northeast NPR-A Study Area 2001-2014
Estimated June Density, 2012 to 2015
(Birds per square mile) (USFWS 2016)
0 to 0.08
>0.08 to 0.26
>0.26 to 0.51
>0.51 to 0.87
>0.87 to 2.22
>2.22
Land Designation
National Petroleum Reserve in Alaska
Data Source:
Amundson, Flint et al. 2019, Unpublished Data Estimated density from USFWS 2016, unpublished data, produced by interpolation using a linear regression spline model based on a 10 x 10 km sample grid of Arctic Coastal Plain aerial breeding waterbird surveys, 2012-2015. Refer to Larned et al. 2012 for survey methodology. Remaining portions of NE NPR-A portrayed in the figure north and east of the Willow study area were surveyed by ABR in miscellaneous years 1999-2014.
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 12

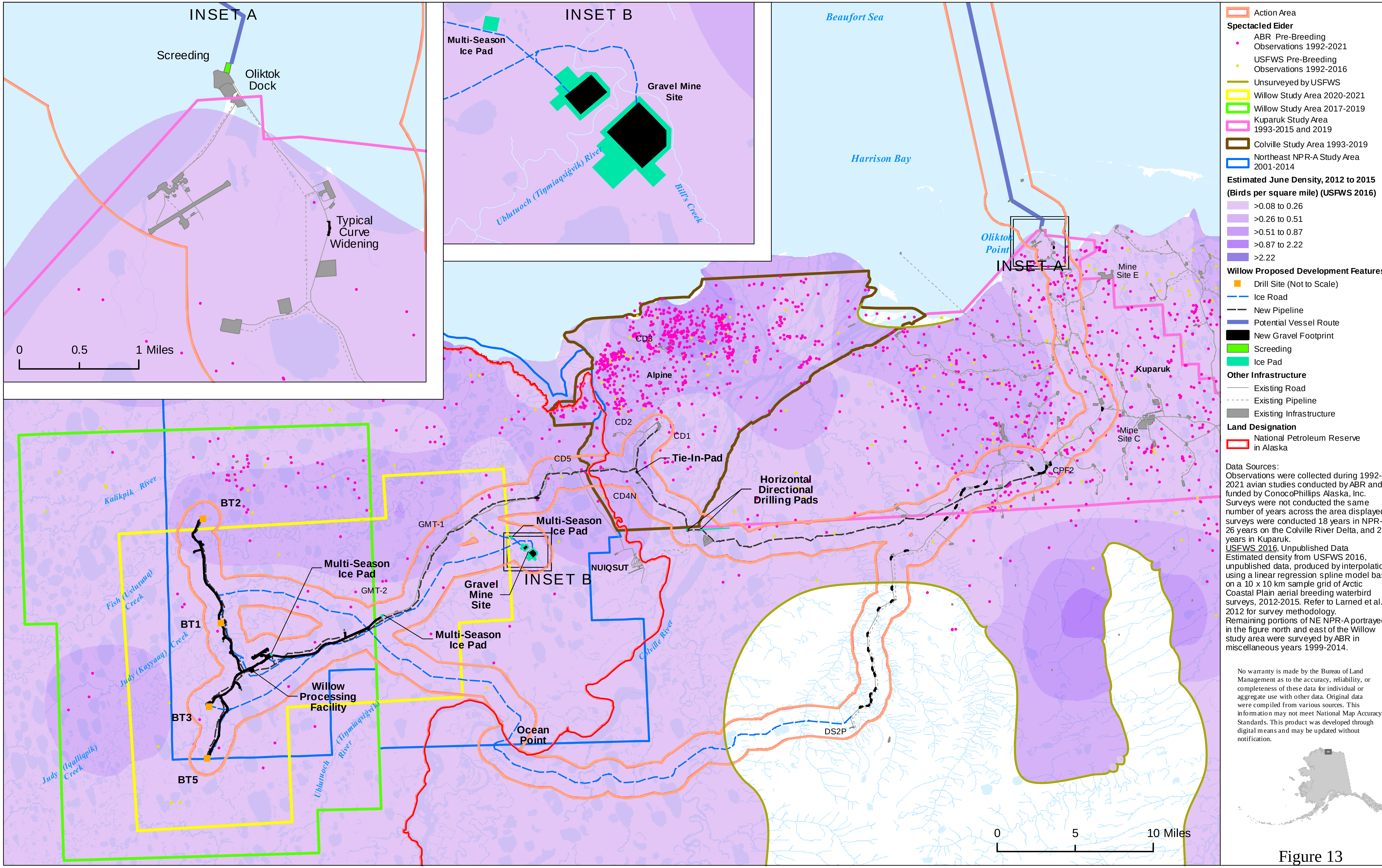

INSET A
Screeding
Oliktok Dock
Typical Curve Widening
0 0.5 1 Miles
INSET B
Multi-Season Ice Pad
Gravel Mine Site
Ublutuoch (Tinmiaqsiġvik) River
Bill's Creek
Beaufort Sea
Harrison Bay
Oliktok Point
INSET A
Mine Site E
Kuparuk
Mine Site C
CPF2
CD3
Alpine
CD2
CD1
CD5
Tie-In-Pad
Horizontal Directional Drilling Pads
CD4N
NUIQSUT
Colville River
GMT-1
Multi-Season Ice Pad
INSET B
Gravel Mine Site
GMT-2
Multi-Season Ice Pad
Multi-Season Ice Pad
Willow Processing Facility
Ocean Point
DS2P
BT2
BT1
BT3
BT5
Kalikpik River
Fish (Uvlutuuq) Creek
Judy (Kayyaaq) Creek
Judy (Iqalliqpik) Creek
Ublutuoch (Tinmiaqsiġvik) River
0 5 10 Miles
Action Area
Spectacled Eider
ABR Pre-Breeding Observations 1992-2021
USFWS Pre-Breeding Observations 1992-2016
Unsurveyed by USFWS
Willow Study Area 2020-2021
Willow Study Area 2017-2019
Kuparuk Study Area 1993-2015 and 2019
Colville Study Area 1993-2019
Northeast NPR-A Study Area 2001-2014
Estimated June Density, 2012 to 2015 (Birds per square mile) (USFWS 2016)
>0.08 to 0.26
>0.26 to 0.51
>0.51 to 0.87
>0.87 to 2.22
>2.22
Willow Proposed Development Features
Drill Site (Not to Scale)
Ice Road
New Pipeline
Potential Vessel Route
New Gravel Footprint
Screeding
Ice Pad
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Land Designation
National Petroleum Reserve in Alaska
Data Sources:
Observations were collected during 1992-2021 avian studies conducted by ABR and funded by ConocoPhillips Alaska, Inc. Surveys were not conducted the same number of years across the area displayed; surveys were conducted 18 years in NPR-A, 26 years on the Colville River Delta, and 24 years in Kuparuk.
USFWS 2016, Unpublished Data
Estimated density from USFWS 2016, unpublished data, produced by interpolation using a linear regression spline model based on a 10 x 10 km sample grid of Arctic Coastal Plain aerial breeding waterbird surveys, 2012-2015. Refer to Larned et al. 2012 for survey methodology.
Remaining portions of NE NPR-A portrayed in the figure north and east of the Willow study area were surveyed by ABR in miscellaneous years 1999-2014.
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Figure 13

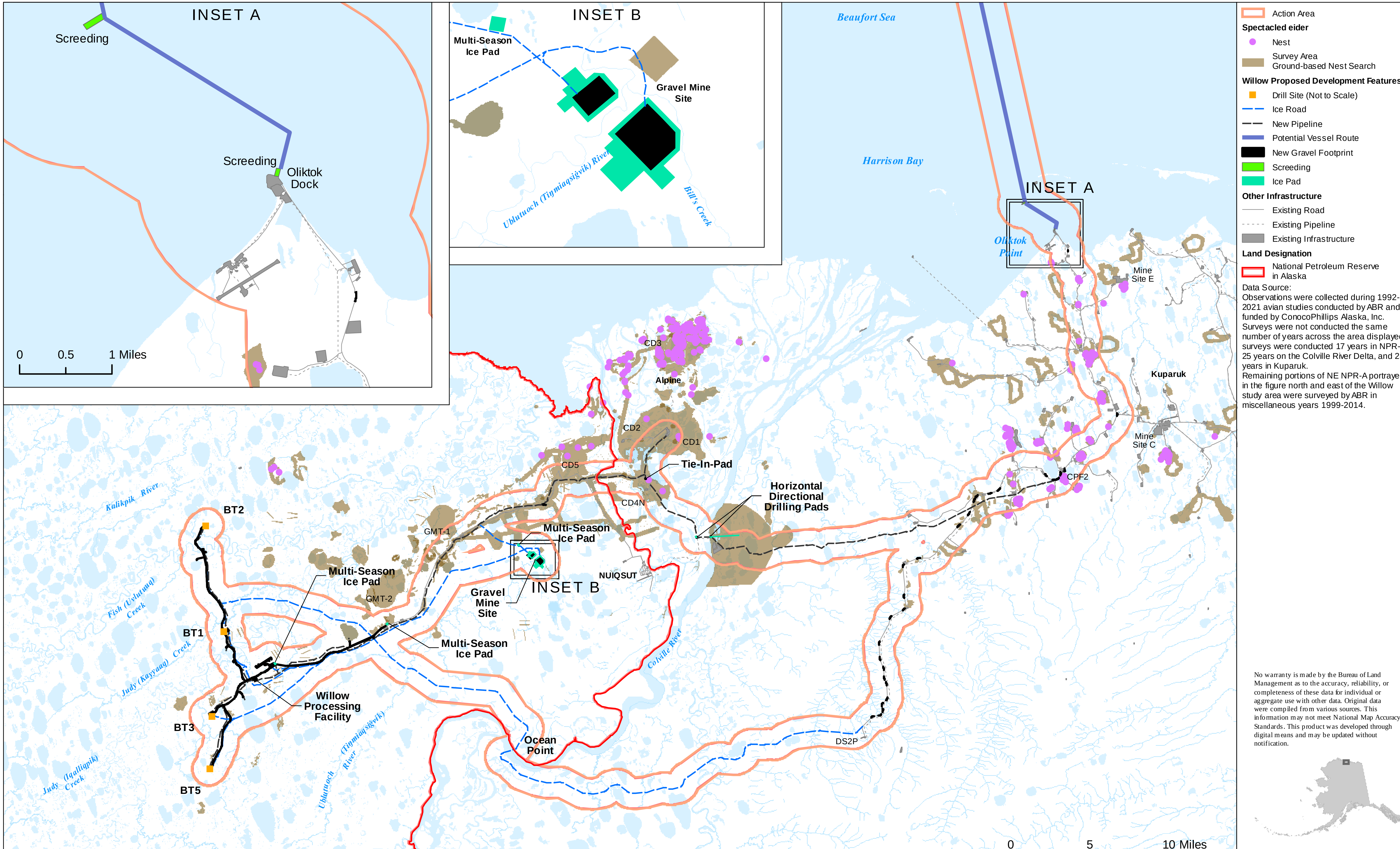
INSET A
Screeding
Screeding
Oliktok Dock
0 0.5 1 Miles
INSET B
Multi-Season Ice Pad
Gravel Mine Site
Ublutuoch (Tinmiaqsiġvik) River
Bill's Creek
Beaufort Sea
Harrison Bay
INSET A
Oliktok Point
Mine Site E
CD3
Alpine
CD2
CD1
CD5
Tie-In-Pad
Horizontal Directional Drilling Pads
CD4N
Kuparuk
Mine Site C
CPF2
Kalikpik River
BT2
GMT-1
Multi-Season Ice Pad
Multi-Season Ice Pad
GMT-2
NUIQSUT
INSET B
Gravel Mine Site
Fish (Uvlutuuq) Creek
BT1
Judy (Kayyaaq) Creek
Multi-Season Ice Pad
Colville River
Willow Processing Facility
BT3
Ocean Point
DS2P
Judy (Iqalliqpik) Creek
Ublutuoch (Tinmiaqsiġvik) River
BT5
0 5 10 Miles
Action Area
Spectacled eider
Nest
Survey Area Ground-based Nest Search
Willow Proposed Development Features
Drill Site (Not to Scale)
Ice Road
New Pipeline
Potential Vessel Route
New Gravel Footprint
Screeding
Ice Pad
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Land Designation
National Petroleum Reserve in Alaska
Data Source:
Observations were collected during 1992-2021 avian studies conducted by ABR and funded by ConocoPhillips Alaska, Inc. Surveys were not conducted the same number of years across the area displayed; surveys were conducted 17 years in NPR-A, 25 years on the Colville River Delta, and 24 years in Kuparuk.
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Figure 14

4.4.2.1 Migratory Timing

Sexson, Pearce et al. (2014) used satellite telemetry data to map important at-sea areas connecting migratory pathways for spectacled eiders captured on breeding areas in western and northern Alaska. They determined that there were seven spatially important areas (Figure 15), five of which occur in Alaska and are as follows:

1. The western Beaufort Sea within approximately 18.6 miles (30 km) of the coast of northern Alaska and the coast between Point Barrow and the Sagavanirktok River Delta
2. The eastern Chukchi Sea within approximately 43.5 miles (70 km) of the coast of northern Alaska and the coast between southern Ledyard Bay and Point Barrow
3. Eastern and southern Norton Sound in the northeastern Bering Sea within approximately 37.2 miles (60 km) of Shaktoolik Bay and the Yukon River Delta, Alaska, respectively
4. The Yukon-Kuskokwim Delta and adjacent marine areas within approximately 12.4 miles (20 km) of the coast of western Alaska between Scammon Bay and Nelson Island
5. The northern Bering Sea within approximately 124.3 miles (200 km) of the southern coast of Saint Lawrence Island, Alaska, and coastal areas near Southeast Cape, Saint Lawrence Island

Spectacled eiders depart the wintering area south of Saint Lawrence Island in April, either flying directly to one of the three primary breeding areas or through the western Bering Strait, eastern Chukchi Sea, East Siberian Sea, or Norton Sound (Sexson, Pearce et al. 2014). Spectacled eiders arrive on the ACP in late May through mid-June (Petersen, Grand et al. 2000; Sexson, Pearce et al. 2014). Based on satellite telemetry, it appears that pre- and post-breeding spectacled eiders migrated over water or followed coastlines.

After nest initiation (early June to late June, depending on location), most males depart for molting areas in marine waters in the east Chukchi Sea, whereas some use open water in the Beaufort Sea (Sexson, Pearce et al. 2014) and marine water near river deltas for up to 30 days before moving west to the Chukchi Sea (Sexson, Pearce et al. 2014; Troy 2003). Approximately 50 days after hatch (hatch is late June to late July depending on location and seasonal phenology), young fledge and females with broods move to marine habitats (Sexson, Pearce et al. 2014). Females that fail at nesting may migrate in June, whereas successful females and offspring move offshore in early September and arrive at post-breeding areas in September and October (Sexson, Pearce et al. 2014). Adult females arrive and depart 1 to 2 weeks earlier than hatch year birds. All adult spectacled eiders stayed in post-breeding or molting areas through October before leaving for the wintering area south of Saint Lawrence Island.

From July to late November, spectacled eiders molt in several distinct areas along Alaska’s western coast and in coastal Russia (Figure 11). In Alaska, late summer and fall molting and staging areas have been identified in eastern Norton Sound (northern Bering Sea) and Ledyard Bay (eastern Chukchi Sea) (Petersen, Grand et al. 2000). Alaska breeding birds also migrate to post-breeding/molting areas in the western Bering Strait and East Siberian Sea (Sexson, Pearce et al. 2014). Since the 1990s, eastward shifts in the core molting areas have been observed within the Indirka/Kolyma deltas, Mechigmenshiv Bay, and Norton Sound molting grounds, and a northward shift in the core molting area has been observed in Ledyard Bay (Sexson, Petersen et al. 2016). The exact causes of these shifts are unknown, but Sexson, Petersen et al. (2016) suggest that these changes in distribution are indicators of a changing ecosystem.

Data from the 1990s indicated that spectacled eiders migrated in October and November after molting and all three breeding populations spent the winter approximately 43 miles (70 km) southwest of Saint Lawrence Island in the Bering Sea (Figure 11) (Petersen, Grand et al. 2000), where they remained in large flocks in polynyas until the period between early March and early May (Sexson, Pearce et al. 2014). Satellite transmitter data from 2008–2010 also indicated that spectacled eiders wintered in the same area as they did during the 1990s, even when sea ice was not fully developed (USFWS 2021e).

More recent satellite transmitter data from 2018–2020 suggest that the winter distribution of spectacled eiders is changing, probably due to increased sea ice extent in the Bering Sea during late winter (USFWS 2021e). Wintering eiders seemed to exhibit three distribution patterns in late winter. Some tagged eiders remained in the 1990s wintering area southwest of St. Lawrence Island, while others moved closer to the southern coast of St. Lawrence Island and still others moved northwest of St. Lawrence Island as far as the Chukotka coast. These northward movements occurred during periods of northward sea ice retreat, the result of persistent southerly winds. Northward ice retreat happened earlier than it had during winters in the 1990s and 2008–2010. During the winter of 2020, sea ice conditions were more consistent in the northern Bering Sea, and both satellite data and aerial survey data showed that wintering spectacled eiders remained south of St. Lawrence Island until March. Sea ice conditions in the wintering area southwest of St. Lawrence Island appear to be more variable in recent years than they were during the 1990s and 2000s and appear to play a role in spectacled eider distribution and movements during the winter months.

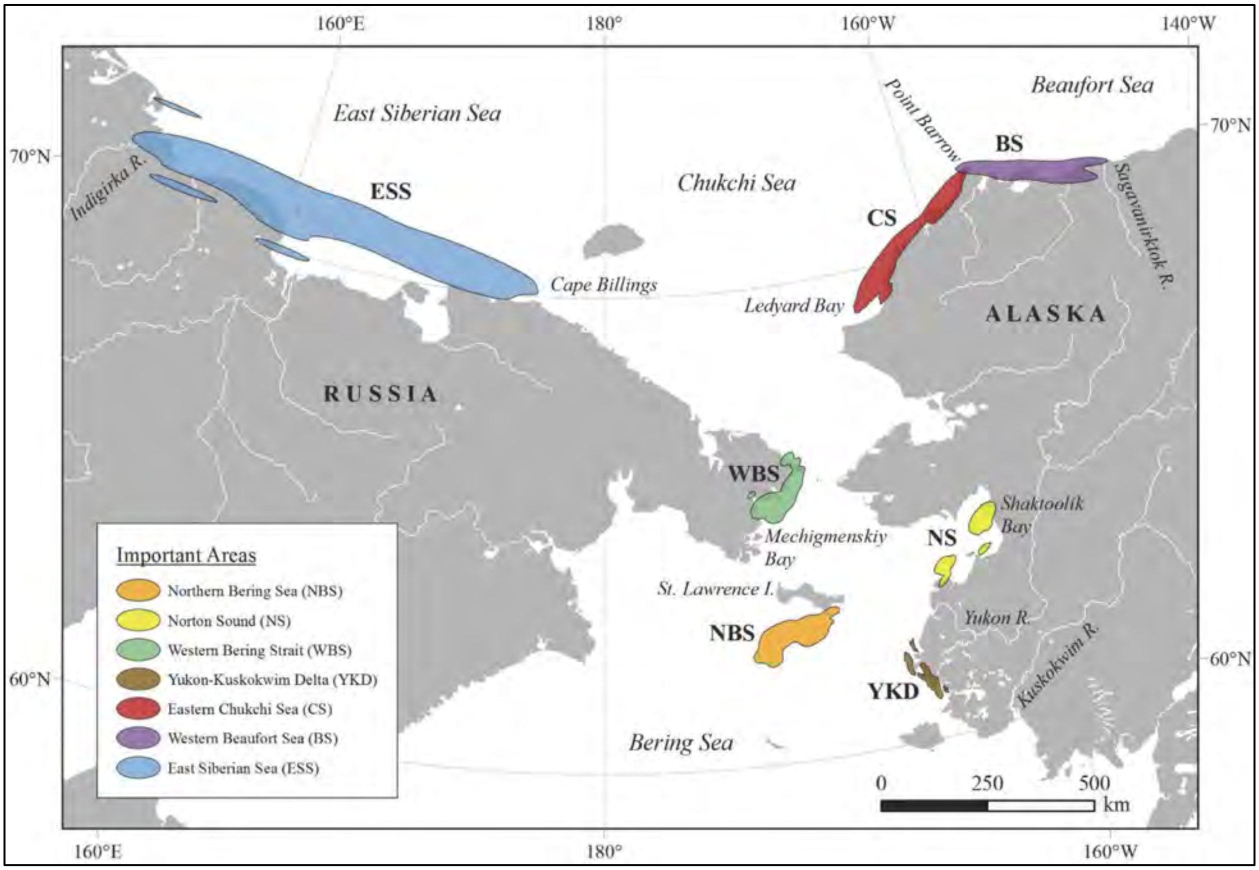


Figure 15. Important At-Sea Areas Used by Spectacled Eiders with Satellite Transmitters that Provided Data from 2008 to 2012

Source: Sexson, Pearce et al. 2014

4.4.3 Habitat

4.4.3.1 Foraging Habitat

Spectacled eiders spend most of the year in marine waters where they feed on benthic invertebrates, primarily clams (USFWS 2021e). On the ACP, adults and ducklings feed on invertebrates and seeds in tundra ponds (Petersen, Grand et al. 2000). During the winter season, in the relatively shallow waters of the Bering Sea, hundreds of thousands of spectacled eiders rest and feed, diving up to 229.6 feet (70 m) to eat bivalves, mollusks, and crustaceans (Lovvorn, Richman et al. 2003).

