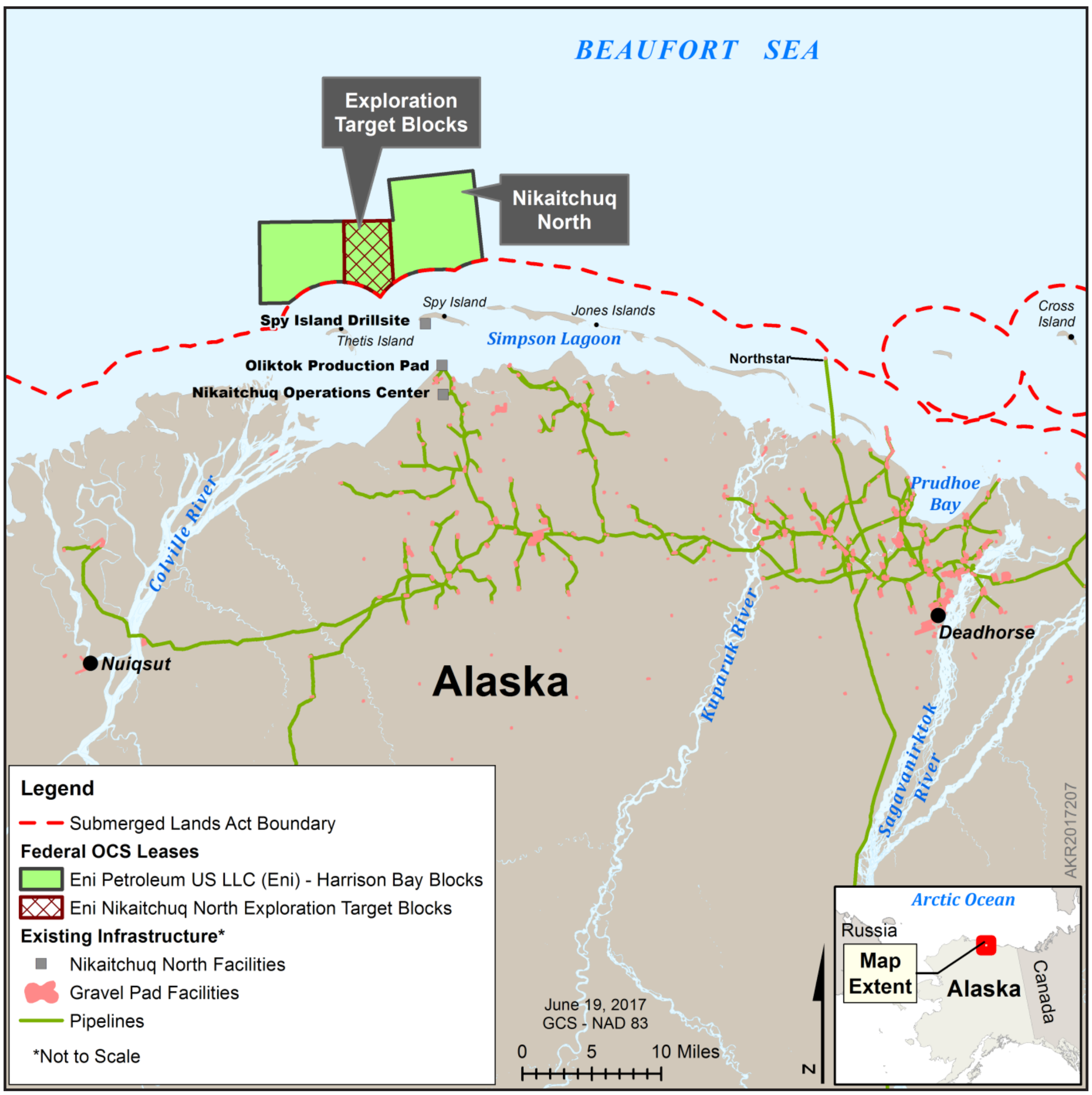
Alaska Outer Continental Shelf

OCS EIS/EA
BOEM 2017-047

Eni U.S. Operating Company Inc.
Outer Continental Shelf Lease Exploration Plan

Harrison Bay Block 6423 Unit - Leases OCS-Y-1753, OCS-Y-1754, and OCS-Y-1757

ENVIRONMENTAL ASSESSMENT



U.S. Department of the Interior
Bureau of Ocean Energy Management
Alaska OCS Region

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Acronyms and Abbreviations

AAAQS ....Alaska Ambient Air Quality Standards
AAQS ....Ambient Air Quality Standards
ACP ....Arctic Coastal Plain
ADEC ....Alaska Department of Environmental Conservation
ADF&G ....Alaska Department of Fish and Game
AEWC ....Alaska Eskimo Whaling Commission
ANS ....Alaska North Slope
AQCR ....air quality control regions
ASRC ....Arctic Slope Regional Corporation
ASWG ....Alaska Shorebird Working Group
atm ....atmosphere (of pressure)
BA ....Biological Assessment
BACT ....Best Available Control Technology
bbl.................................barrels
bbls/d ....barrels per day
BLM ....Bureau of Land Management
BO ....Biological Opinion
BOEM ....Bureau of Ocean Energy Management
BOP ....blowout preventer (system)
CEQ ....Council on Environmental Quality
CFR ....Code of Federal Regulations
CO ....carbon monoxide
CWA.............................Clean Water Act
EA.................................Environmental Assessment
EFH ....Essential Fish Habitat
EIS ....Environmental Impact Statement
EJ ....Environmental Justice
EP ....Exploration Plan
EPA ..............................U.S. Environmental Protection Agency
ESA ....Endangered Species Act
FEIS..............................Final Environmental Impact Statement
FMP ....Fishery Management Plan
FONSI ....Finding of No Significant Impact
FR ....Federal Register
Hz ....Hertz
IHA................................Incidental Harassment Authorization
IPCC ....Intergovernmental Panel on Climate Change
ITA ....Incidental Take Authorization
ITL................................Information to Lessees
IWC ....International Whaling Commission
LA.................................Launch Area
LOA..............................Letter of Authorization
LS ....Land Segment
MAI ....Maximum Allowable Increase
MAWP ....Maximum Allowable Working Pressure
Mbbls............................thousand barrels
MBTA ....Migratory Bird Treaty Act
Mcf ....thousand cubic feet
MLC ....mudline cellar
MMbbls ....million barrels
MMC ....Marine Mammal Commission
MMcf............................million cubic feet
MMPA...........................Marine Mammal Protection Act