Climatic regime shifts that alter the abundance and distribution of marine benthic invertebrates in the Bering Sea will have implications for spectacled eiders wintering in this area (Lovvorn, Richman et al. 2003). As the Bering Sea warms, the ecosystem is shifting from one characterized by cold water temperatures and high benthic biomass to one characterized by warmer water temperatures and higher pelagic, rather than benthic, biomass (Grebmeier 2012; Grebmeier, Overland et al. 2006). There also is potential for climate-induced changes to the physical characteristics and biotic communities of brood-rearing ponds in breeding areas on the ACP and in Arctic Russia (USFWS 2022). Tundra ponds and lakes are draining due to permafrost thaw or increased evaporation and evapotranspiration during longer ice-free periods (USFWS 2022). Changes in weather and precipitation patterns could affect the availability of alternative prey such as lemmings or affect the energy requirements, reproductive effort, and success of breeding eiders (USFWS 2022). The ultimate effects of climate change on spectacled eiders and their critical habitat remain unclear, though species with smaller populations are more vulnerable to the impacts of environmental change (USFWS 2022).

4.4.3.2 Breeding and Nesting Habitat

As open water becomes available in spring, breeding pairs move to nesting areas on wet coastal tundra (USFWS 2021e). In general, spectacled eiders on the ACP nest in wet sedge meadows (patterned and nonpatterned) and polygonal areas near shallow or deep lakes or in basin wetland complexes, often with convoluted shorelines and/or small islands (Anderson, Johnson et al. 1999; Attanas and Shook 2020; Johnson, Parrett et al. 2008; Johnson, Shook et al. 2018). Nest sites are often located within 3 feet of a lake or pond on the CRD (Johnson, Burgess et al. 1996); nests in the northeast NPR-A study area averaged 92 feet (28 m) (n = 10 nests) and nests on the CRD averaged 138 feet (42 m) (n = 137 nests) from waterbodies (ABR 2017). During the 27 years of monitoring in the Kuparuk oilfield, spectacled eider nests averaged 31.8 ± 4.6 feet (9.7 ± 1.4 m) (n = 258 nests) from waterbodies (Attanas and Shook 2020). Female spectacled eiders in Alaska exhibit high inter-annual nest area fidelity with >90% of marked birds returning within 6 miles (10 km) of the initial nest site (Sexson, Pearce et al. 2014). Males showed no nest area fidelity (0 of 5 males returned). Following hatch, broods move from nests to deep, freshwater ponds with emergent vegetation or shallow wetlands that are usually near the nest site (Safine 2013). In Utqiaġvik, spectacled eider females moved their broods 0.35 ± 0.12 mile (565 ± 191 m; mean ± standard error [SE], sample size [n] = 7) and 0.31 ± 0.14 mile (500 ± 223 m, n = 7) from the nest to first observation of a brood and moved a mean maximal distance of 1.35 ± 0.21 mile (2,176 ± 342 m, n = 3) and 1.03 ± 0.30 mile (1,667 ± 477 m, n = 4) until approximately 35 days of age in 2011 and 2012, respectively (Safine 2012, 2013). Mean area used by broods to approximately 35 days of age was 373.1 ± 56.8 acres (151 ± 23 hectares, n = 3) and 180.4 ± 81.5 acres (73 ± 33 hectares, n = 4) in Utqiaġvik in 2011 and 2012, respectively. Habitat types used by broods were primarily aquatic grass (Grass Marsh) and aquatic sedge (Sedge Marsh, Patterned Wet Meadow, Deep Polygon Complex, and Old and Young Basin Wetland Complexes) and deep open water (Deep Open Water with Islands or Polygonized Margins and Deep Open Water without Islands) (Safine 2012, 2013).

4.4.3.3 Preferred Habitat on the North Slope

Field studies of spectacled eiders on the CRD and adjacent areas in northeast NPR-A (Johnson, Parrett et al. 2018, 2019; Johnson, Shook et al. 2018; Parrett, Obritschkewitsch et al. 2022; Shook, Parrett et al. 2020) have documented habitats used and preferred during pre-breeding and nesting (Table 11). (Habitat types are described in Appendix C, Eider Habitat Descriptions.) Figure 16 shows the distribution of habitat types that are preferred, avoided, and used in proportion to availability in the action area (where most of the gravel fill will occur and the gravel mine site will be established). Note that for this evaluation, all habitats used during nesting are considered preferred although sample sizes were too small to test for selection across multiple nest-search areas. The most abundant habitat types are relatively dry compared with aquatic and flooded habitats that are used by breeding spectacled eiders. Moist Tussock Tundra and Moist Sedge-Shrub Meadow were the two most abundant habitat types, together occupying 33% of the area surveyed for pre-breeding spectacled eiders in the Willow area during 2017–2019 (Shook, Parrett et al. 2020). Pre-breeding and nesting spectacled eiders display broad correspondence in their use of habitats; all habitat types used for nesting are used during pre-breeding when eiders are presumably prospecting for nesting areas (Table 11). The most important habitat types (preferred during pre-breeding or used during nesting) contain halophytic types (rare in the action area), lakes, ponds, marshes, wetland and polygon complexes (also rare in the action area), and wet sedge meadows (patterned and non-patterned). The least important areas in northeast NPR-A during pre-breeding and nesting contain Moist Tussock Tundra and Moist Sedge-Shrub Meadow, which are avoided or used less than availability. Avoided habitat types during pre-breeding on the CRD are Open Nearshore Water; Tapped Lake with Low-water Connection; Tidal Flat Barrens; River or Stream; Tall, Low, or Dwarf Shrub; and Barrens. None of the habitat types avoided during pre-breeding have been used for nesting in the surveys conducted to date.

Habitat use by spectacled eiders during brood-rearing appears to be consistent with habitat use during pre-breeding and nesting (Table 11). Although use-availability selection analysis has not been conducted for the brood-rearing period in the action area, it is expected that Sedge Marsh, Grass Marsh, and deep water habitat types (Deep Open Water with Islands or Polygonized Margins and Deep Open Water without Islands) (i.e., habitats similar to those used by spectacled eider broods in Utqiaġvik [Safine 2012, 2013]) are also used by brood-rearing spectacled eiders on the CRD and northeast NPR-A.

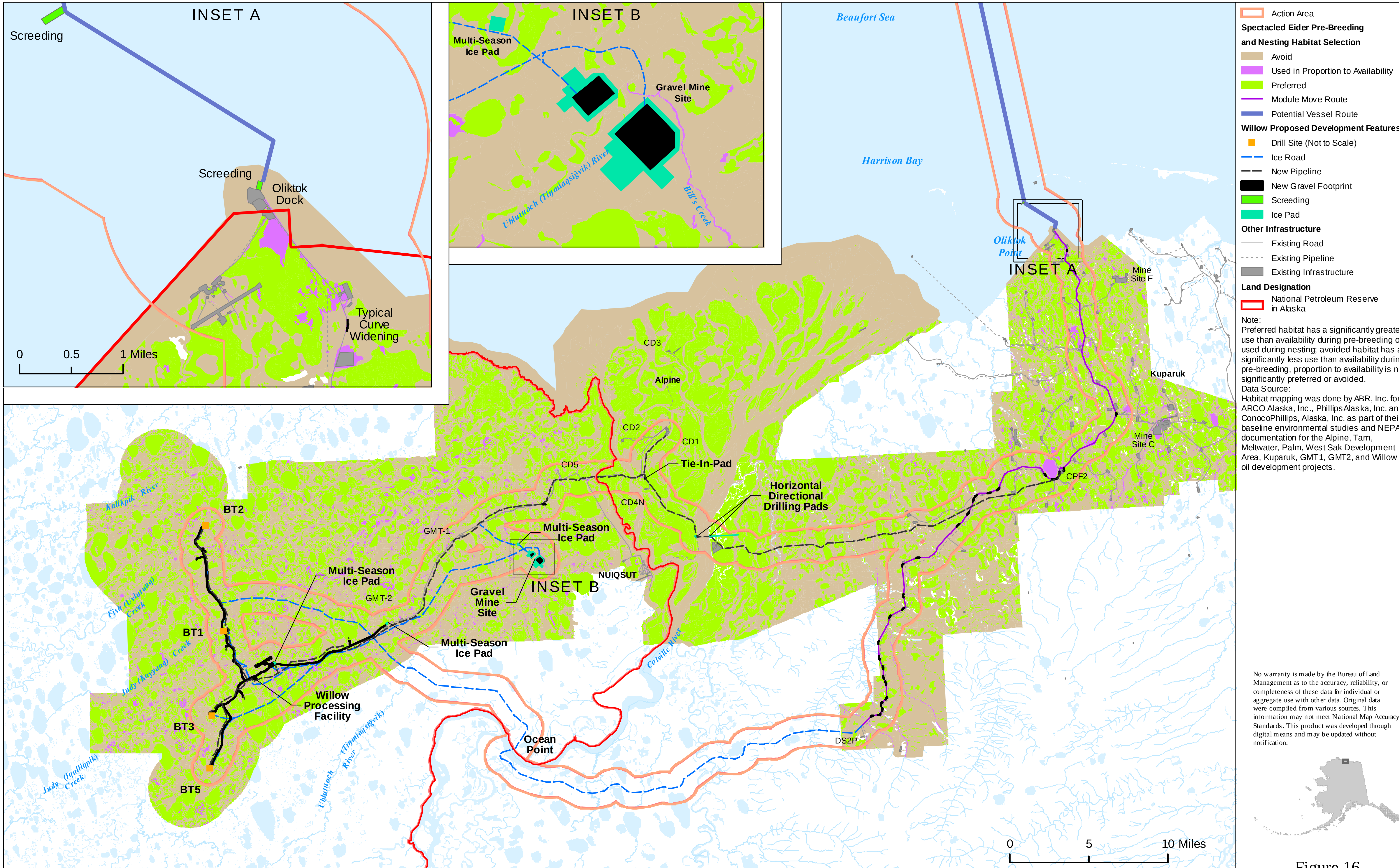

INSET A
Screeding
Screeding
Oliktok Dock
Typical Curve Widening
0 0.5 1 Miles
INSET B
Multi-Season Ice Pad
Gravel Mine Site
Ublutuoch (Tinmiaqsiġvik) River
Bill's Creek
Beaufort Sea
Harrison Bay
Oliktok Point
INSET A
Mine Site E
CD3
Alpine
Kuparuk
CD2
CD1
Mine Site C
CD5
Tie-In-Pad
CPF2
Horizontal Directional Drilling Pads
CD4N
Kalikpik River
BT2
GMT-1
Multi-Season Ice Pad
NUIQSUT
INSET B
Multi-Season Ice Pad
GMT-2
Gravel Mine Site
Fish (Uvlutuuq) Creek
BT1
Judy (Kayyaaq) Creek
Multi-Season Ice Pad
Colville River
Willow Processing Facility
BT3
Ocean Point
DS2P
Ublutuoch (Tinmiaqsiġvik) River
Judy (Iqalliqpik) Creek
BT5
0 5 10 Miles
Action Area
Spectacled Eider Pre-Breeding and Nesting Habitat Selection
Avoid
Used in Proportion to Availability
Preferred
Module Move Route
Potential Vessel Route
Willow Proposed Development Features
Drill Site (Not to Scale)
Ice Road
New Pipeline
New Gravel Footprint
Screeding
Ice Pad
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Land Designation
National Petroleum Reserve in Alaska
Note:
Preferred habitat has a significantly greater use than availability during pre-breeding or used during nesting; avoided habitat has a significantly less use than availability during pre-breeding, proportion to availability is not significantly preferred or avoided.
Data Source:
Habitat mapping was done by ABR, Inc. for ARCO Alaska, Inc., PhillipsAlaska, Inc. and ConocoPhillips, Alaska, Inc. as part of their baseline environmental studies and NEPA documentation for the Alpine, Tarn, Meltwater, Palm, West Sak Development Area, Kuparuk, GMT1, GMT2, and Willow oil development projects.
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 16

Table 11. Spectacled Eider Habitat Preference and Use

Habitat[a]	Northeast NPR-A Pre-breeding Use (%)[b]	Northeast NPR-A Pre-breeding Availability (%)	Northeast NPR-A Pre-breeding Preference[c]	Colville Pre-breeding Use (%)[b]	Colville Pre-breeding Availability (%)	Colville Pre-breeding Preference[c]	Northeast NPR-A Nesting[d] Use (%)	Colville Nesting[d] Use (%)
Open Nearshore Water	1.7	0.3	ns	0.2	1.6	avoid	–	–
Brackish Water	**11.7**	**0.3**	**prefer**	**6.7**	**1.3**	**prefer**	–	**4.0**
Tapped Lake with Low-Water Connection	0	0.2	ns	2.9	4.5	avoid	–	–
Tapped Lake with High-Water Connection	0	<0.1	ns	2.2	3.7	ns	–	**1.2**
Salt Marsh	3.3	0.7	ns	**6.7**	**3.2**	**prefer**	**9.1**	**1.7**
Tidal Flat Barrens	0	0.3	ns	0.2	7.0	avoid	-	–
Salt-Killed Tundra	0	<0.1	ns	**9.3**	**5.1**	**prefer**	–	**12.7**
Deep Open Water without Islands	3.3	8.0	ns	4.3	3.4	ns	–	**0.6**
Deep Open Water with Islands or Polygonized Margins	**13.3**	**4.9**	**prefer**	**3.8**	**2.1**	**prefer**	–	**6.4**
Shallow Open Water without Islands	**11.7**	**1.2**	**prefer**	0.7	0.4	ns	–	–
Shallow Open Water with Islands or Polygonized Margins	**10.0**	**1.4**	**prefer**	**1.4**	**0.1**	**prefer**	**9.1**	**1.2**
River or Stream	1.7	0.9	ns	3.1	14.4	avoid	–	–
Sedge Marsh	1.7	2.2	ns	0.2	<0.1	ns	–	–
Deep Polygon Complex	0	<0.1	ns	**27.6**	**2.7**	**prefer**	–	**24.9**
Grass Marsh	**5.0**	**0.4**	**prefer**	**1.0**	**0.2**	**prefer**	**9.1**	–
Young Basin Wetland Complex	0	0.3	ns	0	<0.1	ns	**9.1**	–
Old Basin Wetland Complex	**18.3**	**8.0**	**prefer**	0	<0.1	ns	**45.5**	–
Riverine Complex	0	0.4	ns	–	–	–	–	–
Dune Complex	1.7	0.9	ns	–	–	–	–	–
Nonpatterned Wet Meadow	3.3	3.9	ns	8.3	8.2	ns	**9.1**	**12.1**
Patterned Wet Meadow	11.7	12.2	ns	20.7	19.3	ns	**9.1**	**35.3**
Moist Sedge-Shrub Meadow	1.7	19.2	avoid	0	2.3	avoid	–	–
Moist Tussock Tundra	0	28.7	avoid	0.2	0.6	ns	–	–
Tall, Low, or Dwarf Shrub	0	4.7	ns	0	4.9	avoid	–	–
Barrens	0	1.1	ns	0.3	14.8	avoid	–	–
Human Modified	0	0	ns	0	0.1	ns	–	–
Total	**100**	**100**	**NA**	**100**	**100**	**NA**	**100**	**100**
Number of Groups/Nest	**60**	**NA**	**NA**	**579**	**NA**	**NA**	**11**	**173**

Note: -- (not applicable); NPR-A (National Petroleum Reserve in Alaska); ns (not significant). Bold habitat types are preferred during pre-breeding in northeast NPR-A study area or Colville River Delta study area or used for nesting in either area. Habitat types are described in Appendix C, *Eider Habitat Descriptions.*

[a] Not all habitats were available in nest search areas; different areas were searched in different years; therefore, total availability of habitat is not presented.

[b] Use = (groups/total groups) × 100.

[c] Significance calculated from 1,000 simulations at $\alpha = 0.05$; ns = not significant (use proportional to availability), prefer = significantly greater use than availability, avoid = significantly less use than availability for pre-breeding eider groups recorded on aerial surveys (Johnson, Parrett et al. 2018, 2019).

[d] Habitats used by nesting spectacled eiders (n = 173 nests) on the Colville River Delta study area and in northeast NPR-A study area (n = 11 nests) collected across multiple study sites (Johnson, Shook et al. 2018).

4.4.4 Critical Habitat

Critical habitat for the spectacled eider was divided into five units: 1) breeding areas in central Yukon-Kuskokwim Delta, 2) breeding areas in southern Yukon-Kuskokwim Delta, 3) molting areas in Norton Sound, 4) molting areas in Ledyard Bay, and, 5) a wintering area in the waters south of Saint Lawrence Island (USFWS 2001b). No critical habitat is designated on the North Slope for spectacled eiders.

None of the onshore portion of the Project is near designated spectacled eider critical habitat. Only marine areas in Ledyard Bay and the marine wintering area south of Saint Lawrence Island are near the barge route (Figure 3), which will be used 6 to 13 times a summer from Year 2 through Year 4, and six times in Year 6. Ledyard Bay will be specifically avoided during barging activities, and barging will not occur between October and April when eiders are overwintering near Saint Lawrence Island.

4.4.4.1 Primary Constituent Elements

PCE Units 1 and 2 (breeding areas on the Yukon-Kuskokwim Delta) and Unit 3 (molting area in Norton Sound) do not occur in the action area or along the barge route of the Project

Unit 4, the molting areas in Ledyard Bay, includes the waters of Ledyard Bay within approximately 40 nautical miles (74 km) of shore, excluding waters less than 1 nautical mile (1.85 km) from shore. Primary constituent elements for Unit 4 include all marine waters greater than 16.4 feet (5 m) and less than or equal to 82 feet (25 m) in depth at mean lower low water, along with associated marine aquatic flora and fauna in the water column, and the underlying marine benthic community. The barge route for the Willow Project will avoid Ledyard Bay.

Unit 5, the wintering area, includes the U.S. waters south of Saint Lawrence Island between the latitudes 61° N and 63° 30′ N, and between the longitudes 169° W and 174° 30′ W. Primary constituent elements for Unit 5 include all marine waters less than or equal to 246 feet (75 m) in depth at mean lower low water, along with associated marine aquatic flora and fauna in the water column, and the underlying marine benthic community. The barge route for the Willow Project is approximately 19.4 miles (31.4 km) east of Unit 5.

4.5 Steller’s Eider

4.5.1 Population

Steller’s eiders are divided into two populations: Atlantic and Pacific. The Pacific population is further divided into the Russian and Alaskan breeding populations (USFWS 2016a). On June 11, 1997, the USFWS listed the Alaska breeding population of Steller’s eider as threatened under the ESA based on the contraction in the species’ breeding range in Alaska and the resulting increased vulnerability of the remaining breeding population to extirpation (USFWS 1997; 62 FR 31748). Factors possibly contributing to the range contraction and population decline of Steller’s eider in Alaska include increased predation on breeding grounds, subsistence hunting, unlawful harvesting, ingestion of spent lead shot, habitat loss or degradation, impaired water quality, collisions with anthropogenic structures, and exposure to contaminants (USFWS 2002, 2016a). Because the Russia and Alaska breeding populations of Steller’s eider cannot be distinguished where they overlap on wintering and staging areas in southwest Alaska, the USFWS considers all Steller’s eiders in Alaska to belong to the listed population (Larned 2007; USFWS 2019b).

The size of the Pacific population of Steller’s eider is not well known (USFWS 2015b). A 2011 USFWS aerial survey of the Steller’s eider spring migration staging in southwest Alaska estimated the Pacific wintering population (composed of the Russia and Alaska breeding Pacific populations) to be approximately 74,369 birds and averaged 81,453 birds between 1992 and 2011 (Larned 2012a). Late sea ice dispersal and weather-impacted survey flights were believed to possibly have influenced the low estimate of 59,638 birds in 2012 (Larned 2012b). The number of Steller’s eiders in northern Alaska has been estimated using 3 main data sources: the ACP aerial waterfowl breeding population survey (Larned, Stehn et al. 2012; Wilson, Larned et al. 2018), the intensive Barrow Triangle aerial survey area for pre-nesting eiders (Obritschkewitsch and Ritchie 2017, 2019), and USFWS ground-based breeding-pair surveys and nest searches (Graff 2018). The most recent 10-year average indicated total Steller's eiders breeding on the ACP outside of the Barrow Triangle is 137 birds (2008–2017; 95% CI = 38 – 236; Wilson, Larned et al. 2018), this estimate is not corrected for differences in detection or other sources of bias, in part because there were too few Steller's eider observations during surveys (Wilson, Larned et al. 2018). During 1999–2019, the total estimated number of Steller's eiders in the Barrow Triangle ranged from 0 to 240 birds and the annual density ranged from 0 to 0.09 birds per square km (Obritschkewitsch and Gall 2020). These numbers have not been corrected for detection differences or other sources of bias (USFWS 2019b). The number of nests found annually during ground-nests searches near Utqiaġvik from 1991–2019 ranged from 0–78, indicating the proportion of the subpopulation that breeds annually is highly variable (Graff 2021).

As part of their 2019 Status Assessment of Steller's eiders, USFWS modeled data from the ACP and Barrow Triangle aerial surveys to obtain less-biased population estimates for Steller's eiders in northern Alaska (USFWS 2019b). Because there were too few Steller's eiders observed ruing ACP surveys to calculate an aerial detection rate for the species, USFWS used the detection rate for long-tailed ducks (*Clagula hyemalis*), another small sea duck present in larger numbers on the ACP. Using a Bayesian detection model, USFWS estimated the average number of Steller's eiders present in the ACP survey area during 2007–2017 to be 308 birds (range = 68–745 birds annually). A similar Bayesian model and the same long-tailed duck detection rate were used to estimate the average annual number of Steller's eiders in the Barrow Triangle using total counts (rather than transect-specific counts) from the Barrow Triangle aerial surveys (Obritschkewitsch and Ritchie 2017, as cited in USFWS 2019b). The estimated average annual number of Steller's eiders in the Barrow Triangle during 1999–2016 was 204 birds (range = 30–468 birds annually). Because the highest densities of Steller's eiders during the breeding season are within the Barrow Triangle, this likely represents a significant portion of the northern Alaska population.

4.5.2 Distribution

The Alaska breeding population of Steller's eider occurs in two disjunct regions: western Alaska and northern Alaska (Figure 17). The Alaska breeding population nests primarily on the ACP, although a very small subpopulation may remain on the Yukon-Kuskokwim Delta (Figure 17; Flint and Herzog 1999, USFWS 2002). Steller's eiders were assumed to have disappeared from the Yukon-Kuskokwim Delta (Kertell 1991) until a few pairs and nests were documented in the late 1990s (Flint and Herzog 1999). During 1997–2017, 44 adult Steller's eiders, 8 nests, and 1 brood were observed during ground-nest surveys, but no Steller's eiders were recorded on aerial surveys during the same time period (USFWS 2019b). Although they nest in terrestrial environments, Steller's eiders spend most of the year in nearshore marine waters. In Alaska, Steller's eiders move to nearshore marine waters of the Kuskokwim Shoals, lower Cook Inlet, and the north side of the Alaska Peninsula in fall to molt and then winter along the Alaska Peninsula, Cook Inlet, Kodiak Island, and the Aleutian Islands (USFWS 2019b). Thousands to tens of thousands of Steller's eiders stage before spring migration along the north side of the Alaska Peninsula, including Izembek Lagoon, Nelson Lagoon, Port Heiden, and Seal Islands. From staging areas, eiders migrate across Bristol Bay, and it appears that all the Alaska-wintering birds gather in northern Kuskokwim Bay and nearby smaller bays before continuing to nesting areas (USFWS 2019b).

The Alaska breeding population of Steller's eider is distributed in very low densities across the ACP from Wainwright to the Sagavanirktok River, but is mainly concentrated around Utqiaġvik (Quakenbush, Day et al. 2002). On the North Slope after the 1970s, no observations of Steller's eider have been made east of the Sagavanirktok River (Quakenbush, Day et al. 2002). Nesting by Steller's eiders away from Utqiaġvik has been reported only three times in recent years: single broods were seen inland along the Colville River in 1987 (Swem 1987 unpublished data), near Prudhoe Bay in 1993 (Quakenbush, Day et al. 2002), and near the upper Chipp River in 1997 (King and Dau 1997). Other observations of Steller's eider east of Utqiaġvik are rare, although non-breeders have been observed occasionally in Prudhoe Bay (Quakenbush, Day et al. 2002); in the Kuparuk oil field in 1995, 2000, 2001, 2007, and 2014 (ABR 2014 unpublished data; Anderson, Stickney et al. 2008)(Anderson, Stickney et al. 2008; ABR 2014 unpublished data); in the northeast NPR-A study area in 2000 and 2001 (Burgess, Johnson et al. 2003; and on the Colville River delta in 1995 (J. Bart, Boise State University, personal communication), 2001, and 2007 (Johnson, Wildman et al. 2013). Four other sightings were recorded near GMT-2 during ACP Aerial Waterbird Population Surveys (USFWS 2019b): one each in 1997, 1998, and 1999 (Figure 18). A lone male was recorded near Atigaru Point north of the Willow area, and there were two additional observations of single birds on the east side of Teshekpuk Lake in June 2021 (eBird 2022). Since 1992, aerial pre-breeding surveys and ground-based nest searches have been conducted in multiple locations adjacent to the action area, and over almost three decades, no nests or indications of breeding by Steller’s eider have been observed (Johnson, Shook et al. 2018). Since 2001, most observations of Steller’s eider in the northeast NPR-A have been near Teshekpuk Lake (USFWS 2012).

Because the terrestrial portion of the action area is outside the current breeding range for Steller’s eider, it is expected that Steller’s eiders will be no more than occasional visitors to the area, unless the population undergoes dramatic growth or a change in distribution. Recent records of Steller’s eider near the action area (e.g., the Willow, CRD, and Kuparuk study areas) are rare and sporadic, and no breeding records of the species have been documented despite annual aerial and ground-based surveys on the CRD and in the northeast NPR-A study area over nearly three decades. As explained in Section 4.4.2, *Distribution*, ground-based nest searches for the Willow area were conducted in 2020 and 2021 (Attanas, Orion et al. 2022; Rozell, Obritschkewitsch et al. 2022), but no Steller’s eiders were observed.

Although the barge route will transit from Dutch Harbor on the north side of the Aleutian Islands and Alaska Peninsula, where Steller’s eiders winter, barges will only transit the area during summer and early fall and thus not encounter wintering birds. The probability of Steller’s eider occurring in the action area during the same seasons as construction, module delivery, and operations, is so low that the species may never occur there during the lifetime of the Project. The probability of a nest or brood occurring in the action area is even less likely.

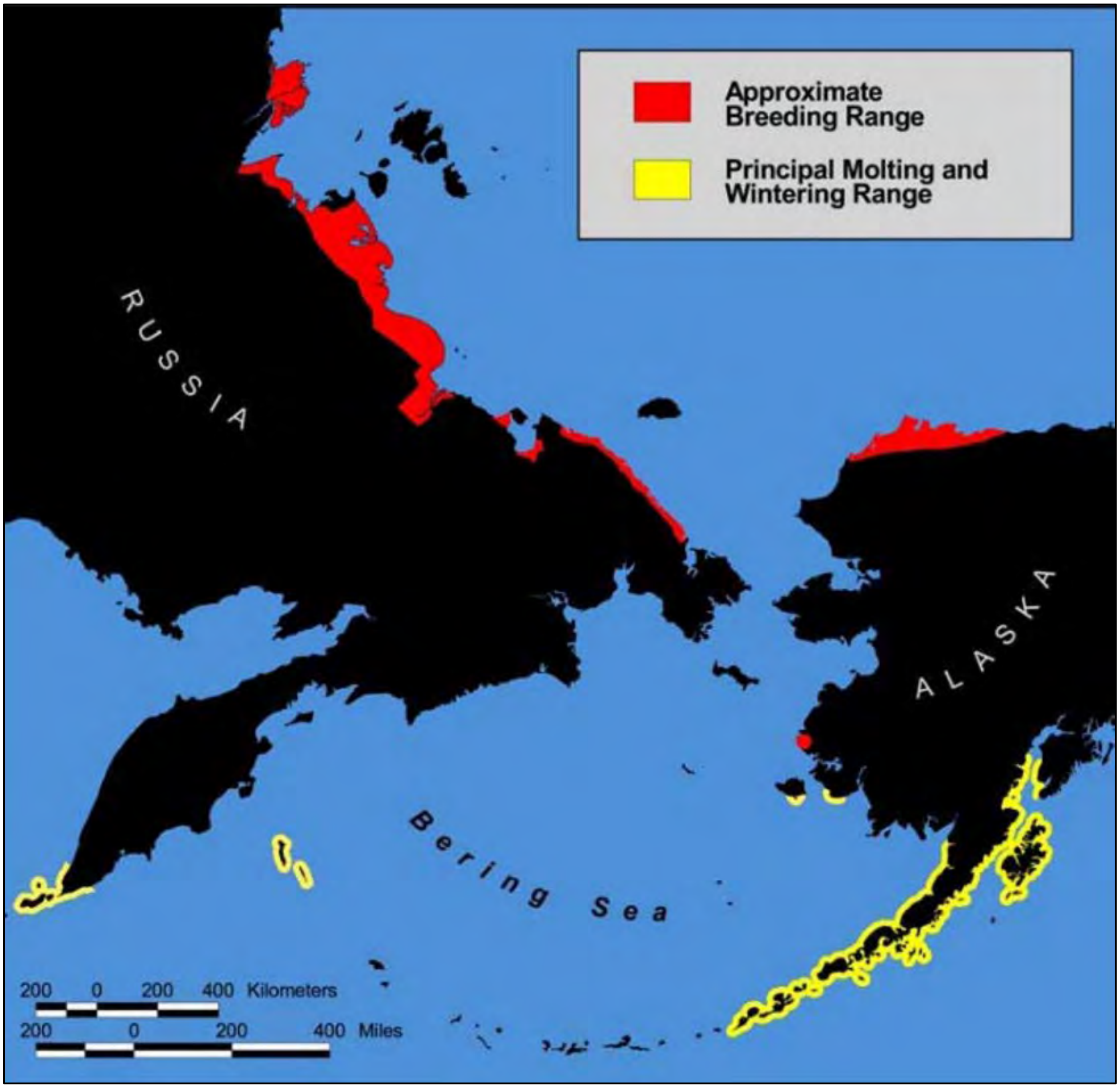
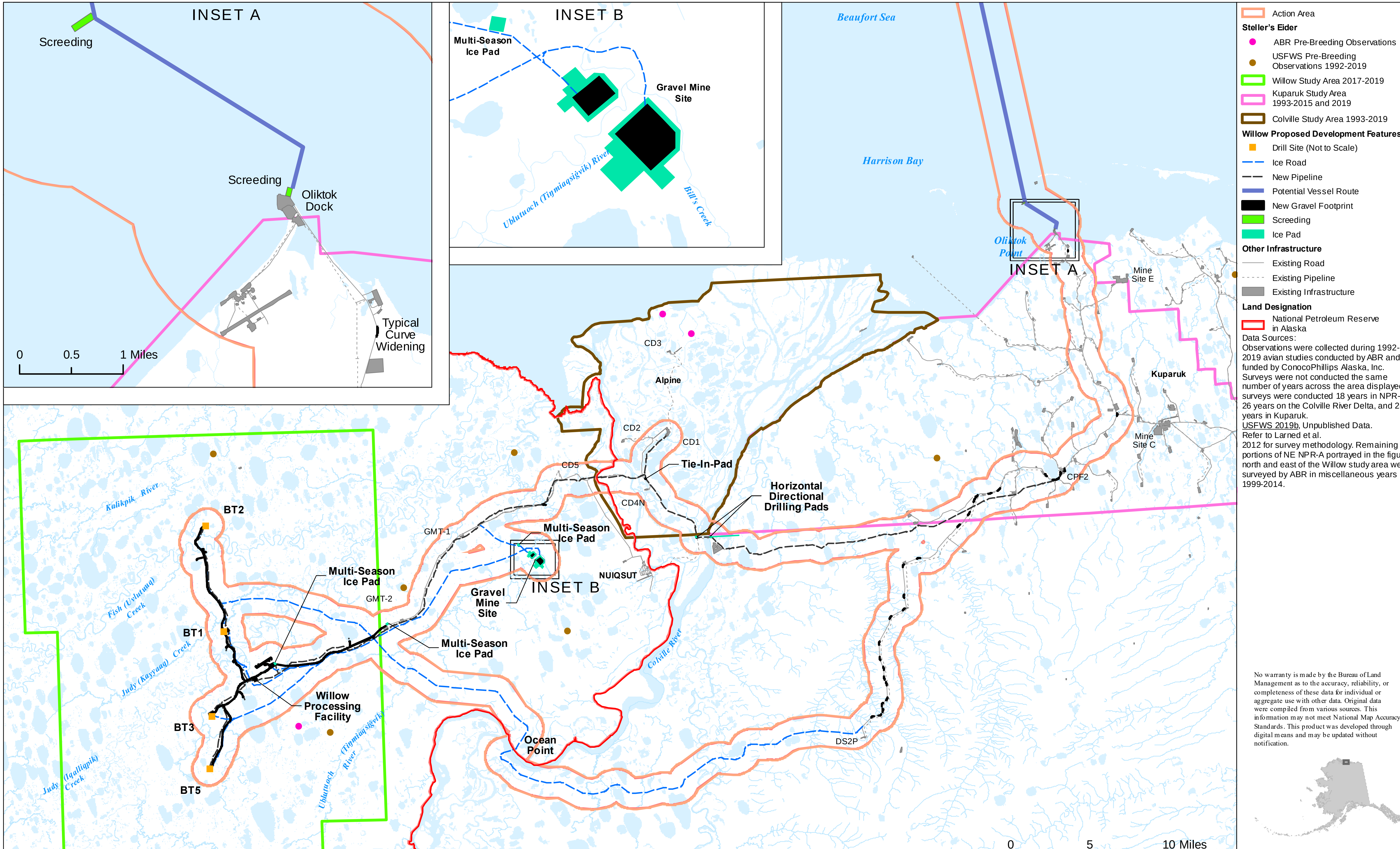


Figure 17. Distribution of the Pacific Population of the Steller's Eider
Source: USFWS 2002


INSET A
Screeding
Screeding
Oliktok Dock
Typical Curve Widening
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Gravel Mine Site
Ublutuoch (Tinmiaqsiġvik) River
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Mine Site E
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Multi-Season Ice Pad
GMT-1
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NUIQSUT
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Gravel Mine Site
Multi-Season Ice Pad
Multi-Season Ice Pad
Willow Processing Facility
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Colville River
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Ublutuoch (Tinmiaqsiġvik) River
BT2
BT1
BT3
BT5
0
5
10 Miles
Action Area
Steller's Eider
ABR Pre-Breeding Observations
USFWS Pre-Breeding Observations 1992-2019
Willow Study Area 2017-2019
Kuparuk Study Area 1993-2015 and 2019
Colville Study Area 1993-2019
Willow Proposed Development Features
Drill Site (Not to Scale)
Ice Road
New Pipeline
Potential Vessel Route
New Gravel Footprint
Screeding
Ice Pad
Other Infrastructure
Existing Road
Existing Pipeline
Existing Infrastructure
Land Designation
National Petroleum Reserve in Alaska
Data Sources:
Observations were collected during 1992-2019 avian studies conducted by ABR and funded by ConocoPhillips Alaska, Inc. Surveys were not conducted the same number of years across the area displayed; surveys were conducted 18 years in NPR-A, 26 years on the Colville River Delta, and 24 years in Kuparuk.
USFWS 2019b, Unpublished Data.
Refer to Larned et al.
2012 for survey methodology. Remaining portions of NE NPR-A portrayed in the figure north and east of the Willow study area were surveyed by ABR in miscellaneous years 1999-2014.
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual or aggregate use with other data. Original data were compiled from various sources. This information may not meet National Map Accuracy Standards. This product was developed through digital means and may be updated without notification.

Figure 18

4.5.3 Habitat

4.5.3.1 Foraging Habitat

When not on breeding grounds, Steller's eiders forage in shallow, nearshore areas feeding primarily on marine invertebrates such as mollusks and crustaceans (USFWS 2002), and they have been found in Norway to rely on mobile crustaceans to a greater extent than other sea ducks (Bustnes and Systad 2001). Steller's eiders were previously thought to confine themselves to shallow waters (30 feet [<10 m] in depth) within 1,300 feet (400 m) of shore, unless the shallows extend farther offshore into bays and lagoons (USFWS 2002). However, Martin et al. (2015) found that wintering Steller's eiders commonly are found in water up to 98 feet (<30 m) deep in offshore areas in southwestern Alaska during December through April, particularly during night, but it is unknown whether this is related to feeding or resting (Martin, Douglas et al. 2015). In breeding habitats, Steller's eiders primarily eat insect larvae and aquatic plants. A Steller's eider diet study during molt in Nelson Lagoon indicated that bivalves, especially blue mussels (*Mytilus edulis*) and Baltic clams (*Macoma balthica*), gammarid, and other amphipods were primary food items (Petersen 1981).

4.5.3.2 Breeding and Nesting Habitat

The Alaskan breeding population primarily nests on the ACP from approximately Point Lay east to Prudhoe Bay and will nest on the Yukon-Kuskokwim Delta on rare occasions (USFWS 2019b). Steller's eiders arrive in small flocks of breeding pairs on the ACP in early June (USFWS 2019b). Most sightings in the past decade have occurred east of the mouth of the Utukok River, west of the Colville River, and within approximately 56 miles (90 km) of the coast (USFWS 2019b). There are only three records of Steller's eider breeding east of Admiralty Bay, approximately 29.8 miles (48 km) east of Utqiaġvik, in the last 25 years (on the CRD in 1987, in Prudhoe Bay in 1993, and inland from Dease Inlet/Admiralty Bay area in 1997) (Johnson, Wildman et al. 2013).

Steller's eiders are solitary breeders that prefer to nest in depressions on grassy edges of tundra lakes and ponds, or within drained lake basins in the Arctic and subarctic tundra. Pair bonding occurs in the winter, and the eiders move to Arctic nesting grounds as the spring sea ice breaks up (mid- to late April). Emergent sedge (Carex sp.) and A. fulva provide important areas for feeding and cover (Quakenbush, Suydam et al. 2004). Most breeding pairs were found in shallow Carex and shallow and deep A. fulva ponds (Graff 2016, 2018, 2021; Safine 2013, 2015), and nests were near waterbodies (114 ± 33 feet [35 ± 10 m; mean ± SE]; Safine 2013) comprising shallow Carex and shallow A. fulva ponds (Graff 2016, 2018, 2021; Safine 2015) and deep open water and deep A. fulva ponds (Graff 2021; Safine 2015). Average nest initiation dates for Steller's eider were in the second to third week of June (13 June, Graff 2016; 23 June, Safine 2013; 23 June, Graff 2021), and nests were commonly located on the rims of polygons and troughs (Quakenbush, Suydam et al. 2004). Hatching occurs from mid-July through early August, after which hens move their broods to adjacent ponds (Rojek 2008), primarily of shallow Carex and shallow A. fulva (Rojek 2008). Average distance to first resighting of a brood after hatch was 1,640 feet (500 m), and average maximal distance moved by broods each year of study (32 to 53 days post-hatch) was 2,133 to 11,483 feet (650 to 3,500 m; Safine 2013). Average distance to first resighting of a brood after hatch was 1,640 feet (500 m), and average maximal distance moved by broods each year of study (32 to 53 days post-hatch) was 2,133 to 11,483 feet (650 to 3,500 m; Safine 2013).

4.5.4 Critical Habitat

In 2001, USFWS designated 2,830 square miles (7,330 square km) of critical habitat for the Alaska breeding population of Steller's eider. Critical habitat was divided into the following five units in the marine waters of southwest Alaska and on the north side of the Alaska Peninsula: 1) Yukon-Kuskokwim Delta (historical breeding area), 2) Kuskokwim Shoal (molting and staging area), 3) Seal Islands (molting and staging area), 4) Nelson Lagoon (molting, wintering and staging area), and 5) Izembek Lagoon (molting, wintering, and staging area) (USFWS 2001a; 66 FR 8850) (Figure 19). None of these units occur on the ACP or in the onshore or offshore portions of the action area, and none of the units will be encountered along the barge route (Figure 2). Designated critical habitat for Steller's eider is located in western Alaska and along the Alaska Peninsula.

Although not near the barge transit route, nearshore and offshore critical habitat includes Unit 2, Kuskokwim Shoal, defined as northern Kuskokwim Bay from the mouth of the Kolavinarak River to near the village of Kwigillingok, extending approximately 11 to 24 miles (17 to 38 km) offshore. Unit 3, Seal Islands, covers the Seal Islands lagoon and the mouth of the Ilnik River, out to the mean high tide line of Bristol Bay. Unit 4, Nelson Lagoon, begins 3.4 miles (5.5 km) north of Harbor Point, on Moller Spit at longitude of 160º 32' W longitude and runs northwest to Wolf Point in the Kudobin Islands and east along the mean high tide line to 161º 24' W longitude, encompassing the Nelson Lagoon, portions of Hague Channel, and Herendeen Bay south to 55º 51' N latitude. Unit 5, Izembek Lagoon, begins at 162º 30' W longitude approximately 5.6 miles (9 km) northeast of Moffet Point and then continues along the mean high tide line inside the boundary of the Izembek National Wildlife Refuge, encompassing the Moffet Lagoon, Izembek Lagoon, Norma Bay, and Applegate Cove (USFWS 2001a).