MMS............................. Minerals Management Service
NAAQS .... National Ambient Air Quality Standards
NAB.............................. Northwest Arctic Borough
NEPA............................ National Environmental Policy Act
NHPA .... National Historic Preservation Act
NMFS .... National Marine Fisheries Service
NMML.......................... National Marine Mammal Laboratory
NO_2 .... nitrogen dioxide
NOA .... Nearest Onshore Area
NOAA .... National Oceanographic and Atmospheric Administration
NOI............................... Notice of Intent
NO_X .... nitrogen oxides
NPDES .... National Pollutant Discharge Elimination System
NPFMC .... North Pacific Fisheries Management Council
NRC.............................. National Research Council
NSB .... North Slope Borough
NSIDC.......................... National Snow and Ice Data Center
NTL .... Notice to Lessees
O_3.................................. ozone
OCS .... Outer Continental Shelf
OCSLA......................... Outer Continental Shelf Lands Act
ODPCP .... Oil Discharge Prevention and Contingency Plan
OSRP .... Oil Spill Response Plan
PM .... particulate matter
PM_{10}.............................. particulate matter equal to or less than 10 micrometers in diameter
$PM_{2.5}$ .... particulate matter equal to or less than 2.5 micrometers in diameter
Ppm.............................. Parts per million
PSD............................... Prevention of Significant Deterioration'
PTS .... Permanent Threshold Shift
ROV.............................. Remotely Operated Vehicle
RUSALCA .... Russian-American Long-term Census of the Arctic
SBS .... southern Beaufort Sea stock of polar bears
SEIS.............................. Supplemental Environmental Impact Statement
SHPO............................ State Historic Preservation Act
SIP .... State Implementation Plan
SO_2................................ sulfur dioxide
SO_4................................ sulfate
SO_X .... sulfur oxides
SS.................................. Subsea
TAPS .... Trans-Alaska Pipeline System
TLUI............................. Traditional Land Use Inventory
TOC.............................. Total organic carbon
TTS............................... temporary threshold shift
ULSD............................ ultra-low sulfur diesel
USC. .... United States Code
USDOC......................... U.S. Department of Commerce
USDOI.......................... U.S. Department of the Interior
USFWS......................... Fish and Wildlife Service
VLOS............................ very large oil spill
VOC.............................. volatile organic compounds
WAH .... Western Arctic (caribou) Herd
WCD............................. Worst Case Discharge

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CHAPTER 1. PURPOSE AND NEED

1.1. Introduction

On June 12, 2017, the Bureau of Ocean Energy Management (BOEM) deemed "submitted" a proposed exploration plan from Eni U.S. Operating Co. Inc. entitled "Nikaitchuq North Exploration Plan" (hereafter, the "EP") for exploration drilling activities in the Harrison Bay Block 6423 Unit (leases OCS-Y-1753, OCS-Y-1754, and OCS-Y-1757). The EP proposes drilling up to four exploration wells, consisting of two extended reach mainbores and two sidetracks, to evaluate the oil and gas resource potential of three of the company's Outer Continental Shelf (OCS) leases in the U.S. Beaufort Sea.

Eni is proposing to start the Nikaitchuq North Exploration project from its existing 11-acre Spy Island Drillsite (SID). The SID is a man-made, land-based gravel island, constructed in shallow (6-8 feet), State of Alaska coastal waters, approximately three miles north of Oliktok Point and just south of the Spy Island barrier island. The SID is 100% owned and operated by Eni and supports ongoing production from State of Alaska leases in Eni's Nikaitchuq Unit. The exploration wells proposed in the EP would begin from the SID and extend subsurface of the ocean floor, ending in the federal leases.

1.2. Purpose and Need for the Proposed Action

The purpose of the activities described in Eni's proposed EP, which is the Proposed Action evaluated in this Environmental Assessment (EA), is to evaluate the oil and gas resource potential of its federal leases within the Nikaitchuq North Harrison Bay Block 6423 Unit (Figure 1-1). The need for this action is established by BOEM's responsibility under the Outer Continental Shelf Lands Act (OCSLA) to make OCS lands available for expeditious and orderly development, subject to environmental safeguards, in a manner which is consistent with the maintenance of competition and other national needs.

The Department of the Interior (DOI) has delegated its OCSLA authority to several bureaus, including BOEM. BOEM is responsible for managing the mineral and energy resources located on the Nation's OCS in an environmentally sound and safe manner. To these ends, BOEM has promulgated regulations implementing certain provisions of OCSLA.

BOEM regulations pertaining to review of proposed EPs are codified at 30 CFR Part 550, where BOEM establishes requirements for the submittal of an EP, the EP review process, and performance standards that an EP must meet in order to be approved.

BOEM has prepared this EA to assist with bureau planning and decision making in accordance with the:

- National Environmental Policy Act (1970) (NEPA) (P.L. 91-190, 42 U.S.C. 4321 *et seq*.),
- Council on Environmental Quality (CEQ) regulations at 40 CFR 1501.3(b) and 1508.9,
- Department of the Interior (DOI) regulations at 43 CFR Part 46, and
- DOI manual at 516 DM 15.