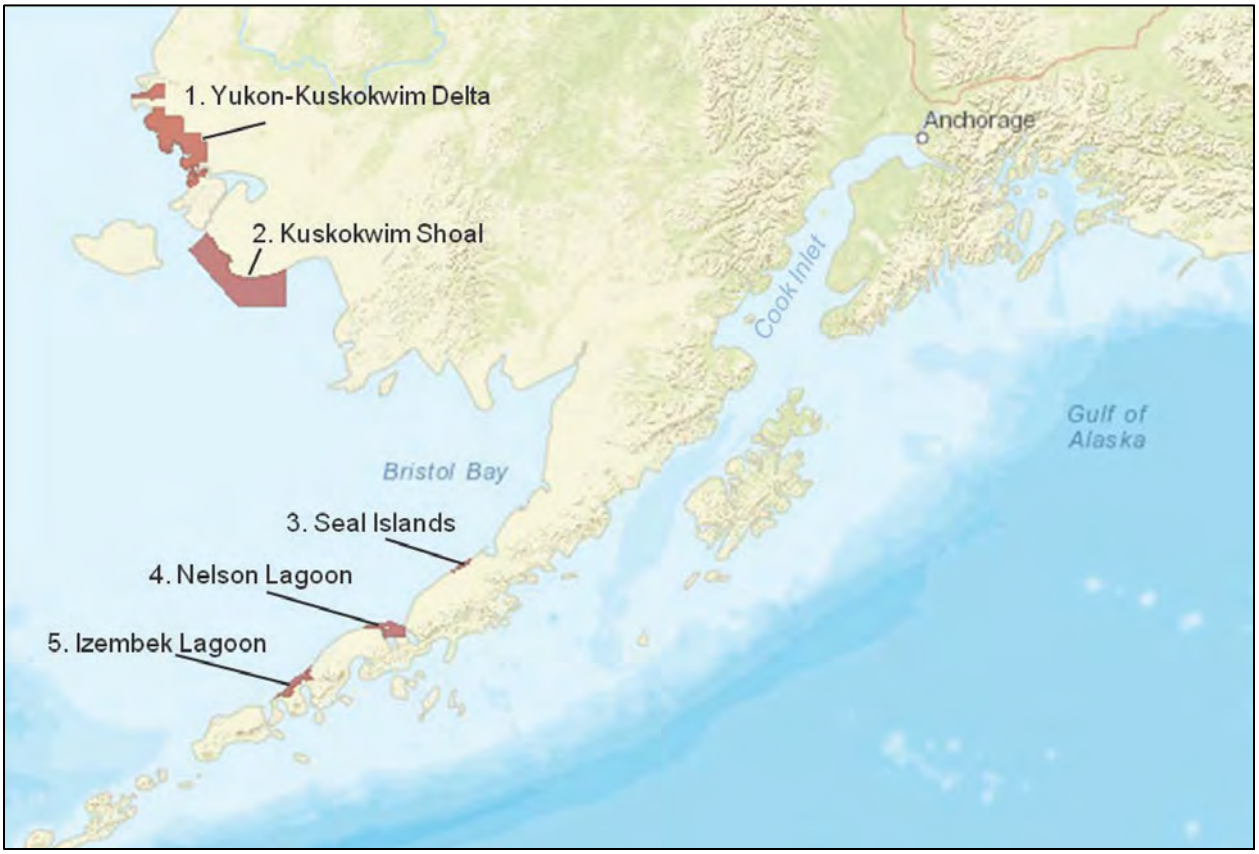

Figure 19. Designated Critical Habitat Units for Steller's Eider
Source: USFWS 2001b

4.5.4.1 Primary Constituent Elements

PCEs of critical habitat for Steller's eider include the following in the marine units closest to the offshore action area (Figure 2):

- Units 2, 3, 4, and 5: Marine waters up to 30 feet (9 m) deep, 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. None of these units are near the barge transit route and all are unlikely to be impacted by offshore activities.

5.0 Environmental Baseline

Environmental baseline, as defined under the ESA, consists of past and present impacts of all federal, state, or private actions and other human activities in action areas; the anticipated impacts of all the proposed federal projects in an action area that have already undergone formal or early Section 7 consultation; and the impact of state or private actions that are contemporaneous with the consultation process (50 CFR 402.02).

5.1 Existing Conditions

Previous developments in the Alpine, GMT, Mustang, and Kuparuk oil fields contribute to the existing environmental baseline and are documented in several BOs, such as those for Alpine CD5 (USFWS 2011a), GMT-1 (USFWS 2015b), and GMT-2 (USFWS 2018b). These oil fields have existing oil and gas infrastructure (gravel and ice roads, processing facilities, etc.) and associated daily vehicle traffic and daily (Alpine, Kuparuk) to weekly (GMT) aircraft traffic. All the oil fields have summer helicopter traffic. The area east of the Colville River to Kuparuk contains the Kuparuk oil field as well as the Nuna and Oooguruk developments; construction has also begun on the Nanushuk development. Kuparuk has extensive existing infrastructure (e.g., gravel and ice roads, pipelines, processing facilities). Kuparuk has existing gravel mine sites, airstrips, reservoirs, a dock (Oliktok Dock), and a seawater treatment facility. The Kuparuk oil field experiences more ground and air traffic than the developments west of the Colville River; ground traffic also travels at higher speeds.

Existing marine infrastructure in the Beaufort Sea action area occurs at Oliktok Point, where there is a commercial sheet-pile dock, shoreline armoring, and a saltwater treatment plant. In addition, Oooguruk Island, a 6-acre constructed gravel island with a pipeline to shore, is located near the mouth of the Colville River. Screeding occurs with seasonal regularity at Oliktok Dock prior to barge arrival.

Existing marine vessel traffic occurs throughout the Bering Sea and less frequently through the Chukchi Sea into the Beaufort Sea. The main port in the action area is Dutch Harbor in the Bering Sea, which has supported moderate year-round vessel traffic since the late 1970s and is the current operations center for the Bering Sea and Aleutian Islands commercial fishing industry (USACE 2019). Most vessel traffic transits northwest from Dutch Harbor toward Russia and Asia. The number of vessels traveling through the Bering Strait to or from Dutch Harbor is approximately 10% of that transiting through Unimak Pass, indicating most vessel traffic in the Bearing sea is to/from locations south of the Bering Strait (Nuka Research and Planning Group 2016). There was an average of 393 annual transits of the Bering Strait between 2006 and 2015 (Nuka Research and Planning Group 2016), though vessel traffic has more than doubled since 2008, and more recent years (2015 and 2016) have seen approximately 458 to 470 vessel transits per year (Audubon Alaska 2017). Transits are predicted to grow to 2,000 transits by 2025 under moderate growth scenarios (International Council on Clean Transportation 2015). Not all traffic transiting the Bering Strait continues to the Beaufort Sea. The areas of the Beaufort with the most vessel use appear to be near Utqiaġvik, Oliktok Point, and Deadhorse (Audubon Alaska 2017).

The community of Nuiqsut (approximately 347 people) will be approximately 27 miles (43 km) from BT1 and approximately 7 miles (11.2 km) from the Tiŋmiaqsiuġvik Mine Site. The community has an airstrip, roads, a power plant, and other infrastructure. Seasonal snow trails and roads occur across the North Slope for community access.

Other past and present actions in the Willow area are oil and gas exploration, including seismic activities, subsistence, research (not associated with oil and gas activities), and in recent years the North Slope Borough's Community Winter Access Trail, which contribute additional vehicle, boat, air, foot, and off-road vehicle traffic.

The acoustic environment of the action area is a composite of all noise sources, both natural (e.g., wildlife, wind, water) and human-made (e.g., traffic, construction, oil production, aircraft, hunting). High winds are common in the action area and are the primary natural noise source in Nuiqsut (BLM 2004). Noise has the potential to affect ESA species in the action area by interfering with activities such as foraging, sleeping, nesting, or denning. Ambient sound levels around Nuiqsut and the lower Colville River, including the eastern action area, were documented by Stinchcomb (2017) from June through August 2016 (a period of peak subsistence use) to quantify natural ambient sound and aircraft noise levels. Natural ambient sound levels ranged from 25 to 47 A-weighted decibels (dBA), with a median level of 35 dBA. The median sound exposure level of aircraft ranged from 55 to 69 dBA (Stinchcomb 2017).

The range of reported ambient underwater sound levels in the Beaufort Sea is 77 to 135 dB re 1 µPa (Greene Jr., Blackwell et al. 2008; LGL Alaska Research Associates Inc., Greenridge Sciences et al. 2013) with average ambient conditions approximately 120 dB re 1 µPa. The Beaufort Sea has a narrow continental shelf that drops off to the north into the Beaufort Sea Plateau, a deep basin with depths of 6,500 to 10,000 feet (1,980 to 3,050 m), allowing for long-range propagation of high amplitude, low frequency sounds. Oliktok Point is located in the shallow waters of Harrison Bay. Generally, underwater sound levels in shallow waters increase with increasing wind speed (Wenz 1962).

6.0 Effects of the Action

This section provides an evaluation of effects on ESA-protected species that are reasonably certain to occur from the Project.

6.1 Polar Bear

6.1.1 Habitat Loss and Alteration

Loss and alteration of polar bear habitat, including critical habitat, will occur as a result of the Project. Project components that will permanently remove habitat are construction and operation of gravel infrastructure and excavation of the Tiŋmiaqsiuġvik mine site; all of these actions will occur inland from the coast 8.1 to 26.0 miles (13.0 to 42.0 km), except for the boat ramp on the Ublutuoch (Tiŋmiaqsiuġvik) River, which will be 5 miles (8 km) from the coast. Project components that will temporarily remove or alter habitat include construction and operation of single- and multi-use ice pads and ice roads and screeding at Oliktok Dock. Ice infrastructure will occur 7.8 to 19.1 miles (12.6 to 30.7 km) from the coast. Table 12 provides a summary of habitat loss and alteration from Project components.

Table 12. Summary of Habitat Loss or Alteration to Polar Bear Habitat

Project Component	Foraging Habitat	Potential Terrestrial Denning Habitat[a]	Terrestrial Denning Critical Habitat	Barrier Island Critical Habitat	Sea Ice Critical Habitat
Permanent habitat loss from gravel fill (gravel pads and roads) or excavation (Tiŋmiaqsiuġvik mine site) (acres)	584.4	1.0	0.1	0	0
Temporary habitat alteration from screeding at Oliktok Dock and barge lightering area (acres)	0	0	0	0	12.1
Temporary habitat alteration from ice roads (miles)	40.5	0.1	0	0	0
Temporary habitat alteration from ice pads (acres)	257.0	0.2	0	0	0

[a] Acres of potential terrestrial denning habitat affected do not overlap with any critical habitat units.

6.1.1.1 Denning Polar Bears

Activities that occur in winter could result in temporary loss of polar bear denning habitat. Construction and operation of single-season ice roads and pads will affect a small portion of habitat available to denning polar bears. The effects of ice infrastructure on potential terrestrial denning habitat will be temporary until the ice road or pad thaws during spring, although multi-season ice pads will result in lost habitat over several seasons. Because ice infrastructure will not affect the underlying topographic characteristics that create suitable denning conditions, there will be no long-term or permanent effects on habitat. Water withdrawal from lakes for construction of the ice infrastructure will not likely alter or cause adverse effects on polar bear terrestrial denning habitat. Pre-construction den detection surveys will identify potential maternal den sites to minimize impacts.

The effects of construction of ice and gravel infrastructure will create the potential for temporary loss of use of suitable denning habitat through behavioral disturbance. Additionally, after the placement of gravel infrastructure during the construction phase, the attractiveness of some potential maternal denning habitat near the infrastructure likely will be diminished for some bears because of the presence of the facilities and associated human activity, however denning habitat is plentiful in the action area and the coastal habitat most used by polar bears will remain unaffected due to the nature of the activities and which will be predominantly occur in inland areas less frequented by polar bears.

6.1.1.2 Non-Denning Polar Bears

The construction of gravel roads and pads will result in permanent loss of some habitat for polar bears. However, the presence of roads and pads does not appear to restrict polar bears from crossing areas with infrastructure in the North Slope oil fields (USFWS 2011b).

Screeding and improvements to Oliktok Dock could affect polar bears indirectly by displacing prey during the open-water season; however, polar bears are not expected to be in the area during open-water season actively hunting seals. Activities at Oliktok Dock will occur in the summer, so there will be no effects on ice habitat (e.g., pupping lairs, haulouts, or breathing holes) for ice seals, which are prey for polar bears. Seals could be displaced during screeding and barging or during dock improvements. Because displacement is expected to be temporary and affect a small proportion of the potential available foraging habitat, only a few ice seals will be affected. Screeding and dock improvements will not impact bears' overall ability to successfully obtain and consume prey (USFWS 2011b).

6.1.1.3 Summary of Habitat Loss and Alteration

In summary, construction activities could temporarily reduce or alter polar bear habitat resulting in localized, seasonal impacts during the winter construction and operations seasons where some habitat may be excluded from polar bear use near human activity. Impacts will be short term and acute to individuals at maternal den sites near construction activities and blasting. Effects of temporary habitat loss or alteration are expected to be further reduced by the application of design features, ROPs, LSs, and mitigation measures required under the current Beaufort Sea ITRs. In particular, pre-construction den-detection surveys for maternal polar bear dens and 1-mile (0.6-km) exclusion buffers around identified dens will help minimize effects of winter activities on polar bears and their habitat.

Screeding and improvements to Oliktok Dock could temporarily displace polar bears prey but will not impact bears' overall ability to successfully obtain and consume prey.

Development of the Tiŋmiaqsiuġvik mine site and gravel infrastructure will permanently remove polar bear habitat. Most of the habitat loss will not be in critical habitat; however, 0.1 acre will occur in terrestrial denning critical habitat.

6.1.2 Disturbance and Displacement

Noise and visual disturbance from human activity and operation of equipment have the potential to disturb polar bears nearby (Andersen and Aars 2008; Blix and Lentfer 1992; MacGillivray, Hannay et al. 2003; Perham 2005; Schliebe, Evans et al. 2006; USFWS 2006, 2008a). General effects of noise on wildlife may range from direct effects, such as physical injury to the auditory system, to indirect effects, such as change in habitat use. Noise may directly affect reproductive physiology or energetic consumption as individuals incur energetic costs or lose mating or foraging opportunities by repeatedly reacting to or avoiding noise. Animals may also be forced to retreat from favorable habitat in order to avoid aversive anthropogenic noise levels. The impact of greatest concern is disturbance of maternal females during the winter denning period, which could result in den abandonment and reduced survival of cubs (Amstrup 1993; Durner, Amstrup et al. 2006; Rode, Olson et al. 2018). Tables 13 and 14 summarize the airborne and underwater noise expected from the Project. The following sections summarize potential disturbance and displacement from Project components.

Table 13. Summary of Potential Airborne Noise for the Project

Noise Source	Duration	Estimated Sound 1,000 feet from the Source (dBA)	Distance to 35 dBA[a] (miles)	Source
General construction[b] (bulldozers, loaders, cranes, etc.)	8 years	62	4.0	BLM 2018
Gravel mining[b] (bulldozers, loaders, crushers, screens, etc.)	5 years	62	4.0	BLM 2018
Gravel mine blasting, L_{max}	5 years	90	101.9	Ramboll US Corporation 2017
Impact pipe pile driving, L_{max}	5 years	84	50.9	WSDOT 2015
Helicopter (B206)	30 years	70 to 80	10.5 to 33.2	BLM 2004
Fixed-wing aircraft (twin-engine)	30 years	69 to 81	6.4 to 20.3	BLM 2004
Ground traffic	30 years	49 to 55	0.9 to 1.4	BLM 2018
Drill rig	7 years	52 to 66	1.3 to 6.4	ARCO Alaska 1986
WPF	Operations: ≥25 years	52	1.3	BLM 2018
Flare at WPF	Operations: ≥25 years	71	11.8	USACE 2018
Tugboats, marine vessels, barges	3 summer seasons	40	0.3	TORP Terminal LP 2009
Pile removal: vibratory method	1 summer season	75	18	WSDOT 2015

Note: ≥ (at least); BLM (Bureau of Land Management); dBA (A-weighted decibels); Lmax (short-term, maximum sound level), USACE (U.S. Army Corps of Engineers); WPF (Willow processing facility); WSDOT (Washington State Department of Transportation).
[a] 35 dBA is the ambient sound level in the action area.
[b] Assumes five pieces of heavy diesel equipment in operation concurrently.

Table 14. Summary of Hydroacoustic Noise Sources for the Project

Activity	Underwater Sound Level (dB re 1 µPa)	Frequency	Source
Screeding (tug and barge)	164 to 179 dB rms at 3.28 feet	Range: 10 to 10,000 Hz Concentration: 10 to 2,000 Hz	Blackwell and Greene 2003
General vessel operations	145 to 175 dB rms at 3.28 feet	10 to 1,500 Hz	Richardson et al. 1995; Blackwell and Greene 2003

Note: dB (decibels); dB re 1 µPa (decibels referenced to 1 microPascal); Hz (hertz); rms (root-mean-square).

6.1.2.1 Facility Construction, Operation, and Use

Construction of and routine operation activities at Project facilities is a potential source of disturbance and displacement for polar bears. Facility construction will have the greatest potential to impact polar bears in the fall, winter, and spring because bears are more likely to occur in the action area during that time, as polar bears are only occasionally reported by industry during the summer open-water season.

Construction and operation of facilities will produce localized noise from equipment operation, generators, etc. The sounds from these activities will be expected to reach ambient levels within a few miles (Table 13). Polar bears near routine industrial noise may habituate to these stimuli and show less sensitivity to disturbance from these types of activities than bears not exposed to such stimuli. Habituation to stimulus, such as noise, is generally considered to be positive because polar bears could experience less stress from industrial activity; however, it could also increase the risk of human-bear encounters. Disturbance from operational noise will occur throughout the life of the Project.

6.1.2.2 Aircraft Traffic

Aircraft can affect polar bears because of the presence and airborne noise. Behavioral reactions of polar bears to aircraft depend on the lateral distance, flight altitude, and the type of aircraft. Reactions range from no detectable response to running away from aircraft traveling less than 660 feet (201 m) above ground level at a lateral distance of less than 1,300 feet (396 m; Amstrup 1993). Polar bears are known to run from sources of noise and the sight of aircraft, especially helicopters (Amstrup 1993; Richardson, Greene et al. 1995; Streever and Bishop 2014). The effects of fleeing from aircraft are likely to be minimal if the event is temporary, the animal is otherwise non-stressed, and the flight occurs in low ambient temperatures. However, with increased temperatures, even a short run may be enough to overheat a polar bear, and a bear already experiencing stress that swims a long distance could require rest for a long period prior to reinitiating essential life functions such as feeding. Persistent aircraft travel could displace polar bears from localized areas in the flight path (USFWS 2011b).

Richardson et al. (1995) summarize that fixed-wing aircraft typically used for oil and gas activities produce sounds in the 68- to 102-Hz range at levels up to 162 dB re 1 μPa-m at the source. Reaction frequency typically diminishes with increasing lateral distance and with increasing altitude. Individual responses appear to vary depending on flight altitude and received sound levels.

Helicopter operations are conducted 1,000 to 1,500 feet (305 to 457 m) above ground level unless safety due to weather or other factors becomes an issue. Helicopters radiate more sound forward than backward and produce sounds in the 68- to 102-Hz range at levels up to 151 dB re 1 μPa-m at the source. By radiating more noise forward of the helicopter, noise levels will be audible at greater distances ahead of the aircraft than to the aircraft's rear. Polar bears are known to run from the sound and sight of aircraft, particularly helicopters (USFWS 2013a).

Polar bears may be disturbed while resting or during foraging activities by low-flying aircraft. Measures typically required by USFWS to comply with the MMPA include a stipulation that industry flights stay at 1,500 feet (457 m) above ground level and avoid overflights of important polar bear areas to reduce the potential for disturbance. Establishing flight corridors several miles inland for industry flights has also reduced the potential for impacts to polar bears from industry flights because most polar bears use the coastline and barrier islands to move between areas.

There will be 12,053 fixed-wing aircraft trips and 2,437 helicopter trips throughout the life of the Project. Traffic volume and rates will vary by Project phase and by season, as detailed in Tables 6, 7, and 8. Fixed-wing air traffic rates will be highest at Willow, where there will be up to 4 landings per day in winter and 0.9 landings per day in summer from Year 2 through Year 10. Fixed-wing air traffic will also travel to Alpine and Kuparuk. Helicopter traffic will be highest at Willow, where there will be up to 0.4 to 0.5 landings per day in spring and summer throughout the life of the Project.

Project air traffic is anticipated to have minimal effects on polar bears. While fixed-wing aircraft and helicopter traffic will be highest near the WOC and the airstrip, the main Project facilities will be approximately 20 miles (32.2 km) inland from the coast. This distance will limit potential aircraft disturbance to polar bears as the majority of bears (95%) observed historically near this region have occurred within approximately 10 miles of the coast. In addition, even though the majority of landings will occur during the winter season, the inland distance of Willow facilities will preclude disturbances to the majority of denning female bears that could occur in this region as the majority of historical dens have been located within 5 miles (8.0 km) of the coast. USFWS-approved den detection surveys in active Project areas will further reduce potential impacts on maternal denning polar bears that chose inland den sites.

The majority of flights from Willow to Alpine or Kuparuk are expected to be inland point-to-point trips. As stated previously, establishing inland flight corridors is expected to reduce the potential for impacts to polar bears because most polar bears use the coast and barrier islands as travel corridors, denning, and resting areas in the region.

Aircraft traffic could disturb bears, as described above; however, use of BLM and CPAI mitigation measures will limit those effects to short-term, behavioral changes, such as retreating from the aircraft.

6.1.2.3 Vehicle Traffic

Polar bears may be displaced or disturbed by ground transportation. Ice road construction and use produce noise, vehicle traffic, and human presence that can disturb or displace polar bears from the immediate area. Alternately, non-denning bears can be drawn to ice road activities because of the presence of attractants such as food waste or simply out of curiosity (USFWS 2015b). The type and extent of disturbance and displacement impacts can vary depending on the polar bear's life history status (e.g., pregnant or post-partum vs. not pregnant).

There will be more than 3.6 million vehicle trips throughout the life of the Project (Tables 6 and 7). Traffic volume and rates will vary by Project phase and by season, as detailed in Tables 7 and 8. Ground traffic rates will be highest in winter and spring from Year 1 through Year 10, when there will be up to 150.1 vehicles per hour (assuming traffic is equally distributed over each 24-hour period throughout the season). Vehicle traffic volume will slow to 3.7 to 9.4 vehicles per hour year-round (assuming traffic is equally distributed over each 24-hour period) from Year 11 through Year 30.

Disturbance from vehicle noise will occur throughout the life of the Project but be greatest during construction. Because construction will occur in winter and will be the closest activity to the coast (the mine site will be approximately 8.1 miles (13.0 km) from the coast and the boat ramp on the Ublutuoch (Tiŋmiaqsiuġvik) River will be 5.0 miles (8.0 km) from the coast), construction vehicle traffic will have a larger impact on bears than operational traffic. Project gravel roads and pads will be approximately 8.1 to 26.0 miles (13.0 to 42.0 km) inland from the coast. This distance will limit some potential vehicle disturbance to polar bears as the majority of bears (95%) observed historically near this region have occurred within approximately 10 miles of the coast.

Similar to aircraft traffic, vehicle traffic could disturb polar bears as described above; however, use of BLM and CPAI mitigation measures will limit those effects to short-term behavioral changes, such as retreating from the traffic.

6.1.2.4 Vessel Traffic

In addition to aircraft and vehicle traffic, facilities construction will be supported by barge traffic. Vessel traffic will occur during the open-water season (estimated to be 85 days: July 7 through September 30). There will be 30 barge trips using 50 supporting tugboats and 285 support vessel trips four summer seasons (Table 6). Encounters between vessels and polar bears are less likely to occur in open water; however, barges passing within 1 mile (1.6 km) of barriers islands and coastlines could disturb and displace polar bears from critical habitat (USFWS 2011b). Vessels and their operations produce effects through a visual presence; traffic frequency and speed; and operating noise of onboard equipment and engines. Vessel traffic could most likely encounter polar bears among sea ice near Point Barrow or Oliktok Point in July or along the coast of the southwestern Beaufort Sea in August and September. Vessels will be required to have marine mammal observers onboard. Some vessels have occasionally reported seeing a swimming polar bear in open water. Vessel presence and noise could temporarily disturb individual polar bears resting or foraging on marine mammal carcasses along the coast or on barrier islands.

If an encounter between a vessel and a swimming bear occurs, it will most likely result in a minor disturbance (e.g., the bear may change its direction or temporarily swim faster) as the vessel passes the swimming bear (USFWS 2011b). Although it has not been thoroughly documented, persistent disturbance from vessels operating within 1 mile (1.6 km) of barrier islands could prevent use of localized areas of barrier island critical habitat (USFWS 2011b). Potential impacts to polar bears from open water activities are expected to be limited to the short-term disturbance of small numbers of individuals.

6.1.2.5 Mine Site Development and Pile Driving

Construction of the Tiŋmiaqsiuġvik mine site will involve multiple blasting events to remove substrate; this could cause denning and non-denning polar bears to avoid or vacate the area. For transient bears, this displacement will be brief and will not result in long-term effects to bear health. Females with recently birthed young could abandon nearby maternal dens; early den abandonment can have adverse consequences on the health, growth, and survival of both mothers and offspring. Such impacts can be short term and acute and can have long-term, chronic effects to individuals. The mine site will be approximately 8.0 miles (12.9 km) from the coast, outside of designated critical habitat and near potential terrestrial denning habitat (Figures 7 and 8).

Blasting at gravel mines and pile-driving of bridge abutments during winter construction will be sources of noise in polar bear denning habitat. Pile driving will occur at bridge crossings over rivers. Pile driving produces high airborne noise levels (Table 13) and, along with gravel blasting, will be one of the noisiest activities from construction. Winter blasting and pile driving are likely to disturb some polar bears. Possible impacts on polar bears exposed to noise potentially include disruption of normal activities, displacement from foraging and denning habitats, and displacement of maternal females and young cubs from dens. Mitigation measures for avoidance and minimization of disturbance of dens required as part of the Beaufort Sea ITRs will reduce the potential impacts of blasting and pile driving on polar bears.

Because mining will be one of the closest activities to the coast (8 miles [12.9 km]), will occur in the winter when bears will be denning, and will be one of the loudest noise sources of the Project, it could have a larger impact on bears than other activities. Impacts to denning bears are discussed below.

6.1.2.6 Denning Polar Bears

The potential impacts of disturbance and displacement to females and cubs could be greater than for non-denning bears. The energetic consequences of moving away from disturbance may be more pronounced in energy-depleted mothers and energy-limited offspring. Disturbance and displacement can also result in the separation of family units (USFWS 2011b). Both of these impacts could in turn affect the health and survival of females and offspring. However, with the exception of cub mortality from separation, reactions of family units to anthropogenic activities are generally brief and temporary, and not of long-term consequence to individuals (USFWS 2011b). Denning polar bears are more sensitive to disturbance in the fall, but the energetic costs of disturbance may be higher in the spring. It is likely that potential consequences of den abandonment after cubs are born in the spring (potential for harm to cubs) results in an increased tolerance to disturbance by the sow in order to protect the maternal and energetic investments made. Polar bear cubs forced to leave dens early are at increased risk mortality from other causes, such as exposure. There is evidence that some bears may habituate to noise. Smith et al. (2007) found that polar bears using dens between 0.6 and 1.2 miles (1 and 2 km) from ice roads were less sensitive than polar bears not exposed to industry activities, indicating that the bears may have become habituated to the activity and no longer perceived it as a risk (Smith, Partridge et al. 2007). Larson, Smith et al. (2020) analyzed different disturbance stimuli, generated by various activities, at den sites and the associated bear responses on Alaska's North Slope. Denned polar bears were overtly unreactive (i.e., largely tolerant) of human activity near den sites (< 1 mile [1.6 km]), and den abandonment did not occur when bears were exposed to low levels of disturbance. The authors further found: 1) the majority of dens subjected to intense disturbance (n = 38) stimuli were not abandoned (n = 27), 2) bears that relocated as a result of disturbance did not suffer reproductive losses, 3) dens abandoned near areas of intense anthropogenic activity were still vacated within the expected normal range for undisturbed bears, 4) individual bears reacted differently to the same stimuli on different occasions, and 5) non-responses to activity are difficult to quantify. Finally, no premature den abandonments that may have led to reproductive failure were observed: females were observed leaving den sites with offspring and no remains of young were observed in dens when examined following abandonment Larson, Smith et al. (2020). However, in other studies, individual polar bears have appeared to abandon their dens due to human activities in the vicinity but the majority of those bears (10 to 12), either re-denned elsewhere or returned to the den after the disturbance event (Amstrup 1993). The final disposition and cub recruitment success for the remaining 2 bears was not definitively ascertained.

Construction and use of gravel infrastructure will occur inland from the coast 8.1 to 26.0 miles (13.0 to 42.0 km), except for the boat ramp on the Ublutuoch (Tiŋmiaqsiuġvik) River, which will be 5.0 miles (8.0 km) from the coast. Construction and use of ice infrastructure will occur 7.8 to 19.1 miles (12.6 to 30.7 km) from the coast. Between Utqiaġvik and the Kavik River (east of Prudhoe Bay), 95% of dens occupied by radio-collared bears were located within 5 miles (8 km) of the coast (Durner, Douglas et al. 2009); historical reports of dens found by other methods demonstrate that some females den farther inland

(Durner, Fischbach et al. 2010; Seaman 1981). Thus, it is unlikely that bears would den in the Willow Area, as evidenced by historical den locations (Figures 7 and 8).

Disturbance from ice road construction and use could cause den abandonment for females in the immediate area. Pregnant bears could be displaced from dens in the early part of the denning season (early winter), and to a lesser extent, pregnant individuals or those with newborn cubs could be displaced later in the season (Amstrup 1993). Pregnant females or post-partum females that abandon dens in mid-winter are at increased risk of mortality from starvation and exposure because female bears in maternal dens fast until emergence in the spring, and pregnancy and lactation increase the energetic cost of survival during what is already a period of energy deficit. Early emergence of cubs, even in spring, can have adverse consequences because cub survival is correlated with their weight at the time they exit the maternity den (Blix and Lentfer 1992). Although the duration of the ice road season is assumed to be December 15 through April 25, it is weather-dependent and could extend into May. Female polar bears and cubs exit dens in March through April (Amstrup and Gardner 1994; Streever and Bishop 2014). After emerging, family units can spend several days near the den before permanently abandoning it (USGS data cited in USFWS 2006). During this time, females and cubs may be particularly susceptible to disturbance (USFWS 2011b) causing early den abandonment.

Ice roads could affect females once they exit maternity dens with cubs-of-the-year because they can produce a disturbance and displacement response caused by auditory or visual stimulus. After den emergence, females will move to sea ice foraging habitat to replenish depleted energy stores. Depending on the spatial distance of maternal dens to activities, ice road presence and traffic could lead to early den abandonment by the mother, putting the cubs at risk because they may not be able to survive the sea ice environment away from the protective environment of the den site.

Construction activities could negatively impact denned polar bears. For example, in 2006, a female and two cubs emerged from a den 1,312 feet (400 m) from an active river crossing construction site. The female abandoned the den site within hours of the second cub emerging for the first time 3 days later. In 2009, a female and two cubs emerged from a den site within 328 feet (100 m) of an active ice road with heavy traffic and abandoned the site within 3 days. Females with cubs will remain near the den site from initial den breakout to abandonment between 2 and 18 days (Smith, Miller et al. 2013).

Various studies have evaluated the impacts of anthropogenic disturbance on polar bears. Females who abandon dens prior to birth of the cubs can successfully establish subsequent dens away from the source of disturbance (Ramsay and Stirling 1986; Rode, Regehr et al. 2014). Amstrup (1993) reported that 10 of 12 denning polar bears tolerated exposure to a variety of disturbance stimuli near dens with no apparent change in productivity (survival of cubs). Two females denned successfully (produced young) on the south shore of a barrier island within 1.7 miles (2.7 km) of an active oil processing facility, and others denned successfully after a variety of human disturbances near their dens. Similarly, during winter 2000–2001, two females denned successfully within 1,312 feet (400 m) and 2,625 feet (800 m) of remediation activities being conducted on Flaxman Island (MacGillivray, Hannay et al. 2003). In contrast, Amstrup (1993) found that several females responded to disturbance early in the denning period by moving to other sites, suggesting that females may be more likely to abandon dens in response to disturbance early in the denning period than later. Hence, the initiation of intensive human activities during the period when females seek den sites (October–November) will give them the opportunity to choose sites in less-disturbed locations (Amstrup 1993). Abandonment later in the denning period exerts greater effects on productivity: survival was poor for cubs that left dens prematurely in response to the movement of sea ice (Amstrup and Gardner 1994) and females that remained in dens through the end of the denning period had much higher cub survival than did females that emerged from dens early (Rode, Olson et al. 2018).

Experimental studies of noise and vibration in artificial (human-made) dens have been used to estimate the distances at which disturbance may occur. Blix and Lentfer (1992) reported that snow cover greatly attenuated sounds and concluded that activities associated with oil and gas exploration and development, such as seismic surveys and helicopter overflights, will not be likely to disturb denning bears at distances greater than 328 feet (100 m) from dens. In a more rigorous study, however, MacGillivray et al. (2003)

compared noise levels inside and outside of artificial dens at sites on Flaxman Island during a variety of industrial remediation activities, including passage by different vehicles and overflights by helicopters at various distances. Snow cover provided an effective buffer, reducing low-frequency noise by as much as 25 dB and high-frequency noise by as much as 40 dB for activities conducted near the artificial dens. The noise levels produced by various stimuli were detectable above background levels at ranges from 0.3 to 1.2 miles (0.5 to 2.0 km). Low-frequency vibrations and noises were detected at the greatest distances. The most audible disturbance stimuli measured from inside the dens was an underground blast, detectable in artificial dens up to 0.8 mile (1.3 km) from the source, and airborne helicopters directly overhead. Helicopters were detectable above background levels as far away as 0.6 mile (0.8 km), but the authors noted that noises just above background are not likely to cause biologically significant responses (MacGillivray, Hannay et al. 2003). The authors noted that high variability in the tolerance of different bears to noise and disturbance, including hazing with acoustic deterrents, was an important factor in evaluating human disturbance. Owen, Pagano et al. (2021) characterized noise propagation from nine industrial activities around four artificial polar bear dens near Milne Point in 2010. Each den was outfitted with microphones and a ceramic heater. The tested noise sources included a fixed-wing aircraft, helicopter, Tucker Sno-Cat, snowmachine, crew truck, vacuum truck, loader-mounted snow blower, and humans walking. The acoustic data were integrated with a polar bear audiogram to predict the probability of detection as a function of distance from the den. The sound was treated as detectable if the 1/3-octave band levels exceeded the polar bear auditory threshold at that band and were >2 dB above background levels. At the closest point of approach, mean sound pressure levels were reduced within the deep-closed, deep-open, and shallow-closed dens by 12.8, 1.5, and 16.6 dB relative to the shallow-open den, respectively. This indicates that the structure and amount of overlying snow directly affects the level of sound penetrating the den. For all dens, the vacuum and crew truck were undetectable relative to background levels. Aircraft had high probabilities (>75%) of being detected by polar bears in closed dens at distances less than 1.0 mile (1.6 km) and at distances less than 1.4 miles (2.3 km) for open dens. Ground-based sources had high probabilities (>75%) of being detected in closed dens at distances less than 0.5 mile (0.8 km) and at distances less than 0.7 mile (1.2 km) for open dens.

Standard mitigation measures, such as activity shutdowns near the den and 24-hour monitoring of the den site, may be implemented to limit human-bear interactions and allow the female bear to naturally abandon the den and minimize impacts to the animals. It is anticipated that the application of these standard mitigations, CPAI’s interaction plan, personnel training, and adaptive management (i.e., enacting case-specific mitigation), will minimize disturbances to the small number of female bears that could den within the inland Project area.

6.1.2.7 Non-Denning Polar Bears

Displacement of non-denning bears from preferred coastal habitats will be another potential impact. Polar bears passing near infrastructure in the action area will be exposed to a variety of stimuli resulting from human activity on the pads, vehicles on pads, and access roads. A variety of behavioral responses by polar bears is likely to occur, ranging from avoidance by maternal females with young cubs in spring to approach by curious bears or those attracted by sights, sounds, and odors. The USFWS (2006, 2008a; 81 FR 52276) has concluded that the types of activities typical of oil and gas projects in northern Alaska were not likely to have population-level effects on polar bear populations at the levels analyzed in areas of existing development because the behavioral responses of individual bears were short term and localized.

Polar bears moving along the coast through established oil fields (such as Kuparuk, Greater Prudhoe Bay, or Point Thomson) routinely encounter human-made obstructions and are able to cross or move past them without difficulty, resulting in short-term disturbance at most (USFWS 2008a; 81 FR 52276). Short-term behavioral responses are not likely to have population-level effects and thus are considered less problematic than are den disturbance and abandonment (USFWS 2008a; 81 FR 52276). Polar bears spending more time on land and fasting more as sea ice cover diminishes are likely to experience an increase in negative effects on energy budgets as a result of reduced access to fat-rich prey (Pagano, Durner et al. 2018).

The number of bears affected is likely to increase during the operational life of the Project as summer sea ice cover continues to diminish in the future, resulting in more bears being present onshore during the open-water period, traveling the coastline more in summer and fall, and denning onshore. Such an increase is expected as a result of the current trends for increasing use of coastal habitats and terrestrial denning habitats (Fischbach, Amstrup et al. 2007; USFWS 2006, 2008a, 2017). It is likely that maternal denning will continue to increase in terrestrial habitats in the future, although the presence of operating facilities will probably discourage female bears from denning in suitable habitat nearby; instead, they will be more likely to seek suitable den sites in less-disturbed areas.

Construction and use of gravel infrastructure will occur inland from the coast 8.1 to 26.0 miles (13.0 to 42.0 km), except for the boat ramp on the Ublutuoch (Tiŋmiaqsiuġvik) River, which will be 5.0 miles (8.0 km) from the coast. Construction and use of ice infrastructure will occur 7.8 to 19.1 miles (12.6 to 30.7 km) from the coast. Coastal components of the Project (barging and screeding) will occur only during construction. Approximately 90% of polar bears observed at existing CPAI operations were 7.7 miles from the coast (12.4 km) and 95% were 9.6 miles (15.4 km) from the coast (Figure 7). Thus, the inland location of the Willow Project will reduce impacts to polar bears.

6.1.2.8 Summary of Disturbance or Displacement

In summary, temporary disturbance and localized displacement could occur during construction activities, affecting a small number of polar bears, with no long-term impacts anticipated. The types of activities and infrastructure for the Project are similar to other projects across the North Slope oil fields; polar bears continue to den and use these areas. The mitigation measures in the LSs and ROPs, will be used to site facilities and minimize impacts to polar bears.

6.1.3 Human-Polar Bear Interactions

Project activities will increase the potential for human–polar bear interactions in the form of incidental take or deterrence in the action area, which may result in a risk of polar bear injury or death. As sea ice cover continues to diminish, the number of encounters between humans and nutritionally stressed bears is expected to increase (USFWS 2017). Polar bears could be attracted to Project facilities. Polar bears are curious and opportunistic hunters, frequently approaching and investigating locations where human activity occurs. Proximity to humans poses risks of injury and mortality for both bears and humans and may necessitate nonlethal take through deterrence or, on rare occasions, lethal take to defend human life. Sightings of polar bears at industrial sites in the Beaufort Sea region of Alaska have increased in recent years, consistent with increasing use of coastal habitats as summer sea ice cover has diminished (USFWS 2008a, 2017b; 81 FR 52276); this trend is likely to continue. Encounters between polar bears and humans in the action area are most likely to occur on and near the coastline as bears move through in late summer and fall (August–October) and as pregnant females search for den locations in autumn and early winter (October–November). Most Project components are 5.0 to 26.0 miles (8.0 to 42.0 km) inland and only actions near the coast (barging, screeding, Oliktok Dock and Kuparuk road improvements) are anticipated to encounter bears during this time. In addition, females with dependent young departing in late winter (March–April) may also encounter Project actions on the coast (moving of sealift modules by road), although these family groups are not likely to be attracted to industrial facilities because of their greater sensitivity to disturbance.

When human activities overlap with habitat used by polar bears, there is potential for human-polar bear interactions. An increase in human-bear interactions can occur if bears are deflected away from coastal travel corridors and toward developed areas. The presence of attractants (e.g., food waste) associated with construction activities and traffic can also increase human-bear interactions (Streever and Bishop 2014; USFWS 2017).