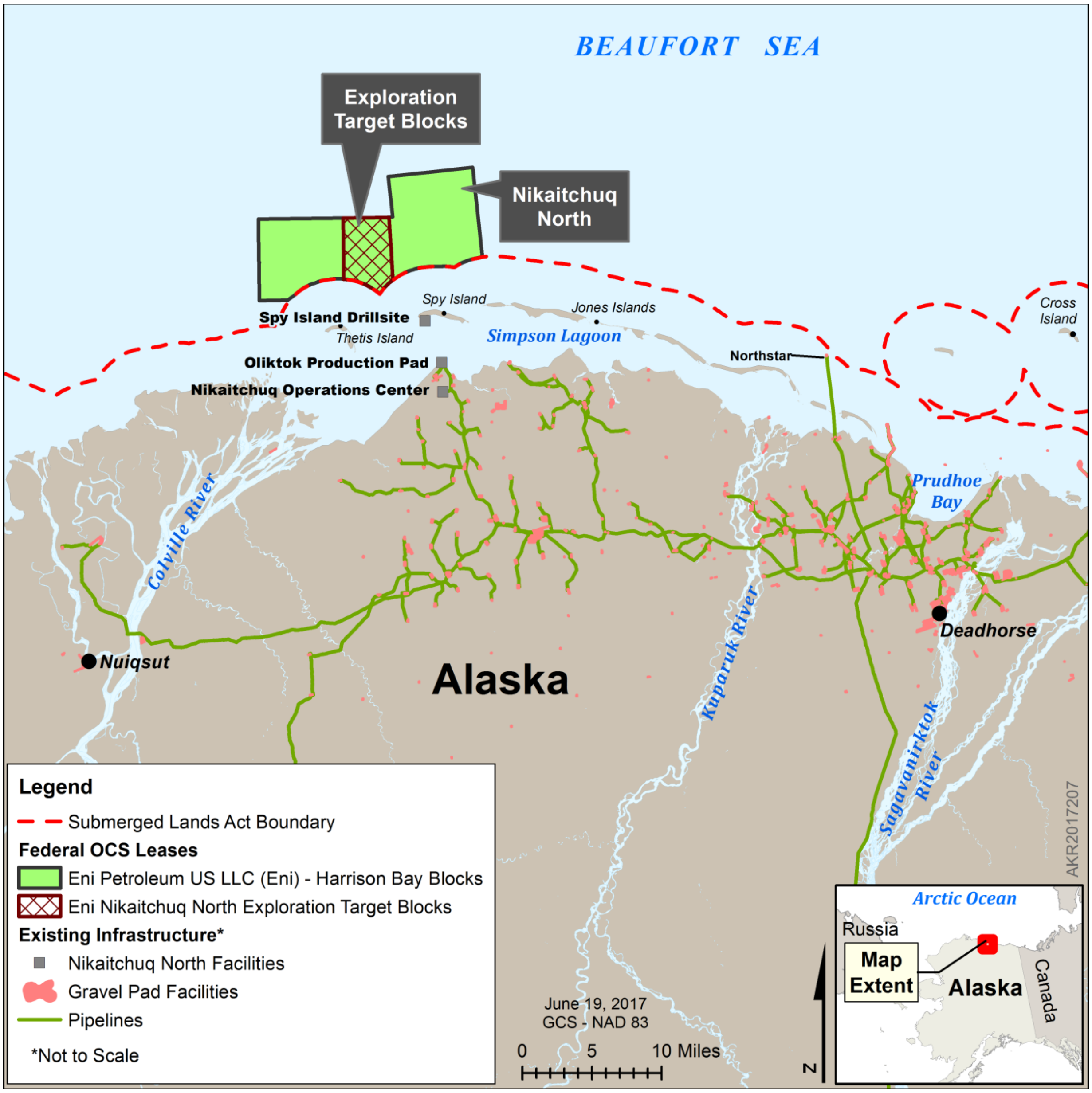

Figure 1-1. Location of Eni's proposed exploratory drilling in the Beaufort Sea.

1.3. Background

The Nikaitchuq oilfield lies offshore of the North Slope of Alaska in the Beaufort Sea. The discovery and development of the field dates back to the mid-2000s, when Armstrong Oil and Gas partnered with Kerr-McGee for exploration drilling. Leases OCS-Y-1753, OCS-Y-1754, and OCS-Y-1757 were initially acquired by Armstrong Oil & Gas through the Beaufort Sea OCS Lease Sale 195, held in March 2005, and later sold to the Kerr McGee Oil and Gas Corporation. Eni subsequently purchased a 40% interest in the leases. Eni's partners in the federal leases are Shell Offshore (40%) and Repsol E&P USA, Inc. (20%). Kerr-McGee submitted a proposal for the development of the Nikaitchuq Development Project in 2005; the leases were later assigned to Eni in 2006.

In early 2008, Eni began Nikaitchuq development and construction activities which included construction of an onshore production and processing facility, the Oliktok Point Pad (OPP), at Oliktok Point and a man-made gravel island, the Spy Island Drillsite (SID). A subsea pipeline bundle connected OPP to SID. Construction was completed in 2010 and the first oil was produced in January 2011. The development involved drilling from both the OPP and the SID.

Eni completed its initial program of OPP development wells in October 2012 and began a continuous drilling program from the SID in November 2012 using the Doyon Rig 15. Eni's onshore processing facility at Oliktok Point delivers crude through a 14-mile aboveground transmission pipeline that ties in to ConocoPhillips' Kuparuk pipeline system for delivery to the Trans Alaska Pipeline System (TAPS).

The Spy Island Drillsite program continued until December 2015, when the company suspended drilling operations due to low oil prices. SDI has 18 production wells, 13 injection wells, and one Class I Underground Injection Control (UIC) well. Production activities on State of Alaska leases are ongoing.

Seeking to evaluate the oil and gas potential of its nearby Federal leases, Eni submitted its Nikaitchuq North EP under BOEM regulations at 30 CFR 550 Subpart B. Eni proposes to drill up to four exploration wells, consisting of two extended reach mainbores and two sidetracks, from its existing man-made island, SID. Exploration activities are scheduled to commence in December 2017 and continue through May 2019, although actual well drilling would occur only during the winter months.

In support of the 2017 EP, Eni submitted the following:

- An environmental impact analysis (EIA) as Appendix O of the 2017 Eni EP (Eni, 2017);
- Environmental information and reports;
- An Oil Spill Response Plan (OSRP) and an Oil Discharge Prevention and Contingency Plan (ODPCP);
- Site-specific geological and geophysical information;
- Measures to reduce potential impacts; and
- Other information as required by BOEM regulations and lease stipulations.

For analysis purposes, BOEM assumes that all four exploration wells would be drilled; however, the information on the subsea geology and properties of the potential reservoir formations obtained from drilling the initial wells may result in Eni's canceling subsequent wells, submission of a revised EP, and/or submission of a Development and Production Plan (DPP). If Eni submits a DPP, BOEM will conduct subsequent review and NEPA analysis to evaluate the impacts of that separate action.

1.4. Previous Applicable Analyses

This EA has been prepared to analyze Eni's exploration activities in the Beaufort Sea. The EA is a site- and project specific analysis of potential impacts that could result from implementation of that Proposed Action. The EA will assist BOEM in meeting its NEPA obligations and in determining whether the Proposed Action would result in any significant impacts, such that preparation of an Environmental Impact Statement is necessary.

BOEM's level of NEPA review depends on the OCSLA stage (516 DM 15), the scope of the proposed activities, and the agency's findings on the potential effects of the proposed activities. The EA assists BOEM in ensuring compliance with NEPA and in making a determination as to whether any "significant" impacts could result from the analyzed actions. BOEM has engaged in numerous NEPA reviews of Beaufort Sea activities. NEPA reviews relevant to the Proposed Action include the following:

- Final Environmental Impact Statement – Outer Continental Shelf Oil & Gas Leasing Program: 2002-2007 (OCS EIS/EA MMS 2002-006) (USDOI, MMS, 2002) (hereafter “2002-2007 Five Year Program EIS”)
- Final Environmental Impact Statement — Outer Continental Shelf Oil and Gas Leasing Program: 2007-2012. Final Environmental Impact Statement, Volume 1. OCS/EIS/EA MMS 2007-003 (USDOI, MMS, 2002) (hereafter “2007-2012 Five Year Program EIS”)
- Final Programmatic Environmental Impact Statement — Outer Continental Shelf Oil and Gas Leasing Program: 2012-2017. Final Programmatic Environmental Impact Statement. OCS/EIS/EA BOEM 2012-003 (USDOI, BOEM, 2012) (hereafter “2012-2017 Five Year Program EIS”)
- Final Environmental Impact Statement — Beaufort Sea Planning Area Oil and Gas Lease Sales 186, 195, and 202 (OCS EIS/EA MMS 2003-001) (USDOI, MMS, 2003) (hereafter “Beaufort Sea Multiple-Sale EIS”)
- Environmental Assessment — Proposed Oil & Gas Lease Sale 195, Beaufort Sea Planning Area and Finding of No Significant Impacts (OCS EIS/EA MMS 2004-028) (USDOI, MMS, 2004) (hereafter “Sale 195 EA”)
- Environmental Assessment — Shell Offshore, Inc., 2012 Revised Outer Continental Shelf Lease Exploration Plan, Camden Bay, Beaufort Sea, Alaska, Flaxman Island Blocks 6559, 6610 & 6658, Beaufort Sea Lease Sales 195 & 202

These documents are available at https://www.boem.gov/ak-eis-ea/. Relevant sections of these documents are summarized and incorporated by reference into this EA. This EA tiers from the 2002-2007 Five Year Program EIS, and the Beaufort Sea Multiple-Sale EIS.

This EA also summarizes and incorporates by reference relevant information and analyses from the following documents:

- NMFS Biological Opinion for Oil and Gas Leasing and Exploration Activities in the U.S. Beaufort and Chukchi Seas, Alaska and Authorization of Small Takes Under the Marine Mammal Protection Act (USDOC, NOAA, NMFS, 2008)
- FWS Biological Opinion for Beaufort and Chukchi Sea Program Area Lease Sales and Associated Seismic Surveys and Exploratory Drilling (USDOI, FWS, 2009)

1.5. Regulatory and Administrative Framework

Eni’s proposed exploration drilling activities are subject to an established regulatory framework that includes Federal laws and regulations. Some, but not all, of the framework governing oil and gas exploration on the OCS include:

- Outer Continental Shelf Lands Act
- National Environmental Policy Act
- BOEM and Bureau of Safety and Environmental Enforcement (BSEE) Regulations
- Endangered Species Act
- Marine Mammal Protection Act
- Clean Air Act
- Clean Water Act
- Oil Pollution Act of 1990
- National Historic Preservation Act
- National Invasive Species Act

  Magnuson-Stevens Fishery Conservation and Management Act

CHAPTER 2. PROPOSED ACTION AND ALTERNATIVES

2.1. Description of the Alternatives

2.1.1. Proposed Action

Eni proposes to drill four exploration wells, consisting of two extended reach mainbores and two sidetracks, from the Spy Island Drillsite (SID). The proposed wells would be drilled to a specified true vertical depth (TVD) beneath the island, and extend subsurface of the ocean floor to reach three of the thirteen federal leases within Harrison Bay Block 6423 Unit: Y-1753, Y-1754 and Y-1757.

Operational development and production facilities already in existence at the SID would be utilized for the Proposed Action. Activities associated with the Proposed Action are scheduled to begin in December 2017 and would continue through May 2019. All drilling would occur during winter, under solid ice conditions (December-April 15).

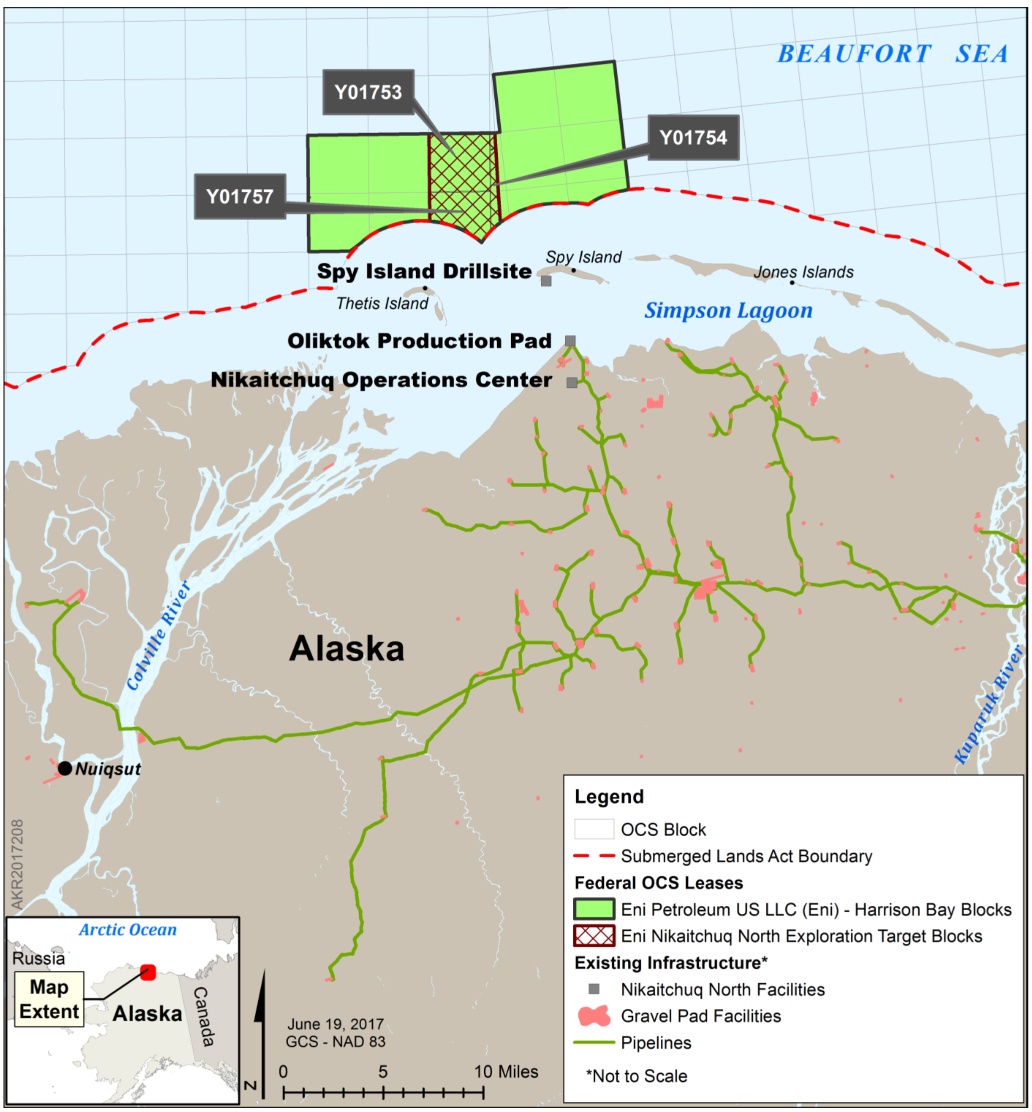

Figure 2-1. Project Area Map.