It is anticipated the Project will incur human-polar bear interactions near the coast during the 4 summer seasons of barging and screeding at Oliktok Dock. Further inland, it is anticipated individual interactions of single polar bears will occur as bears transit through the area. Although camps and other activity areas have the potential to attract polar bears, past projects demonstrate that these risks can be mitigated effectively by following a Polar Bear Avoidance and Interaction Plan. Measures in CPAI's 2021 Polar Bear Avoidance and Interaction Plan (CPAI 2021) include adequate lighting; installation of safety gates, fences, and cages for workers, as well as skirting of elevated buildings; careful waste handling and snow management; chain-of-command procedures to coordinate responses to bear sightings; and employee education and training programs (USFWS 2006). All program-related activities must be conducted to minimize the attractiveness of work and facility sites to polar bears and to prevent access to food, garbage, putrescible waste, and other potentially edible or harmful materials. Staff will receive training in North Slope wildlife awareness, and all polar bear sightings will be reported immediately to safety personnel.

6.1.3.1 Summary of Human-Bear Interaction

In summary, human-bear interactions could lead to injurious or lethal take of a small number of polar bears; however, most interactions will be limited to short-term behavioral changes from polar bears that interact with anthropogenic activities. Proactive and reactive mitigation measures, including those that CPAI has committed to implementing (Section 3.4.5, *Other Mitigation*), previously described will help mitigate human-bear interactions and inland facility locations further reduce the potential for human-bear interactions.

6.1.4 Injury or Mortality

6.1.4.1 Recorded Industry Lethal Take

Despite increased interactions in the existing oil fields in recent years, lethal take associated with oil and gas activities is rare. Three polar bears have been killed at oil and gas industrial sites in Alaska since the late 1960s: one in winter 1969; one in 1990 at the Stinson exploration site in western Camden Bay, north of the action area (Perham 2005; USFWS 2006); and one in 2011 (killed accidentally during a deterrence event) since the Chukchi Sea and Beaufort Sea ITRs went into effect in 1991 and 1993, respectively (USFWS 2008a; 81 FR 52276). The continued evolution of the oil and gas industry's management of attractants, proactive deterrence programs, and standard operating procedures in regards to human-bear interactions would result in a very-low likelihood of lethal take of polar bears from the proposed actions.

6.1.4.2 Premature Den Abandonment Potential

In addition to attraction to areas of human activity and direct interaction with humans, a second potential source of injury or mortality is premature den abandonment, which is a possible outcome of den disturbance and has been documented as an adverse effect on cub survival, where cub mortality could occur (Amstrup and Gardner 1994; USFWS 2006, 2008a; 76 FR 47010; 81 FR 52276). For example, in 2006, USFWS concluded that a female and two cubs of the year prematurely abandoned their den site as a result of disturbance caused by industry activity occurring approximately 1,312 feet (400 m) away from the den site. Although the fate of the mother or the cubs is unknown, a premature departure from the den most likely increased the probability that the smaller, younger cubs may not have survived the environment. Although the action area is outside of high-use denning habitat, polar bears occasionally den further inland and the need to minimize and mitigate disturbance to maternal polar bear dens that could cause den abandonment persists. Mitigation measures to minimize impacts to maternal polar bear dens near infrastructure on the North Slope are continuously improving. These include increased monitoring of the den sites, a reduction or cessation of proximal human activity, and increased communication between project operators and USFWS to prevent disturbance to polar bear(s) makes premature den abandonment from the proposed action unlikely to occur.

6.1.4.3 Vehicle-Bear Collision Potential

Traffic on ice roads poses a collision risk to polar bears; however, no such incidental collisions of polar bears and vehicles had been documented on the North Slope. CPAI data from 2015 to October 2021 indicates that collisions of mammals in the Alpine and GMT developments were mostly with foxes, and 1 wolverine; no collisions with polar bears nor grizzly bears were reported. In general, bears that have not been previously food-conditioned to human presence will be expected to avoid close interactions with moving vehicles given their mobility and the noise of the vehicles. Additionally, given that ice road traffic supporting the Project comprises slow-moving construction vehicles, bears transiting ice roads will have sufficient time to move out of the way of any oncoming traffic. Given the Project's inland location where a limited number of polar bears may be found, vehicle-polar bear collisions associated with the Project are not anticipated.

An additional potential source of injury or mortality to polar bears is traffic on ice and gravel roads that intersect the movement paths taken by females with young moving from terrestrial denning habitat to hunting areas offshore in late winter (March–April), posing a risk of vehicle strikes and disturbance-related distributional shifts. No vehicle strikes of polar bears along ice roads in the North Slope oil fields have been reported in agency documents evaluating impacts on polar bears, indicating the impact is discountable.

6.1.4.4 Spills

Although there have been no documented impacts on polar bears from oil spills on the North Slope, spills of oil, fuel, and waste products could impact polar bears and other marine mammals. In the unlikely event of a spill, polar bears could be exposed to toxic substances. A detailed analysis of spill risk is provided in Appendix D, *Spill Risk Assessment* (Chapter 4.0 of the Willow MDP Final EIS, BLM 2020).

Operational spills may occur during the transfer of fuel, refueling, handling of lubricants and liquid products, and the general maintenance of equipment. Polar bears may be impacted by external contact with oil, ingestion of oil, and/or inhalation of fumes. Depending on the season, location, and volume of a potential spill, polar bears could encounter spilled substances during open water and ice-covered seasons in offshore or onshore habitat (USFWS 2021a, 2021b).

Effects on experimentally oiled captive bears have included acute inflammation of the nasal passages, marked epidermal responses, anemia, anorexia, biochemical changes indicative of stress, renal impairment, and death (Øritsland, Engelhardt et al. 1981; USFWS 2006). Oiling could cause significant thermoregulatory problems by reducing the insulation value of the pelt (Hurst and Øritsland 1982; Øritsland, Engelhardt et al. 1981). In experimental oiling, many effects did not become evident until several weeks after exposure to the oil (USFWS 2006).

Oil ingestion by polar bears through consumption of contaminated prey and by grooming or nursing could have pathological effects, depending on the amount of oil ingested and the physiological state of the bear (USFWS 2006). It is likely that polar bears swimming in, or walking adjacent to, an oil spill will inhale petroleum vapors. Inhalation of highly concentrated vapors, such as gasoline in excess of 10,000 parts per million, is typically fatal (Boesch and Rabalais 1987). At lower concentrations, up to 1,000 parts per million, humans and laboratory animals can develop inflammation, hemorrhaging, and congestion of the lungs (Boesch and Rabalais 1987). Øritsland et al. (1981) reported that inhalation of hydrocarbons from crude oil in a confined space may have been a factor in the death of two of three captive polar bears exposed to oil in their experiments.

Small, localized spills on land or in the water are typically cleaned up quickly and pose little to nominal threats to polar bears. Large spills, however, may pose a potentially more serious threat to bears. Historically, large spills (10,000 to 100,000 gallons [240 to 2,400 barrels]) associated with Alaskan oil and gas activities on the North Slope have been production related and have occurred at production facilities or pipelines connecting wells on land (USFWS 2006). Only seven shallow-gas blowouts have occurred on the North Slope since 1974. Although it is conceivable that a shallow-gas blowout could occur during drilling, the expected relative rate of occurrence of such an event will be very low. There have been no reservoir blowouts on the North Slope since drilling began in the late 1960s (approximately 7,000 wells). During operations, the expected rate of occurrence for a reservoir blowout to occur as part of the Project will be very low (approaching zero). Spills on gravel pads directly associated with petroleum development infrastructure could originate from wellheads (leaks from the wellhead or the well casing during normal operations), facility and process piping, or from aboveground storage tanks. Based on historical spills data, the expected rate of occurrence of wellhead spills will be very low to low; they will range in size from very small (<10 gallons [<0.24 barrels]) to large, typically last from a few hours to a few days, and be contained within the immediate vicinity of the well itself and not be expected to reach areas beyond the gravel pad. Based on historical North Slope spills data, the expected occurrence rate for pipeline and piping related spills will range from very high for very small spills to very low for very large (>100,000 gallons [>2,400 barrels]) spills.

During Project construction, potential spills to the marine environment are expected to be very small to small (10 to 99.9 gallons [0.24 to 2.4 barrels]), limited to refined products (e.g., diesel, lubricating oil), localized to the immediate area of the sealift barge location, and short in duration (less than 4 hours). The expected spill occurrence rates for these spill types will be low to very low, and the spills will be expected to originate from smaller watercraft (e.g., tugs that handle the module transport barges, support vessels). On land, spills occurring on ice and gravel roads could result from construction vehicles capable of hauling gravel, bulk fuels, equipment, and other supplies. Spills occurring on ice or gravel pads could occur at vehicle and equipment storage areas, equipment maintenance and repair facilities, designated refueling areas, and at temporary aboveground storage tank locations. The likelihood of occurrence for very small to small spills of fuel or refined products is medium to low, and spills could occur in the event of vehicle accidents.

6.1.4.5 Contaminants

Waste, petroleum products, or other hazardous materials (e.g., lubricants, solvents) are possible attractants for polar bears and are toxic if ingested (Streever and Bishop 2014). In April 1988, a large adult male polar bear was found dead on a barrier island north of Prudhoe Bay because of poisoning from ingestion of a mixture that included ethylene glycol and Rhodamine B dye (USFWS 2006). In September 2012, two polar bears were found dead on a barrier island east of Prudhoe Bay. Samples from the bears and nearby soil and driftwood indicated the presence of Rhodamine B dye and acetic acid, but the cause of death and source of the chemicals was unknown (USFWS 2013d). Storage containers and designated areas for hazardous materials will be present during Project operations on gravel pads and removed upon the termination of activities. Although some hazardous substances are used during oil production activities, these substances, if spilled, will most likely be spilled on land where oil and gas industry procedures require immediate cleanup when detected. Standard hazardous material management and disposal measures will be implemented during Project operations, reducing the likelihood of polar bears being exposed to harmful substances, making the exposure likelihood to contaminants low.

6.1.4.6 Summary of Injury or Mortality

In summary, Project activities will result in the potential for human-polar bear interactions in the form of incidental take or deterrence in the action area, which may result in a very low risk of polar bear injury or death. Most Project components and activities will be inland 5.0 to 26.0 miles (8.0 to 42.0 km), except during the construction phase when activities will occur along the coastline for a 4-year duration. It is anticipated there will be an increased potential for both incidental and intentional (deterrence) take during this time. Such events inherently create risk for injury or mortality of bears; however, the risks are well understood and mitigation measures have been successfully implemented in existing North Slope oil and gas developments. With Project design features, ROPs, LSs, and mitigation measures in place, the proposed action is not likely to result in injury or mortality of individual polar bears. Given the current and predicted continuing decline of the SBS stock of polar bears, emphasis will be placed on avoiding injury or mortality, and current mitigation measures in the active oil fields appear to be effective at reducing such risks.

6.2 Northern Sea Otter

Potential effects from the Project on northern sea otters could arise from vessel traffic and potential accidental discharges from them. Norther sea otters may be encountered by Project vessels along the southern end of the transit route near Unalaska Island, Unalaska Bay, and Dutch Harbor. Very rarely would northern sea otters be present in offshore areas.

6.2.1 Habitat Loss and Alteration

The barge route transits through sea otter critical habitat, including Management Unit 2, Eastern Aleutian (Figure 10). Barges will temporarily increase noise while vessels are moving. There will be 30 barge trips (3 to 13 per year) with 50 supporting tugboats over four open-water seasons (Table 6). As described in Section 5.1, *Existing Conditions*, there are approximately 458 to 470 annual transits of the Bering Strait (Audubon Alaska 2017), and Project vessels will increase it slightly (by approximately 3% in Year 4, the year with the highest number of barges needed). The presence of vessels in critical habitat may temporarily dissuade sea otters from using the immediate area around the vessels but will not affect the value or function of critical habitat and will have no effect on any of the physical or biological features of critical habitat PCEs. There will be no permanent alteration or loss of sea otter habitat as a result of the Project.

6.2.2 Disturbance and Displacement

Barge and tug traffic may result in short-term behavioral disturbance of small numbers of northern sea otters along the barge transit route. Sea otter responses to vessel noise are highly variable and depend on the degree of vessel noise and the current behavioral state of the animal. Documented responses to vessels include no reaction, diving, or traveling away from the source (USFWS 2013f). Sea otters in groups (e.g., rafted otters) may disperse (USFWS 2013f); however, rafted otters showed interest in a boat passing within 328 feet (100 m) (Richardson, Greene et al. 1995). Sea otters often show no reaction to boats approaching or transiting through an area; however, there are observations of sea otters avoiding areas with heavy vessel traffic and returning during the seasons when vessel traffic is less frequent. Curland (1997) observed sea otters traveling greater distances in areas with vessel disturbance than areas without. Sea otters on land have also been observed moving into the water when small boats approach within 328 feet (100 m) of the shore (Richardson, Greene et al. 1995). The small number of Project barges and tugs (0 to 13 barges per year and 0 to 20 tugs per year over five open-water seasons; see Table 6) relative to existing traffic levels in the sea otter range will result in short-term, localized behavioral disturbance to a few sea otters. Project vessels will increase existing vessel traffic in the Bering and Beaufort seas slightly (by approximately 3% in Year 4, the year with the highest number of barges needed).

To minimize the effects of disturbance associated with vessel activity on sea otters in the area, CPAI will have trained protected species observers with each sealift transit.

6.2.3 Injury and Mortality

Barges transiting through sea otter habitat could strike otters. Vessel strike is a recurring cause of death across all three stocks. However, it has been determined in most of these cases that although trauma was the ultimate cause of death, there was a contributing factor, such as disease or biotoxin exposure, which incapacitated the animal and made it more vulnerable to vessel strike (USFWS 2014). Barges will follow standard marine mammal disturbance guidelines to reduce the potential for vessel strike. Further, the small number of barges (30 with 50 supporting tugboats across four open-water seasons) reduces the probability of injury or mortality of sea otters from barges to very low.

6.2.3.1 Spills

During construction, potential spills to the marine environment are expected to be very small to small (10 to 99.9 gallons [0.24 to 2.4 barrels]), limited to refined products (e.g., diesel, lubricating oil), localized to the immediate area of the sealift barge location, and short in duration (less than 4 hours). The expected spill occurrence rates for these spill types will be low to very low, and the spills will be expected to originate from smaller watercraft (e.g., tugs that handle the module transport barges, support vessels).

Though the likelihood of spills from the Project affecting northern sea otters is low, the possible consequences if a spill were to occur could be severe if sea otters were exposed. Sea otters are dependent on their fur for thermoregulation and oiling severely reduces fur thermoregulatory performance. In the event of exposure to a spill, otters would experience thermal stress, including decreased body temperature and significantly increased metabolic rates, as well as increase energy expenditure through additional grooming attempts (Costa and Kooyman 1982; Engelhardt 1983; Kooyman, Gentry et al. 1976). Sea otters may also ingest oil through grooming of oiled fur or through ingestion of contaminated prey, leading to lung, liver, and kidney damage (Bickham, Mazet et al. 1998; Lipscomb, Harris et al. 1996).

Spills may also cause direct and indirect effects on critical habitat elements for sea otters, particularly kelp forests. For example, the rocky shoreline recovery after the Exxon Valdez oil spill took more than a decade (Peterson, Rice et al. 2003). A reduction in otter survival rates was still evident nine years after the spill (Monson, Doak et al. 2000) and the affected population took nearly a quarter century to recover (Ballachey, Monson et al. 2014).

Overall, discharges from Project vessels are unlikely to affect sea otters and their critical habitat because the action area will have limited overlap with the range of the listed sea otter and their critical habitat; only a small number of vessel transits associated with the Project will occur in the northern sea otter's range. Furthermore, the likelihood of a small spill is very low to low and not likely to affect individual otters or their critical habitat.

6.3 Spectacled Eider

6.3.1 Habitat Loss and Alteration

Project activities with the potential to remove or alter spectacled eider habitat include the following:

- Fill placement for new gravel roads and pads
- Gravel mining
- Gravel spray and dust deposition, thermoskarsting, impoundments, and delayed snowmelt
- Screeding
- Water withdrawal from lakes
- Construction of ice roads

There is no designated critical habitat for the spectacled eider on the North Slope and therefore no direct impact to critical habitat from Project activities. Spectacled eider habitat occurs in the Project footprint. Approximately 429.0 acres will be permanently lost from fill for gravel roads and pads, boat ramps, access roads, airstrip, and minor curve widening along Oliktok Road. Approximately 119.4 acres will be permanently altered due to excavation for the Tiŋmiaqsiuġvik mine site. The Tiŋmiaqsiuġvik mine pit (119.4 acres) will fill with rain and snowmelt and be converted to a deep waterbody. Approximately 110.6 acres (or 24.1% of the total fill footprint) of preferred eider nesting habitat will be lost directly to gravel fill. Another 15.1 acres (or 9.1% of the total fill footprint) will be directly altered from the Tiŋmiaqsiuġvik gravel mine pit; though these acres will not be available for nesting, the altered habitat will be available for use during pre-breeding and brood-rearing (Table 15). Project roads and pads were designed, as much as possible, to avoid wet and aquatic habitats that spectacled eiders favor for nesting and brood rearing. The largest proportion of the area directly lost to the Project comprises drier habitats (Moist Tussock Tundra, 59.0% of area directly lost, and Moist Sedge-Shrub Meadow, 11.2% of the area directly lost), which are avoided by pre-breeding and nesting spectacled eiders (Table 15). Avoided habitats make up 75.9% of the area of direct loss. Habitats preferred by spectacled eiders make up 22.7% of the area that will be directly lost to Project infrastructure and the remaining 1.4% are habitats used in proportion to availability.

Table 15. Summary of Direct and Indirect Impacts to Spectacled Eider Habitat in the Action Area

Habitat Use	Habitat	Direct Loss[a] (acres)	Direct Loss (%)[b]	Direct Alteration (excavation for mine site) (acres)	Direct Alteration (%)[b]	Indirect Alteration (dust, thermokarst, impoundments)[c] (acres)	Indirect Alteration (%)[b]	Disturbance Loss (within 656 feet of gravel)[d] (acres)	Disturbance Loss (%)[b]
Preferred	Brackish Water	0	0	0	0	0	0	0	0
Preferred	Tapped Lake with High-water Connection	0	0	0	0	0	0	32.6	0.2
Preferred	Salt Marsh	0	0	0	0	0	0	44.5	0.3
Preferred	Deep Open Water without Islands	0	0	0	0	15.1	0.5	434.8	2.5
Preferred	Deep Open Water with Islands or Polygonized Margins	0.2	<0.1	0	0	11.0	0.4	132.2	0.8
Preferred	Shallow Open Water with Islands or Polygonized Margins	0	0	0	0	13.7	0.5	131.1	0.8
Preferred	Shallow Open Water without Islands	2.4	0.6	0	0	28.4	1.0	290.7	1.7
Preferred	Deep Polygon Complex	0	0	0	0	0	0	79.5	0.5
Preferred	Grass Marsh	0	0	0	0	2.1	0.1	41.6	0.2
Preferred	Young Basin Wetland Complex	0.1	<0.1	0	0	1.0	<0.1	143.1	0.8
Preferred	Old Basin Wetland Complex	19.3	4.4	0	0	174.5	6.0	1,295.4	7.4
Preferred	Nonpatterned Wet Meadow	11.4	2.6	0	0	112.7	3.9	1,112.2	6.4
Preferred	Patterned Wet Meadow	65.1	15.0	4.8	4.0	472.7	16.4	2,649.5	15.2
--	**Total Preferred Habitat**	**98.5**	**22.7**	**4.8**	**4.0**	**831.2**	**28.8**	**6,387.2**	**36.6**
Proportional[e]	Sedge Marsh	3.2	0.7	1.4	1.2	59.9	2.1	335.2	1.9
Proportional[e]	Riverine Complex	0.5	0.1	0	0	12.2	0.4	49.1	0.3
Proportional[e]	Dune Complex	1.0	0.2	0	0	11.4	0.4	16.8	0.1
Proportional[e]	Human Modified	1.3	0.3	0	0	0.2	<0.1	171.2	1.0
--	**Total Habitat Used in Proportion to Availability**	**6.0**	**1.4**	**1.4**	**1.2**	**83.7**	**2.9**	**572.3**	**3.3**
Avoid	Tapped Lake with Low-water Connection	0	0	0	0	0	0	1.2	<0.1
Avoid	River or Stream	0.6	0.1	0	0	13.1	0.5	165.2	0.9
Avoid	Moist Sedge-Shrub Meadow	48.4	11.2	40.9	34.2	325.8	11.3	3,300.4	18.9
Avoid	Moist Tussock Tundra	256.0	59.0	72.4	60.6	1,413.0	48.9	5,977.5	34.3
Avoid	Tall, Low, or Dwarf Shrub	23.5	5.4	0	0	211.3	7.3	848.6	4.9
Avoid	Barren	0.8	0.2	0	0	9.8	0.3	179.5	1.0
--	**Total Avoided Habitat**	**329.3**	**75.9**	**113.3**	**94.8**	**1,973.0**	**68.3**	**10,472.4**	**60.1**
Unknown	No Data (unmapped)	0	0	0	0	2.2	0.1	2.7	<0.1
--	**Total Impacted Area**	**433.8**	**100.0**	**119.5**	**100.0**	**2,890.1**	**100.0**	**17,434.6**	**100.0**

Note: -- (not applicable).
[a] Direct habitat loss includes gravel fill for roads, pads, boat ramps, mine site perimeter berms, airstrip, and curve widening.
[b] Percent of total loss, alteration, or disturbance.
[c] Indirect habitat alteration includes the dust shadow within 328 feet (100 meter) of gravel infrastructure.
[d] Based on a 656-foot (200-meter) disturbance zone around gravel infrastructure and pipelines.
[e] Habitat not significantly preferred or avoided, therefore used in proportion to its availability described in Table 11.