2.1.1.2. Use of Existing Facilities

The Proposed Action would utilize the following existing facilities and infrastructure:

- Spy Island Drillsite (SID): gravel island located offshore of Oliktok Point
- Nikaitchuq Operations Center (NOC): onshore support facilities
- Oliktok Production Pad (OPP): onshore processing and drilling facility

2.1.1.3. Drilling Information

Four exploration wells, consisting of two extended reach mainbores and two sidetracks, would be drilled from a surface location at the SID, which is 3.2 miles from shore, and 560 ft from the natural barrier island, Spy Island. Wells are expected to be approximately 8,000 ft TVD and 34,000 ft measured depth. The distance from the SID to the boundary of the targeted federal leases is approximately 3.8 miles.

Extended Reach Drilling (ERD) wells are those that have a drilled horizontal reach greater than true vertical depth by a factor greater than or equal to two. The proposed extended reach wells would be approximately 6,000-10,000 ft farther than existing Nikaitchuq wells on State leases. The technical challenges associated with ERD will be considered by BSEE in its comprehensive review of each proposed well design as part of its APD review process. BSEE will not approve the APD, and Eni will not be authorized to drill, if BSEE determines that the well designs proposed here are not safe.

Mobilization activities would begin with transportation of equipment and materials onto the SID between late July and October 2017. Drilling would be conducted during the 2017-2018 and 2018-2019 winter solid ice seasons. No drilling would occur during open water, break-up or freeze-up seasons.

Table 2-1. Proposed Action Drilling Schedule.

Activity	Start Date	End Date	No. Days
Drill Well NN01	12/10/2017	2/13/2018	65
Drill Lateral Sidetrack	3/25/2018	4/14/2018	20
Flow Test /Suspend Operations	4/14/2018	5/14/2018	30
Drill Well NN02	12/1/2018	2/14/2019	75
Drill Lateral Sidetrack	3/26/2019	4/15/2019	26
Flow Test /Suspend Operations	4/21/2019	5/23/2019	32

Drilling Unit Description

Doyon Rig 15, a mobile oil and gas well drilling facility capable of drilling in extreme Arctic conditions, would be used to drill the wells. This drill rig consists of three fully integrated modules, and is capable of drilling on 8-foot well spacing. Some modifications to the drill rig would be required, including the addition of two engines (CAT Model 3516 or similar). Table D-1 of the EP (Eni, 2017) shows the technical specifications of the drill rig.

Vehicle and Vessel Support

The Proposed Action would require the transport of personnel and freight, and other types of logistical support throughout the projected two year duration. This support would be provided via ground based vehicles and watercraft.

Oliktok Production Pad (OPP), an onshore process and drilling facility, resides on a ten-acre gravel pad at Oliktok Point in Simpson Lagoon. The means and frequency of transporting freight and personnel from OPP to SID in support of the Proposed Action would vary by season. During the winter season, Eni would construct and maintain an ice road, approximately 4.25 mi (6.8 km) long and 60 ft wide, to support operations on SID. Ice road transport between the OPP and SID is typically available from early February through mid-May. Buses and vans would use the ice road when available, and hovercraft would be used when needed during shoulder seasons (break-up and freeze-up). Marine vessels and barges would be employed to transport equipment and personnel during the open water season.

Land and water-based transport estimated for support of the Proposed Action are provided in Table 2-2.

Table 2-2. Estimated Vessel and Vehicle Support required for the Proposed Action.

Year	Vehicle/Vessel Type	No. Trips (Proposed Action)
2017		
	Hovercraft	1,163
	Crew Boat	614
	Bus/Van	1,500
	Barge	152
2018		
	Hovercraft	1,163
	Crew Boat	1,378
	Bus/Van	1,500
	Barge	108
2019		
	Hovercraft	862
	Crew Boat	614
	Bus/Van	1,500
	Barge	8

Note: All Trips are one-way.

Existing infrastructure, support vessels and vehicles already on site and in use at the SID would provide the support required; however, the levels of activity would change under implementation of the Proposed Action. Further details regarding transportation and logistics are provided in Section L and Appendix O of the EP (Eni, 2017).

Discharges and Wastes

The Proposed Action does not include any new point-source discharges. The Proposed Action would contribute to ongoing point-source operational discharges occurring in State waters under State permitting authority.

The drilling fluids used would be in a steel-pit-contained mud system and would not be discharged into marine waters. All cuttings and wastes would be disposed of via a permitted Class I Underground Injection Control (UIC) well on SID.

Compliance with Lease Stipulations

Eni's leases were obtained under the Beaufort Sea Lease Sale 195 in March 2005, thus the proposed exploration activities must comply with all applicable stipulations from Lease Sale 195. Eni provided information regarding its compliance with Lease stipulations (Eni 2017a, Section J).

The following lease stipulations apply to the Proposed Action. The full text of these stipulations is provided in Appendix C.

Stipulation 1 – Protection of Biological Resources

Stipulation 2 – Orientation Program

Stipulation 3 – Transportation of Hydrocarbons

Stipulation 4 – Industry Site-Specific Monitoring Program for Marine Mammal Subsistence Resources

Stipulation 5 – Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Marine Mammal Subsistence-Harvesting Activities

Stipulation 6 – Pre-Booming Requirements for Fuel Transfers

Stipulation 7 – Measures to Minimize Effects to Spectacled and Steller's Eiders During Exploration Activities

2.2. No Action Alternative

Under the No Action Alternative, BOEM would not approve Eni's proposed EP. This would preclude Eni from evaluating the oil and gas resource potential of its federal leases within the Nikaitchuq North Harrison Bay Block 6423 Unit.

Eni has indicated that if the proposed EP were not approved, it would continue to produce oil from its existing wells on State leases, and would likely pursue additional development drilling on State leases. Ongoing and potential activities on State leases are not authorized by BOEM and are not part of the Proposed Action analyzed in this EA. These activities are evaluated as past, present, and reasonably foreseeable future actions within the Cumulative Effects Scenario (Appendix B), and their potential contributions to cumulative impacts are accounted for within each resource-specific section of Chapter 4.

2.3. Other Alternatives Considered But Not Analyzed in Detail

The following concepts were considered as potential alternatives, but were not analyzed in detail.

- **Delay of the proposed exploration activities.**
  The delay of exploration activities does not advance BOEM's responsibility under OCSLA to make OCS lands available for expeditious and orderly development, subject to environmental safeguards, in a manner which is consistent with the maintenance of competition and other national needs. Because this alternative would not meet the Purpose and Need described in Section 1.2, it is not considered a reasonable alternative under NEPA and was not carried forward for detailed analysis.
- **Use of other methods or technologies to obtain reservoir information.**
  BOEM is unaware of other methods or technologies that would meet the purpose and need for the project. Because the information (data) collection for the reservoir occurs at substantial depth below the ocean floor (drilling extends to 8,000 ft TVD and 34,000 ft measured depth), alternative data collection methods are not practicable.
- **Access to OCS leases via another location.**
  The proximity of the SID to the target OCS leases makes it possible to conduct the exploration activities using ERD in an efficient manner using an existing island. Accessing the leases from other locations that are within the reach of ERD technology would require additional surface facilities and infrastructure, create additional environmental impacts, and drive up project costs. This alternative would not meet the purpose and need described in Section 1.2, nor does it advance BOEM's responsibility under OCSLA, because it would require a dramatically altered exploration plan and would result in substantial project delay or discontinuation.

BOEM received eight comment submissions from individuals and non-governmental organizations during the 10-day comment period. These comments raised several issues that are analyzed in this EA. No additional, reasonable alternatives were identified in these comments.

2.4. Spill Prevention and Response

Eni's Oil Discharge Prevention and Contingency Plan (ODPCP) describes its practices and procedures for the control and removal of product spilled into the environment (Eni, 2017a; Eni, 2017b). Response equipment and trained personnel would be available on-site to deploy recovery equipment should the need arise. Section 2.5 describes in more detail oil spill response and exercise requirements.

No exploratory drilling may commence prior to submittal and BSEE approval of an Oil Spill Response Plan (OSRP) that is consistent with applicable Federal regulations and guidance. The OSRP must demonstrate that the operator has the spill response resources, equipment, personnel, and strategies necessary to efficiently and effectively respond to a worst case discharge (WCD). Eni submitted an Oil Spill Response Plan (OSRP) for it oil and gas production operations in March 2017. BSEE is currently reviewing the OSRP.

2.5. Oil Spill Response and Exercise Requirements

The Oil Pollution Act of 1990 (OPA 90) established new oil spill preparedness requirements for both the Federal government and the facility plan holder operating offshore. For the Federal government, the provisions of OPA 90 required the development of a National Contingency Plan (NCP), which would provide for efficient, coordinated, and effective action to minimize damage to the environment in the event of a release. The NCP assigned specific duties and responsibilities to Federal departments and agencies in coordination with State of Alaska (SOA) and local agencies. Executive Order (EO) 12777 implemented the provisions of OPA 90 and made specific assignments regarding which Federal departments were responsible for specific portions of the Act.

Under the NCP, the Federal government was charged with developing Area Contingency Plans for each designated geographic area of the country. The Area Contingency Plan (ACP) describes the area covered along with areas of special economic or environmental importance that might be damaged by a discharge. The APC 1) describes in detail the responsibilities of a plan holder, as well as, the Federal, SOA, and local agencies in removing a discharge, 2) provides a list of equipment, dispersants or other mitigating substances, and devices and personnel available to a plan holder, 3) compiles a list of local scientists, both inside and outside Federal government service with expertise in the environmental effects of spills, and 4) describes how the plan is integrated into other ACPs and vessel, offshore facility, and onshore facility approved response plans.

EO 12777 assigned to the Department of the Interior the responsibility for the following: establishment of procedures, methods, and equipment and other requirements for containing discharges of oil and hazardous substances from offshore facilities, including associated pipelines, other than deep water ports; issuance of regulations requiring owners or operators of offshore facilities, including associated pipelines, to prepare and submit response plans; the approval of means to ensure the availability of private personnel and equipment; the review and approval of such response plans; and the authorization of offshore facilities including associated pipelines, to operate without approved response plans. DOI in turn delegated these responsibilities to BSEE. BSEE promulgated regulations governing oil spill response requirements, which are found in 30 CFR 254, Oil Spill Response Requirements for Facilities Located Seaward of the Coast Line.

Permittees operating offshore are required to comply with the applicable Federal oil spill response requirements for each activity site. These regulations implement the provisions of OPA 90 for offshore oil and gas operations, which place the responsibility for preparing for and responding to a spill on the operator. Each operator is required to prepare an oil spill response plan (OSRP) for their facilities seaward of the coastline. In the OSRP the operator must include an emergency response action plan, a worst-case discharge (WCD) volume and response scenario, an inventory of response equipment sufficient to respond to the WCD scenario, contractual agreements with oil spill removal organizations (OSRO) who will provide response services, a dispersant-use plan, an in situ-burning plan, and a training and response drills plan. The OSRP must also be consistent with the requirements of the NCP and any applicable ACP for the area in which the facility is located. In the SOA, the ACP is a combined Federal/SOA plan entitled the Unified Plan for Preparedness to Oil Discharges and Hazardous Substance Release (Unified Plan). The Unified Plan is further supplemented by ten Subarea Contingency Plans covering the SOA. For activities located on the North Slope, the OSRP must also be consistent with the North Slope Subarea Contingency Plan. Prior to the start of drilling operations, the operator must have a BSEE-approved OSRP.

In developing the WCD scenario, operators are required to conduct an appropriate trajectory analysis for the area where the facility will be located. This analysis must identify onshore and offshore areas that a discharge potentially could impact and further identify resources of special economic or environmental concern that may be present. The operator must describe what strategies would be used to protect these areas and the resources required. BSEE may require operators to demonstrate proposed spill response strategies before approval of an OSRP is granted. When determining equipment requirements for the WCD, the operator is required to derate the throughput capacity of skimmers to 20% of the listed capacity to compensate for environmental factors such as sea state, temperature, available daylight, and emulsification of the oil to ensure sufficient recovery capabilities. BSEE, through its approval action, also may require operators to stage spill response equipment near areas of concern to facilitate more rapid deployment to protect critical resources and limit oil exposure.

To ensure plan holder readiness, BSEE conducts routine inspections of the operator's facilities to ensure that the identified spill response resources are readily available and in the quantities and condition described in the OSRP. Inspections of response equipment owned by OSROs along with maintenance and inspection records also are conducted to verify response readiness. Reviews of training records and spill drill reports are made to verify that response personnel have completed the mandatory training and that all parts of the OSRP have been exercised as required in the regulations.