Gravel spray and dust deposition, thermokarst, impoundments, and delayed snowmelt from snow dumps and drifting will indirectly impact terrestrial habitats through modification. Most dust falls within 100 m (328 feet) of roads and pads (Walker and Everett 1987), and this distance is used to calculate indirect habitat alteration effects. Approximately 2,890.1 acres will be indirectly altered; most (68.3%) of those acres are in avoided habitats, primarily Moist Tussock Tundra (48.9%) and Moist Sedge-Shrub Meadow (11.3%). Some preferred habitats will be altered (28.8% of acres indirectly affected), mostly Patterned Wet Meadow (16.4%; see Table 15). Effects will likely be permanent and will include changes to vegetation, loss of habitat to delayed snowmelt, thawing of permafrost, and increases in standing water near gravel roads and pads. Most of the area within 328 feet (100 m) of gravel roads and gravel pads will be altered, and may or may not remain appropriate habitat for spectacled eiders depending on the type and degree of alteration. The area adjacent to roads is often the first to be snow-free in spring, and early-arriving eiders and other waterbirds use these areas before other areas farther from roads become available (Anderson, Ritchie et al. 1999), which may benefit the earliest migrants but also exposes them to increased risk of collisions with vehicles.

Screeding will temporarily alter benthic foraging habitat and increase turbidity in the 12.1-acre screeding footprint. Spectacled eiders that depend seasonally on this habitat for foraging could experience temporary decreased foraging success from turbidity and a decrease in availability of benthic foods in the screeding footprint. However, the screeding footprint is relatively small, and the plume from screeding will increase turbidity for short periods of time. Screeding will require approximately 1 week to complete and will occur before each barge delivery; habitat will be altered until the substrate is naturally redistributed (likely within several days to several weeks) and suspended sediment settles to the sea floor (expected to be a period of hours to days). Alternative areas for foraging will likely be available in the screeding vicinity and until the screeding footprints are colonized by benthic invertebrates.

Water withdrawal from lakes could lower water levels if lakes do not fully recharge in the spring. Decreased water levels could alter lake and shoreline habitats for nesting spectacled eiders and could reduce suitability for nesting or expose nests to predation, particularly at small islands and low-lying shoreline areas. Lowered lake levels might also impact bird forage species (invertebrates and fish). The State of Alaska regulates water withdrawal by restricting the volumes of water removed, which should minimize some or all negative effects. Impacts of water withdrawal on nesting spectacled eiders are not very likely given the low density of pre-breeding birds in the Willow area, the low probability that a nest will be placed on a water-source lake, and the expectation that lake levels will recharge to pre-withdrawal conditions.

Ice roads (511.4 miles, 3,749.4 acres) and ice pads (single and multi-year, 944.0 acres) may alter spectacled eider habitat by compacting vegetation in the ice road footprint, especially standing dead vegetation that might be used by spectacled eiders for nest concealment. Ice roads could remain in place until after eiders have arrived in late spring to early summer. Ice infrastructure can also cause impoundments of water because the compressed ice melts relatively slowly compared to the surrounding snow.

Direct and indirect habitat losses from the Project could result in a loss or displacement of nests within the action area and will likely result in the displacement of adult birds to other areas of appropriate habitat. Three spectacled eider nests were found in a wetland approximately 5 miles (8 km) northeast of BT2 (Figure 14) during ground-based nest surveys in 2001 (Burgess, Johnson et al. 2002). No spectacled eider nests were found during ground-based nest searches of the Willow area in 2020 or 2021(Attanas, Orion et al. 2022; Rozell, Obritschkewitsch et al. 2022). Pre-breeding density of spectacled eiders in the Willow area is very low (mean = 0.019 birds per square mile [0.007 birds per square km], Rozell, Obritschkewitsch et al. 2022), which implies that nesting spectacled eiders will occur at even lower densities. In the Kuparuk area, several nests were found near the Oliktok Road (Figure 14) during annual ground nest searches in 1993 through 2019 (Attanas and Shook 2020).

6.3.2 Disturbance and Displacement

Project activities that could disturb or displace spectacled eiders include the following:

- Increased activity and noise from personnel and machinery, as well as ground, air, and marine traffic
- Visual and noise disturbance from construction, operations (including flaring), and infrastructure

Disturbance can increase concealment behaviors; decrease nest attendance; cause movement or flight; or interfere with resting, feeding, and brood-rearing activities. It can also increase energetic costs or lead to displacement of breeding and non-breeding birds. For breeding birds, disturbance and displacement may increase nest and brood predation, thereby reducing reproductive success (Meixell and Flint 2017; Stien and Ims 2015; Uher-Koch, Schmutz et al. 2015). Studies of bird reactions to human disturbance in oil fields indicate that responses vary among species, by season and breeding status, by type of human disturbance, and by distance to the source of disturbance (Anderson, Murphy et al. 1992; Johnson, Burgess et al. 2003; Johnson, Parrett et al. 2008; Murphy and Anderson 1993).

Eiders along the nearshore barge and support vessel route could also be temporarily disturbed or displaced from slow-moving vessels during the construction phase. Effects will occur during four open-water seasons (July 7 through September 30; see Table 6), be localized, and shallow nearshore marine waters used by post-breeding and migrating eiders (Sexson, Pearce et al. 2014; USFWS 2021e) are abundant in the area. Given the timing of activity in the open-water season, failed and post-breeding spectacled eiders moving to molting areas and breeding females and fledged young leaving breeding areas could encounter barge traffic and support vessels. Thirty barge trips with 50 tugboats and 285 support vessel trips will be needed over four summers (Table 6). Vessels near foraging eiders may disturb the birds from feeding, causing them to move to another area. Steller's eiders have been observed to flush at 328 to 656 feet (100 to 200 m) from a small skiff (HDR 2004), and it is expected that spectacled eiders will do the same. This disturbance will be short term, occurring during four open-water seasons. However, barge and support vessel traffic will likely have little impact on spectacled eider use of marine habitat because the barges will have slow transit speeds, and support vessels will be operating between Oliktok Dock and the lightering area (2.3 nautical miles; 4.3 km). Large areas of unaffected marine habitat will be available for feeding and resting. If spectacled eiders are near vessels that are underway, they may be temporarily displaced, but overall distribution could be unaffected, as was reported for long-tailed ducks in response to seismic and boat traffic in Simpson Lagoon (Flint, Reed et al. 2003). Aerial surveys of nearshore areas in the Beaufort Sea found no displacement of long-tailed ducks in areas of industrial development and vessel and aircraft activity, although sample sizes may have lacked power to detect effects (Fischer, Tiplady et al. 2002).

Eiders in the nearshore marine area around Oliktok Point will also be disturbed or displaced due to in-water work (screeding), noise (both airborne and underwater), and human activity. In-water work and underwater noise will occur over four summer seasons; airborne noise and human activity onshore at Oliktok Dock will occur for one summer construction season (4 weeks) and during each barge offloading. Oliktok Dock improvements will be within the existing footprint of the dock. All dock improvements will be on shore; no in-water work and no pile driving are proposed.

The effects of underwater sound on birds, in general, have not been well studied but could include masking of the ambient noise environment, disturbance, and hearing impairment. Studies of the effects of underwater seismic survey sound on molting long-tailed ducks (*Clangula hyemalis*) in the Beaufort Sea showed little effect on their behavior (Flint, Reed et al. 2003; Lacroix, Lanctot et al. 2003). The studies did not consider potential physical effects on the ducks. Lacroix, Lanctot et al. (2003) suggested caution in interpreting the data because of their limited utility to detect subtle disturbance effects and recommended further study.

Summer construction will occur along existing Kuparuk roads from Oliktok Dock to DS2P, including upgrading roads (i.e., curve widening), increasing the thickness of the existing gravel pad to be used for module staging (within its current footprint), and moving sealift modules to the staging pad. Onshore summer construction will result in human activity, machinery, traffic, and noise that could disturb or displace birds near the construction areas. Winter activities (construction and ice roads) will have minimal impacts on eiders because they are not present in the action area during winter.

Noise and visual stimuli from ground and air traffic will disturb or displace eiders throughout the life of the Project. Vehicle traffic and aircraft flights could result in eider avoidance of certain areas, abandonment of nesting attempts, or reduced survival of eggs and young. Ground and air traffic will be highest during winter construction (December through April) when spectacled eiders do not use the action area. Traffic disturbance impacts to eiders will be greatest during early to mid-summer when the most eiders are present and eiders are breeding. During summer, up to 0.6 to 0.9 fixed-wing landings per day at Willow will occur for the duration of the Project (Table 7). Helicopter trips to Willow will average 0.4 to 0.5 trips per day during summer for the same period. Aircraft trips to or from Alpine to support the Project will cease after Year 7. Tables 6, 7, and 8 in Section 3.2.2.7.5, *Traffic*, provide details on traffic. Hazing birds at or near airstrips will temporarily disturb or displace additional individual birds. There will be 14.3 vehicle trips per hour in the summer from Year 1 through Year 10. Ground traffic rates will decrease to 3.7 vehicles per hour in summer from Year 11 through Year 30.

Disturbance and displacement will be lower in intensity during operations than during construction and drilling. Vessel traffic will end after the summer of Year 6, virtually eliminating disturbance or displacement of post-breeding eiders in nearshore waters. Vehicle traffic will decrease by approximately 75% after Year 10 (Tables 6 and 7), reducing impacts to pre-nesting and nesting eiders.

Spill response and containment equipment will be deployed and maintained annually after ice-out at pipeline waterbody crossings. Locations and number of sites for containment are not available at this time. Based on spill prevention at Alpine, it is expected that deployment and maintenance will occur before or during spectacled eider nesting, and therefore could be a source of disturbance. Activity could include deployment of supplies by helicopter, boat, or road-based vehicles. Most sites will require activity on the tundra or streams over a period of 1 to 10 days to establish storage and anchor locations for floating containment booms. Periodic maintenance to pre-staged supplies and equipment will be necessary on an annual basis, and spill response drills will occur regularly. Although rivers and streams are little used by pre-breeding and nesting eiders (Table 10), activity on tundra areas around streams and lakes could disturb pre-breeding, nesting, and brood-rearing spectacled eiders.

Disturbance can increase movement of individuals and groups away from sources of disturbance, and in extreme cases, cause flight or flushing. However, displacement in the distribution of breeding spectacled eiders around oil field infrastructure was not observed in a pre–post-construction study of spectacled eiders at the CD3 satellite in the Alpine oil field (Johnson, Parrett et al. 2008). No displacement of pre-breeding spectacled eiders from gravel infrastructure was detected from aerial survey data for the CRD among the periods of pre-Alpine construction (1993–1997), post-Alpine construction (1998–2004), and post-CD3/CD4 construction (2005–2007; Johnson, Parrett et al. 2008). Pre-breeding spectacled eiders were closer to Alpine, the Alpine airstrip, and CD4 ($P \leq 0.04$) in the post-CD3/CD4 construction period than in the pre- and post-Alpine periods. Distance of pre-breeding spectacled eiders to CD3 were closer but not significantly closer ($P = 0.4$) in the post-CD3/CD4 period. Data on nesting locations also exhibited no indications of displacement or of adverse effects to nest fate. Nests were nearer to CD3 after construction of CD3 than before construction, and successful nests were nearer to CD3 than failed nests. However, Analysis of Variance found no significant effects on distance of nests to infrastructure related to year, nest fate, or interaction terms ($P = 0.56$) or on construction period, nest fate, or interaction terms ($P = 0.36$; Johnson, Parrett et al. 2008). Similar data on broods and post-breeding spectacled eiders are not available. In another study, displacement was documented for non-breeding spectacled eiders during the nesting period at a gas handling plant in Prudhoe Bay; Anderson, Murphy et al. (1992) found flocks of non-nesting spectacled eiders were an average of 1,971 feet (600 m) farther (6,056 feet [1,846 m] versus 4,085 feet [1,245 m]) from the plant after noise increased with the installation of two compressors.

The estimated area of disturbance from all summer terrestrial activities (the area around gravel infrastructure and pipelines) will be 17,431.9 acres, during all Project phases, based on a 656-foot (200-m) disturbance zone around gravel infrastructure and pipelines (Table 15). Similar to the distribution of habitat impacts for the Project, most (60.1%) of the disturbance impacts will occur in habitats avoided by pre-breeding and nesting spectacled eiders, and lesser amounts of disturbance impacts will occur in preferred habitats (36.6%) and habitats used in proportion to availability (not significantly preferred or avoided, 3.3%).

To prevent disturbance of breeding spectacled eiders, the USFWS established a 656-foot (200-m) zone around nesting spectacled eiders where human activities off gravel pads and roads are prohibited (USFWS 2015b, 2018b). This zone is included in ROP E-18 (BLM 2022) and is used in this BA to approximate the area adversely affected by human activity, noise, traffic, and machinery. This is a much smaller distance than where displacement occurred (4,085 feet or 1,245 m) at the gas handling plant described above (Anderson, Murphy et al. 1992), but also greater than the distances summarized for waterfowl in a review of flight initiation distances (distance to source of disturbance, which elicited flight reaction) and derived minimum approach distances (1.5 × flight initiation distance) across 11 orders, 27 families, and 49 species of birds (Livezey, Fernandez et al. 2016). Only one order, Falconiformes (falcons, hawks, and eagles), had flight initiation distances of >656 feet (200 m). Non-nesting Anseriformes (e.g., ducks, geese, swans) had greater minimum approach distances than nesting Anseriformes, although the largest minimum approach distance (486 feet [148 m] to motorized watercraft) was still within the 656-foot (200-m) zone used by USFWS for spectacled eiders. Similar data were unavailable for spectacled eiders and, among the studies reviewed, none included eiders or any other sea ducks (Livezey, Fernandez et al. 2016). Data collected on spectacled eiders on the Colville River during nesting found that nesting spectacled eiders rarely (7% of 84 hens on nests) flush at distances greater than 82 feet (>25 m) from people on foot, and the greatest distance at which flushing occurred was 131 feet (40 m) (ABR 2016 unpublished data). Similar data on flushing are unavailable for non-nesting spectacled eiders, but observations of pairs of spectacled eiders not obviously associated with nests suggest some are more sensitive to human presence and flush at greater distances than do incubating spectacled eiders.

The 656-foot (200-m) disturbance zone therefore encompasses the documented flushing distances of nesting spectacled eiders and the flight initiation distances and minimum approach distances from reviewed data for all but the Falconiformes (Livezey, Fernandez et al. 2016). The disturbance zone exceeds the largest minimum approach distances for non-nesting Anseriformes by only 171 feet (52 m) and for nesting Anseriformes by 495 feet (151 m) (Tables 1 and 2 in Livezy et al. 2016). It should be noted that the 656-foot (200-m) disturbance zone is intended to include most adverse effects to breeding spectacled eiders, not only severe and obvious reactions, such as flushing from nest sites. The 656-foot (200-m) zone does not encompass the distance at which displacement from an industrial noise source occurred for non-nesting spectacled eiders during the nesting season (4,035 feet [1,245 m]; Anderson, Murphy et al. 1992).

Potential incidental take of spectacled eiders can be estimated from empirical data on the density of birds in the action area within the 656 feet (200 m) disturbance zone around Project infrastructure (Table 16). The 656-foot (200-m) disturbance zone was overlaid on Figure 13 (USFWS 2016c unpublished data), to calculate areas in two density categories (0 to 0.08 and >0.08 to 0.26 eiders per square mile). The mid-points of each density category were multiplied by the area in each density category within the disturbance zone to estimate the number of spectacled eiders, and those products were summed for the total number of eiders potentially observed in each disturbance zone. The number of eiders was divided by a detection rate of 0.75 (mid-point of detection rates for singles and pairs) to correct for spectacled eiders present but not observed on aerial surveys (Wilson, Stehn et al. 2017). Number of nests were assumed to be 50% of the number of pre-breeding eiders, and each nest was assumed to produce 4.3 eggs (Bart and Earnst 2005). Annual estimates of spectacled eiders, nests, and eggs in Table 16 were calculated using the following steps:

1. Density midpoint × area = estimated number of observed pre-breeding eiders observed in each of two density categories in the disturbance zone
2. Observed eiders / detection rate = estimated number of eiders corrected for lack of detection
3. Corrected estimated number of pre-breeding eiders / two = number of nests in disturbance zone

4. Number of nests × 4.3 eggs/nest = number of eggs in disturbance zone

Based on average area-specific densities, an estimated 2.2 pre-breeding spectacled eiders could be observed annually from USFWS aerial surveys in the disturbance zone, which will result in a corrected number for detection error of 2.9 spectacled eiders. A potential loss of 1.45 nests/year or 6.2 eggs/year was calculated (Table 16). The average density from ABR's surveys in the Willow area, which were conducted annually and at 50% sampling rate, was within the range but lower (0.024 indicated eiders per square mile during 2017 to 2021 [Parrett, Obritschkewitsch et al. 2022]) than the average densities estimated from USFWS surveys. By comparison, USFWS surveys were conducted at approximately 2% to 8% sampling rate and over a 4-year cycle, thus the estimated densities would be expected to have less precision.

The mean clutch size from long-term records on the Colville delta and the northeast NPR-A (the nearest study sites to the Project that had adequate clutch size data) was 4.1 eggs per nest (Johnson, Shook et al. 2018). This estimate was slightly smaller than the 4.3 eggs used to calculate the annual estimate (Bart and Earnst 2005). However, clutch sizes were sometimes larger in Utqiaġvik (4.1 to 5.1 eggs), but that was in an area of fox control (Safine 2011, 2012, 2015), which may have affected those estimates. Assuming that disturbance will affect spectacled eiders for the life of the Project (approximately 30 years), a total of 87.0 eiders, 43.5 nests, and 187 eggs could be disturbed, lost, or displaced. These estimates are maximal numbers and probably an overestimate estimate of displacement and loss, for the following reasons:

1. The 656-foot zone around Project infrastructure is composed primarily of habitats avoided by pre-breeding spectacled eiders and not used by nesting spectacled eiders (44% of the area is in Moist Tussock Tundra and Moist Sedge-Shrub Meadow; see Table 15).
2. Spectacled eiders have been found to nest within 656 feet (200 m) of active gravel roads, pads, and airstrips, with similar success rates as those farther away from those facilities (Johnson, Parrett et al. 2008; Seiser and Johnson 2018).
3. Actual densities of spectacled eiders within 656 feet (200 m) of Project infrastructure are more likely in the range of 0.01 to 0.04 birds per square mile, based on the densities measured on aerial survey sampled at 50% sampling intensity by ABR within the Willow study area (Rozell, Obritschkewitsch et al. 2022). USFWS densities are based on low sample intensity (approximately 2% to 8%) and large-scale extrapolation from small numbers of observations in the action area (Figure 13).

Table 16. Estimated Annual Number of Spectacled Eiders, Nests, and Eggs Occurring in the Disturbance Zone

Density (birds per square mile)	Midpoint Density (birds per square mile)	Area (square miles)	Observed Eiders	Eiders Adjusted for Detection	Total Nests	Total Eggs
>0.08 to 0.26	0.17	21.75	3.70	4.93	2.47	10.60
>0.26 to 0.51	0.39	5.46	2.13	2.84	1.42	6.10
Total	**--**	**27.21**	**5.83**	**7.77**	**3.89**	**16.7**

Notes: -- (not applicable). Densities are shown in Figure 13 and based on pre-breeding densities USFWS surveys from 2012 to 2015. Disturbance zone is the area within 656 feet (200 m) of gravel infrastructure based on the USFWS buffer for nesting spectacled eiders (during June 1 to 31 July).
Source: USFWS 2016 unpublished data 2012–2015, Figure 13.