BSEE also will conduct government initiated unannounced exercises (GIUE) to test the operator's ability to carry out the provisions of the OSRP. These exercises may take the form of tabletop exercises (TTX) and/or equipment deployments. GIUEs are conducted in accordance with the National Preparedness Response Exercise Program (NPREP) Guidelines. These guidelines were developed in cooperation with the U.S. Coast Guard (USCG), U.S. Environmental Protection Agency (EPA), Pipeline and Hazardous Materials Safety Administration (PHMSA), and BSEE to allow regulatory agencies the opportunity to evaluate various aspects of a plan holder's preparedness, including their emergency procedures and their contracted OSROs' capabilities for proper and timely equipment deployment. For BSEE regulated offshore facilities, the number of GIUEs is determined by the Oil Spill Preparedness Division (OSPD) Chief. A facility will not participate in a BSEE initiated unannounced exercise more than once every 36 months, unless the results of previous exercises indicate that follow-up drills are warranted due to inadequate performance during a drill.

In preparing for a GIUE, be it a TTX or equipment deployment, BSEE will coordinate their activities with other Federal, SOA and local regulatory partners in an attempt to conduct a joint exercise to leverage scarce resources in order to more readily assess plan holder and OSRO capabilities within the local area. Based on the results of these drills, BSEE may require the operators to amend their OSRP to improve response operations.

TTX GIUE will occur at the plan holder's incident command post and usually will not entail mobilization or deployment and operation of equipment. The TTX is aimed at testing the capabilities of the incident management team (IMT) to organize, support, and direct a response. These exercises generally last from two to eight hours depending on how quickly the IMT is able to complete BSEE's exercise objectives.

Equipment deployment GIUEs will occur either at the plan holder's OSRO or at their offshore facility if equipment is staged on-site. These exercises usually involve the deployment and operation of equipment from a single tactic cited in the OSRP but can involve multiple tactics. For open-water and broken ice conditions, a deployment will generally involve between one and three boats used to deploy and tow containment boom, deploy and operate a skimmer, and shuttle temporary storage devices to and from a lightering point. These exercises would normally be conducted in close proximity to the industrial area near West Dock or at Eni's SID to limit impacts on wildlife. The deployment GIUE would last approximately four to eight hours depending on the time to mobilize, deploy and operate the equipment.

In the largest potential deployment GIUE the plan holder could be expected to deploy upwards of 20 vessels ranging in size from an oil spill response vessel (OSRV) or oil spill response barge and tug (OSRB) up to 300' to multiple smaller vessels ranging in length from 55' to 12'. The vessels are either jet propelled, propeller driven, or air boats. These vessels would be used to tow containment boom, deploy skimmers and conduct skimming operations, shuttle on-water storage devices like mini-barges and towable bladders to and from shore, and deploy shoreline protection booming in shallow waters and along the shoreline.

The size and amount of containment boom will vary based on the tactic, skimming platform, and water depth. For an OSRV or OSRB, these vessels would be used in deeper coastal waters and open ocean, boom size can range from 30" up to 79" in width, and deployed and towed in lengths of up to 2,000'. For smaller workboats conducting skimming operations, boom ranging from 38" to 50" will most likely be employed in lengths up to 500'. In a large-scale exercise, it is expected up to three such vessels would conduct these operations at various locations around the exercise location. For nearshore and shoreline protection booming, shallow water and delta boom will be utilized. Most tactics call for lengths of up 200' to be deployed and anchored in position either offshore or on the shoreline. In a large-scale drill, it is anticipated up to two such tactic demonstrations would be required.

The skimmers deployed during the course of the exercises will be hydrophilic brush, and disk models. Because these skimmers are designed to recover oil with very little water uptake, only the disks or brushes would be rotated during operations and the pumps would not be employed other than in a brief burst to demonstrate they are operational. These skimmers are hydraulically driven.

BSEE may also require a plan holder to mobilize equipment used for non-mechanical response options such as in situ burning (ISB) and dispersant application operations. For ISB operations, an operator has the option of igniting a pool of collected oil using hand-held ignitors or a torch slung beneath a helicopter. BSEE may require the operator demonstrate their ability to mobilize and deploy the helicopter and helitorch and conduct simulated operations over a designated area offshore. A single sortie is expected to satisfy the operator's capability. In addition to the aircraft, up to two vessels operating as spotters would provide feedback to the pilot and burn operations supervisor.

It is highly unlikely that the operator would request or receive approval for dispersant use for operations in the Beaufort Sea given the shallow water depths in the area of operations. However if the operator establishes the capabilities to apply dispersants, BSEE could require the operator to demonstrate their ability to carry out a dispersant application. Dispersants may be applied via fixed wing aircraft, rotary wing aircraft with application equipment slung beneath, or by vessel.

Fixed-wing application could be carried out using a large multi-engine cargo aircraft like a Hercules C-130 to small single-engine planes, such as a Cessna 188 AGWAGON. The application aircraft would make multiple passes at approximately 75 feet above the ocean surface to discharge their payload. The use of a spotter aircraft is also required to guide the dispersant aircraft over the designated area and to indicate when to begin and end dispersant application. Spotter aircraft would be single or multi-engine propeller planes, most likely a Cessna or Twin Otter. An on-water monitoring vessel would also be required to observe operations. BSEE may require the dispersant application aircraft to discharge fresh water to the ocean surface to demonstrate the operability of the application system. On-water application would only occur if required approvals from Federal and SOA authorities were received prior to the exercise.

Rotary-wing application of dispersants is another option. This involves a helicopter with a dispersant application system slung beneath the aircraft. A spotter aircraft is also required for application along with a monitoring vessel as described for fixed-wing aircraft application. The helicopter would make multiple passes over the target area to simulate dispersant application.

The other option for dispersant application is from a vessel-based system. Spray arms are affixed to the vessel and the vessel then transits through the oiled surface applying the dispersants. Vessels used for application can range from an OSRV/OSRB to smaller vessels depending on the operating environment. Spotter aircraft are required to guide and observe application along with a monitoring vessel.

During winter, the ocean surface freezes solid thereby necessitating the use of winter tactics to respond to a discharge to the environment. A GIUE conducted during solid ice conditions would involve land-based tactics adapted for the ice environment. Depending on the scenario, the operator may be required to mobilize response equipment such as a front-end loader, dump truck, vacuum truck, loader mounted ice trimmer, bobcats, snowmobiles, ATVs, and snow blowers to respond to a simulated blowout to solid ice.