6.3.3 Injury and Mortality

Collisions with vehicles, aircraft, barges and support vessels, as well as stationary structures (such as communication towers, drill rigs, buildings and pipelines) could injure or kill a few individual spectacled eiders. Such collisions will be low probability events given 1) the low densities of spectacled eiders recorded in the area and 2) the higher likelihood that spectacled eiders will occur along the coast where Project actions will be limited to barge offloading and dock improvements. Spectacled eiders in the Project area move to nearshore marine waters after breeding in early June through September, depending on age, sex, and breeding status (Sexson, Pearce et al. 2014), and any vessels moving through the nearshore area during this time could pose a collision risk. Project gravel roads and boat ramps will increase subsistence access and could result in increased harvest of eggs and birds, leading to increases in mortality for eiders in areas accessible by road and by boat (lakes and wetlands along Ublutuoch [Tiŋmiaqsiuġvik] River, Judy [Iqalliqpik] Creek, and Fish [Uvlutuuq] Creek). Increased hunting could also increase the use of lead shot, which is toxic to eiders. Lead shot deposited in tundra wetlands and shallow marine habitat where eiders forage poses a threat to spectacled eiders. The toxic effects of ingestion of lead poisoning may vary among individuals but include lethal and sublethal effects (Hoffman 1990). Ingestion of spent lead shot reduced survival rates of spectacled eiders on the Yukon-Kuskokwim Delta (Flint, Petersen et al. 1997; Franson, Petersen et al. 1995; Grand, Flint et al. 1998). Ingestion of lead shot by listed eiders could occur during the breeding season, particularly for breeding hens and young birds foraging in shallow tundra ponds and wetlands. Exposure may decline during incubation, when hens largely forgo foraging, but the need to forage resumes after hatching, and both hens and ducklings may encounter and ingest lead shot. Waterfowl hunting with lead shot is prohibited throughout Alaska. However, its sale and use continues in villages, and lead deposited in wetlands previously and in the future with increased access on new roads and boat ramps could increase in wetlands and be ingested by waterfowl for some time into the future.

6.3.4 Spills

Mortalities or injuries to spectacled eiders caused by spills are unlikely, based on the size, location, and frequency of spills that have occurred in North Slope oil fields in the past (BLM 2012). Small-volume spills from vehicles may occur but have a low probability of reaching the tundra or lakes, and large spills are extremely rare. See predictions of spill sizes and types in section *6.1.4.4 Spills*. A detailed analysis of spill risk is provided in Appendix D, *Spill Risk Assessment* (Chapter 4.0 of the Willow MDP Final EIS, (BLM 2020). Effects from oil spills or accidental releases on eiders and their habitat will depend on the location and season of the spill. An oil discharge in the summer in breeding, molting, brood-rearing, or staging habitats could impact birds that congregate in these areas. Light to moderate oiling of birds can reduce reproduction (through pathological effects on breeding birds or the transfer of oil to eggs) or survival (Anderson, Newman et al. 2000). Heavy oiling of birds will be lethal and cause hypothermia through loss of insulation or mortality through ingestion and inhalation (Holmes, Cronshaw et al. 1978). The effects of other toxic material spills could be similar or more severe, depending on the material. Oil spills on the tundra or in water are extremely rare, as are large spills (greater than 10,000 gallons). Releases to the tundra could threaten breeding and non-breeding birds, but such releases will not spread widely unless undetected. Spills to waterways (if not frozen) could spread farther and more quickly. However, spill prevention, spill response, and pre-staging of spill containment equipment on waterways, streams, and rivers near production facilities and pipeline crossings as required by the Project's *Oil Discharge, Pollution, and Contingency Plan*, should reduce the chance that any potential spills would spread by water.

During construction, potential spills to the marine environment are expected to be very small to small (10 to 99.9 gallons [0.24 to 2.4 barrels]), limited to refined products (e.g., diesel, lubricating oil), localized to the immediate area of the sealift barge location, and short in duration (less than 4 hours). The expected spill occurrence rates for these spill types will be low to very low, and the spills will be expected to originate from smaller watercraft (e.g., tugs that handle the module transport barges, support vessels). Spills in the marine environment could affect post-breeding and fledged spectacled eiders in the Beaufort Sea or molting eiders in Ledyard Bay. The level of mortality from such spills will depend on the type and amount of spill, the duration of spill cleanup and containment, and the number of birds exposed, which will depend on the season and location. Spills in important at-sea areas (Figure 15) would have the severest effects.

6.4 Steller's Eider

All the effects described above for spectacled eiders could also occur for Steller's eider; however, the probability of Steller's eider occurring in the action area and being affected by the Project is so low, it is discountable. This conclusion is based on the current breeding range of Steller's eider on the ACP

(Quakenbush, Day et al. 2002) and the paucity of observations of Steller's eider where annual surveys have been conducted since the 1990s in the northeast NPR-A study area (surveyed since 1999), CRD study area (surveyed since 1992), and Kuparuk study area (surveyed since 1993) (Figure 18).

Because the terrestrial portion of the action area is outside the current breeding range for Steller's eider, it is expected that Steller's eider will be no more than occasional visitors to the action area, unless the population undergoes dramatic growth or a change in distribution. Recent records of Steller's eider in the vicinity (e.g., the Willow, northeast NPR-A, CRD, and Kuparuk study areas) are rare and sporadic, and no breeding records of the species have been documented despite annual aerial and ground-based surveys in the CRD and northeast NPR-A study areas over nearly three decades. Although the barge route will transit from Dutch Harbor on the north side of the Aleutian Islands and Alaska Peninsula, where Steller's eiders winter, barges will only transit the area during late summer and early fall and thus not encounter wintering birds. The probability of Steller's eider occurring in the action area during the same seasons as construction, module delivery, and operations is so low that the species may never occur there during the lifetime of the Project. The probability of a nest or brood occurring in the action area is even less likely.

Additionally, all designated critical habitat is outside of the shipping route and unlikely to affected by the Project. In the unlikely event that a vessel will have to travel through Steller's eider critical habitat, the vessel is not expected to impact the physical or biological features essential to the conservation of the species or any of the critical habitat units. The timing of vessel traffic will be during the summer open-water season, when Steller's eiders are least likely to occur in wintering or molting areas.

As was determined in the BO for GMT-2 (USFWS 2018b), an adjacent project that will be connected by road to the Willow Project, the likelihood that an individual or pair of Steller's eiders will be affected by habitat loss, disturbance, contamination, or increases in predator populations in the Willow action area, thus causing negative consequences to the population of Alaska breeding Steller's eiders, is so low as to be discountable (Johnson, Shook et al. 2018; USFWS 2018b). Thus, the Willow Project is not likely to adversely affect Steller's eiders for any Project action.

6.5 Cumulative Effects

The definition of cumulative effects in the context of ESA Section 7 includes the effects of future nonfederal actions that are "reasonably certain to occur" (50 CFR 402.02). Future federal actions that are unrelated to the Project are not considered. Because most commercial development on the North Slope has a federal nexus, these were not considered in the cumulative effects analysis. Nonfederal actions that are reasonably certain to occur include climate change, increased vessel traffic and commercial shipping as the extent of sea ice shrinks, increased subsistence harvest, expansion or changes in the activities of local communities, and management and research actions by state agencies or private entities; these actions could contribute to cumulative effects on polar bear, northern sea otter, spectacled eider, Steller's eider, and short-tailed albatross. These future actions (except climate change, which is discussed separately below) could reduce productivity and survival, remove or alter habitat, and disturb, displace, injure, or kill these species in a similar way to what is described for this Project. The effects of climate would be additive or synergistic with effects from project-related and non-federal actions.

Warming global temperatures, and associated reductions in extent and duration of sea ice (Durner, Douglas et al. 2009) that have already occurred and are predicted to worsen in the future, may have serious implications for polar bears and their ice-dependent marine prey. Over-winter survival of the world population of spectacled eiders may be negatively affected by changing sea ice regimes, as well as declines in prey availability due to climate change-related shifts in primary productivity (USFWS 2021e). Analysis of long-term data sets show substantial decreases in both extent (area of ocean covered by ice) and thickness of sea ice cover since 1979 (IPCC 2019 as cited in USFWS 2021). These trends are projected to continue, though the timing and duration of sea ice disappearance during summer months is not certain. There is a projected 1% chance of a given September being ice-free at the end of the 21st century if global warming is stabilized at 1.5°C; this probability rises to 10% to 35% if global warming is stabilized at 2°C (IPCC 2019 as cited in USFWS 2021). This suggests that all ice-dependent species may experience conditions that could result in declines of food availability and foraging and breeding habitat.

Recent shifts in distribution and habitat use by polar bears in the Beaufort and Chukchi seas are likely attributable to loss of sea ice habitat. The greatest declines in optimal polar bear habitat are expected to occur in those areas, where reduced habitat will likely reduce polar bear populations (Durner, Douglas et al. 2009; Regehr, Laidre et al. 2016). Polar bears of the SBS stock experienced twice as many days of reduced sea ice from 2008 to 2011 than did those of the Chukchi Sea stock. Despite similar diets, SBS bears were smaller and in poorer condition and exhibited lower reproduction, and twice as many were fasting in spring (Rode, Regehr et al. 2014). Consuming terrestrial foods is judged to be insufficient to offset the loss of ice-based hunting. The lack of sea ice or delayed formation of ice also forces bears to spend more time on land where they have difficulty catching prey, spend longer periods fasting, and increasing the chance of interactions with humans, increasing the risk of mortality of bears killed in defense of life or property (Amstrup 2000; Whiteman, Harlow et al. 2015).

Warming also affects eiders. Ocean warming is also expected to cause changes in species composition where benthic fauna could be exposed to new predators (Coyle, Konar et al. 2007). Movement of commercially harvested species could lead to competition with eiders for food and could open new areas to commercial fishing in the spectacled eider wintering habitat, where it does not yet occur. USFWS (2021e) also noted that future changes in winter sea ice conditions could affect the wintering distribution and energy balance of spectacled eiders. Recent satellite transmitter data suggests that the winter distribution of spectacled eiders is changing, especially during periods of northward sea ice retreat (USFWS 2021e). Lovvorn, Grebmeier et al. (2009) found that availability of ice was important for eiders as a resting platform to conserve energy when not foraging, thus if ice decreased, daily energy expenditure increased. Results of a mark-recapture analysis by Christie et al. (2018) suggest that extremely low sea ice extent may result in lower adult female survival rates. Changing precipitation patterns, longer growing seasons, drying of tundra (Martin, Jenkins et al. 2009; Post, Forchhammer et al. 2009), and other possible habitat modifications may affect the distribution and breeding success of spectacled and Steller’s eiders. Climate change could also result in earlier insect emergence and a phenological mismatch could occur if nesting eiders cannot adjust the timing of nest initiation earlier (USFWS 2021e).

The effects of continuing climate change pose long-term and major challenges to the future well-being of both marine and terrestrial species, probably leading to population declines and range contraction for some ice-dependent marine species and terrestrial species favoring aquatic and wet tundra habitats, such as breeding eiders. However, the ability of federal agencies to influence the processes thought to be responsible for climate change (such as global greenhouse gas emissions) is extremely limited at present, absent an effective worldwide response to the problem.

The Project will add vessel traffic to the Beaufort Sea at a time when traffic is expected to continue to increase due to changing climate and reduced sea ice extents. Project vessel traffic in combination with increased shipping and vessel traffic could increase the likelihood of vessel strikes of northern sea otters, spectacled eiders, and Steller’s eiders. Increased vessel traffic will also increase the number of vessels that could experience a spill or untended release.

Increased subsistence harvest due to increased onshore subsistence user access could injure or kill more polar bears and spectacled eiders or displace these species to other habitats to avoid harvest. The combination of increased subsistence user access and bears forced to spend time on shore will likely lead to more harvest of bears. Increased subsistence hunting could increase the risk of contamination of eiders with lead shot, which can cause toxicity through ingestion or from unintentional wounding by lead pellets.

Expansion of local communities and hunting or fishing camps or changes in the activities of local communities could create more development in the action area. However, most development along the central Beaufort Sea coast, and in the action area in particular, is in terrestrial habitats, which receive substantially less use by polar bears than do marine habitats but are important for breeding spectacled eiders. Spectacled eiders will be cumulatively affected by onshore future actions in the action area, and the Project will contribute to, but not substantially change, those cumulative effects.

Management and research actions by state agencies or private entities could increase human presence as well as increase ground, air, and marine traffic. This could contribute additional disturbance or displacement of polar bears, northern sea otters, and spectacled eiders.

7.0 Determination of Effects

Based on low numbers and seasonal occurrence of listed species in the action area, the relatively small footprint of the facility, the brief construction period, and conservation measures proposed to reduce Project impacts, it is unlikely that the direct or indirect effects of the Project will have population-level effects on any federally listed species or adversely modify critical habitat (Table 17). Below is a summary of the conclusions for each species.

Table 17. Determination of Effects from the Project

Species	Status	Critical Habitat	Determination of Effects
Polar bear	Threatened	Yes	May affect, likely to adversely affect polar bears. Not likely to adversely modify critical habitat.
Northern sea otter	Threatened	Yes	May affect, not likely to adversely affect northern sea otters. Not likely to adversely modify critical habitat.
Spectacled eider	Threatened	Yes	May affect, likely to adversely affect spectacled eiders. Not likely to adversely modify critical habitat.
Steller's eider	Threatened	Yes	May affect, not likely to adversely affect Steller's eiders. Not likely to adversely modify critical habitat.

7.1 Effect on Polar Bear and Its Critical Habitat

Construction activities associated with the Project (ice infrastructure, heavy equipment, traffic, etc.) will result in temporary alteration and loss of polar bear habitat, including terrestrial denning habitat. Operation and use of Project facilities (gravel roads and pads, pipelines, boat ramps, traffic, etc.) will result in permanent alteration and loss of habitat. Project activities could result in behavioral disturbance of polar bears from noise and visual disturbance; activities during the winter will have the potential to disturb denning maternal polar bears and cubs, which are more sensitive than non-denning bears. There will be an increase in potential for human-bear encounters, effects of which could range from behavioral harassment to injury or mortality. Due to their typical behaviors, polar bears are expected to be encountered at higher frequency in the coastal region than in the primary inland Project area, and most human-bear interactions are expected to occur during when the Project is active in the coastal region.

The Project's substantial design features, along with its many protective LSs and ROPs, will greatly reduce effects to the polar bear and its habitat. The LSs and ROPs were developed in part from current oil field practices and appear to be effective in managing human activity so that bears are not affected. Additionally, stipulations and mitigation measures required by the current Beaufort Sea ITRs (86 FR 42982) and CPAI's own mitigation measures for the Project's duration will further limit impacts to polar bears. However, the Project may still result in disturbances and bear-human interactions that may affect individual bears.

For this reason, BLM concludes that the Project **may affect** and **is likely to adversely affect polar bears** but is not likely to threaten the continued existence of the species.

Most of the Project components will be located outside of polar bear critical habitat because most of the activities are located farther inland. Oliktok Dock is excluded from critical habitat and is also an existing industrialized area. The Terrestrial Denning Critical Habitat Unit overlaps Project components by 1.0 acres, which is a small amount relative to the area of the entire unit. The 1.3 acres of fill will be along existing Kuparuk roads and will occur in the summer. Based on a review of the current status of the critical habitat, the environmental baseline for the action area, the amount of polar bear critical habitat in the action area, and the direct, indirect, and cumulative effects of the Project, the Project is not likely to adversely modify polar bear critical habitat. Project activities could result in ground disturbance, noise, or human presence that compromise the ability of PCEs to effectively function in those localized areas. The Project could affect localized denning habitat and barrier islands used as resting sites and travel corridors for polar bears by precluding bears from using these areas. Small spills are unlikely, but if they occurred, they would be expected to impact small areas of critical habitat in the action areas. The development footprint and the manner, location, and timing of activities that might occur within critical habitat will be subject to management constraints contained in and LSs and ROPs. These constraints will also greatly minimize the likelihood, extent, and effects of accidental contaminant spills and the associated effects to polar bear critical habitat. The BLM concludes that the Project is **not likely to adversely modify critical habitat** of polar bears.

7.2 Effect on Northern Sea Otter and Its Critical Habitat

The barge transit route will intersect the current range of northern sea otter as well as designated critical habitat (Section 4.2.5, *Critical Habitat*). Vessel transit will cause temporary disturbance and low potential for vessel strike. The low numbers of barges relative to the high level of existing vessel traffic in the area will result in very low disturbance potential. Increased vessel traffic will also increase the number of vessels that could experience a spill or untended release.

The population size of the listed northern sea otter remains small compared to abundance estimates prior to the 1980s when marked declines occurred. Trends appear to have stabilized and some local populations appear to be increasing, but overall, the listed population remains threatened. Northern sea otters and their designated critical habitat occur along the barge transit route and could be affected by traffic, noise, and potential spills from Project vessels. Otters will likely respond to vessel traffic and noise with short term avoidance and vigilance. These responses are not likely to affect the survival or fitness of animals exposed to these stressors. Sea otters could also be impacted by unintentional fuel spills during vessel refueling in Dutch Harbor; however, because refueling spills would likely be small and quickly contained and remediated, it is anticipated impacts to listed sea otters from small spills would be insignificant. Thus, given the low probability of adverse effects to individual sea otters, the Project **may affect, but is not likely to adversely affect** the Southwest Alaska DPS of the northern sea otter. Project Vessel traffic will overlap designated critical habitat near Dutch Harbor and Unalaska Island, which is a very small portion of designated critical habitat for sea otter. Furthermore, vessel presence in critical habitat will be temporary as barges pass through the area. Specific impacts (localized, short-term disturbance) from Project vessel traffic are expected to be insignificant. Spills are unlikely, but if they occurred, would be expected be very small to small oil spills. Small spills evaporate and disperse quickly in offshore waters and may not reach the sea otter critical habitat. However, if a small spill reaches sea otter habitat, it could contaminate food resources or cause a loss of kelp that provides protection from marine predators. It is likely that any habitat impacts would be short term and there would be no persistent contamination. It is not likely that a small spill would diminish the value of the physical and biological elements of habitat that are essential to the conservation of the listed population of sea otters and any effects would be insignificant. Based on a review of the current status of the critical habitat, the environmental baseline for the action area, and the direct, indirect, and cumulative effects of the Project, BLM concludes that the Project is **not likely to adversely modify critical habitat** of northern sea otters.

7.3 Effect on Spectacled Eider and Its Critical Habitat

The Project **may affect** and **is likely to adversely affect** the spectacled eiders but is not likely to jeopardize the continued existence of spectacled eider by reducing the likelihood of survival and recovery through reducing reproduction, numbers, or distribution. The Project is not likely to have population-level effects on spectacled eiders because low numbers of spectacled eiders occur in the action area, and the area affected by direct habitat loss and indirect loss due to disturbance and displacement is relatively small and comprises primarily habitats avoided during breeding. The records of breeding in the action area are for areas northeast of BT2, north of CD5, from the CRD area, and in areas where no new roads or pads are proposed; the amount of preferred breeding habitat that will be lost or modified from construction and operations is small. Spectacled eiders also nest in the Kuparuk oil field where the sealift module delivery will occur at Oliktok Point. However, impacts at Oliktok Point will occur only during the construction phase when new gravel will be laid in summer on 5 acres to widen roads for module transport. Barge trips, screeding, and support vessel trips to and from Oliktok Point will occur over four summers and along existing gravel roads. Winter construction will eliminate much of the potential disturbance of eiders near facilities.

The Project's substantial design features, along with its many protective ROPs and LSs, will greatly reduce effects to the spectacled eider and its habitat. The ROPs and LSs were developed in part from current oil field practices and appear to be effective in managing human activity so that eiders are not affected.

As reported here, the Project may, via direct and indirect impacts, affect spectacled eiders; spectacled eider behavior; and their nesting, brood-rearing, foraging, and molting habitats through habitat loss, alteration, and disturbance or displacement. The spectacled eider also could be impacted by the Project as a result of various sources of injury and mortality (e.g., collisions, increased predation, increased subsistence harvest and egg gathering, lead shot ingestion) or as a result of spills and other unintended releases. The types and levels of effects from the Project are within the range of effects previously considered by the NPR-A IAP/EIS (BLM 2020b) and BO (USFWS 2022) and similar to those identified for the GMT-1 and GMT-2 BO (USFWS 2015b, 2018b). No new factors have been identified, nor has the extent of the impacts expanded. Therefore, consistent with the IAP/EIS, the Project is not likely to jeopardize the population of spectacled eiders breeding on the North Slope.

No critical habitat has been designated for spectacled eiders on the North Slope, and vessel traffic will not traverse areas of marine designated critical habitat. Therefore, the Project is **not likely to adversely modify critical habitat** of spectacled eiders.

7.4 Effect on Steller's Eider and Its Critical Habitat

The Project is outside the current breeding range of Steller's eiders, which is centered in the Utqiaġvik area. Although the Project is within the historical range of Steller's eiders, only a few singles and pairs of birds and no evidence of breeding have been observed in the vicinity for almost three decades. The likelihood of Steller's eiders occurring in the action area is so low that any effects of the Project on Steller's eiders are discountable. There are no indications of breeding Steller's eiders in the Willow, northeast NPR-A, CRD, and Kuparuk study areas and as such, the overall cumulative impact to Steller's eiders from the Project and other reasonably foreseeable future actions is also discountable. The Project **may affect** but is **not likely to adversely affect** the Alaska breeding population of Steller's eiders.

No critical habitat for Steller's eider occurs on the North Slope and vessel traffic will not traverse areas of marine designated critical habitat. Therefore, the Project is **not likely to adversely modify critical habitat** of Steller's eiders.

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