For a simulated release from a pipeline, the operator would be required to deploy augers to bore through the ice to the water below, utilize a Rube Witch Trencher or chain saws to cut slots in the ice sheet to allow the oil to surface and pool, and then employ a skimmer such as a foxtail driven by a gasoline powered generator. Multiple ATVs, bobcats, trucks and gasoline powered lighting systems would be required to support these response exercise operations.

If an oil spill occurs, the operator is required to immediately implement their OSRP and notify the National Response Center of the spill, regardless of volume. If the suspected volume of the spill is one barrel or greater, the operator must orally notify the BSEE Regional Supervisor of Field Operations without delay. It is up to the operator to mobilize sufficient equipment and personnel to control, contain, and clean up the spill to the greatest extent possible. In the event that the spill volume is significant or there are critical resources at risk, a Unified Command (UC) may be stood up to direct cleanup operations. For incidents occurring on the North Slope, the UC would be composed of the Responsible Party (RP), the Federal On-Scene Coordinator (FOSC), who for offshore events is from the USCG; the State On Scene Coordinator (SOSC), who is a representative from the Alaska Department of Environmental Conservation, and the Local On-Scene Coordinator (LOSC), who is a representative from the North Slope Borough (NSB). This group works jointly to establish spill-response priorities and direct overall response activities. If the RP is unable to adequately carry out response activities, the FOSC has the option to assume command of the response to ensure appropriate response actions are taken.

Effectiveness of cleanup operations is highly dependent on volume, location, and time of year in Alaska. A small spill occurring during winter on solid ice and snow can be readily cleaned up using conventional land-based equipment such as shovels, snow blowers, and bulldozers, resulting in a near 100% recovery rate. Spills to open-water and broken-ice conditions result in lower recovery rates of 5-20% of the spilled oil. Removal of a spill on water requires the deployment of containment boom to corral and concentrate the oil into a recoverable thickness, skimmers to remove the oil from the water surface, temporary storage vessels to hold the recovered oil and water, and vessels to deploy the equipment and personnel. Recovery rates are lower on water because the oil can disperse rapidly throughout the area, and responders must first locate and contain the spill before it can be recovered.

Government initiated unannounced exercises (e.g., oil spill drills), are infrequent, of short duration, (<8 hours), and utilize existing equipment. GIUE's would not alter the impact conclusions for any of the resources analyzed in this EA.

CHAPTER 3. AFFECTED ENVIRONMENT

3.1. Introduction

The following subsections summarize environmental conditions and resources found within areas that could be affected by the Proposed Action and the No Action Alternative. Each summary focuses on information relevant to understanding potential environmental impacts.

3.2. Meteorology and Oceanography

3.2.1. Meteorology

The Nikaitchuq North Exploration project is physically located within the Arctic Climate Zone. This climatological zone is characterized by cold temperatures, low precipitation, consistent wind, and frequent winter storms (MMS, 2007). Hourly surface meteorological data from the following sources are used to characterize the climate and meteorology of the region for the project:

- NOAA National Weather Service (NWS) Cooperative Observer Program stations located at Umiat and Kuparuk;
- NOAA NWS Automated Surface Observing System station located at Utqiaġvik; and
- NOAA Automated Weather Observing System (AWOS) station located at the Nuiqsut airport.

Air Temperature

Air temperature data observed at the monitoring locations described include the mean, maximum mean, minimum mean, and monthly extreme surface air temperatures recorded at the stations. Below freezing temperatures (temperatures at or below 32°F or 0°C) were recorded for most of the year and were observed to occur during any calendar month. Two main seasons exist in the region and are characterized by the following ambient surface temperatures:

- Summer: June through September with a mean daily high temperatures above 32°F (0°C)
- Winter: October through May with a mean daily high temperatures rarely exceeding 32°F (0°C).

During the winter period, the region, including the adjacent ocean, is primarily covered by snow and ice, which creates a more continental-like climate regime that is similar to adjacent land areas (MMS, 2007; Overland, 2009).

Precipitation

Precipitation data recorded at four monitoring locations: Umiat, Kuparuk, Utqiaġvik, and Nuiqsut include average total precipitation, average total snowfall, and mean snow depth. Total annual average precipitation for the region ranges from about 2.4 inches in Nuiqsut to approximately 5.2 inches in Umiat. More than three quarters of the total annual precipitation falls during the summer season (June through September). Snowfall can occur in the region during any month, with the greatest average snowfall occurring during October, which may account for approximately 20% to 25% of the annual average total snowfall.

Wind

The first full calendar year of wind data was collected at the NWS Nuiqsut AWOS station during 1999. For the 16-year period from 1999 through 2014, the average wind speed observed at Nuiqsut station was 4.6 meters per second (m/s) (10.3 miles per hour [mph]). The region experiences wind speeds ranging from 3.6 m/s to 11.1 m/s (8.1 mph to 24.8 mph) for more than half the year (Eni, 2017). Data collected, at the NWS Nuiqsut AWOS station between 1999 and 2014, shows that, on an annual basis, the predominant winds are comprised of onshore wind components from the east-northeast, northeast, and east, and offshore wind components from the south-southwest, southwest, and west-southwest. The winter season (October through May) is characterized by predominant onshore wind components from the northeast, east-northeast, and east, and offshore wind components from the south-southwest, southwest, and west-southwest. In contrast, during the summer season, a predominance of onshore winds exist from the east northeast, northeast, and east, while the offshore wind components from the south-southwest, southwest, and west-southwest each are much less significant. This unidirectional onshore wind component experienced during the summer is caused by a thermal gradient between the relatively warm land and cold sea during the summer months (MMS, 2007).

3.2.2. Oceanography

The Beaufort Sea, one of the northernmost seas bordering Alaska, is part of the Arctic Ocean and is linked oceanographically to the Pacific Ocean by the Bering Strait. This conduit draws relatively warm nutrient-rich water into the Arctic Ocean from the Bering Sea.

The Beaufort Sea is a semi-enclosed basin with a narrow continental shelf extending 19 to 50 miles from the coast, and from the Canadian border west to Point Barrow. The continental shelf of the Beaufort Sea is relatively shallow, with an average water depth of about 121 feet. Bottom depths on the shelf increase gradually to a depth of about 260 feet, then increase rapidly along the shelf break and continental slope to a maximum depth of around 12,470 feet. Numerous narrow and low relief barrier islands lie within 1 to 20 miles of the coast and influence nearshore processes (NOAA, 2016).

The nearshore, shallow waters of the Beaufort Sea are subjected to seasonally varying conditions, such as heating, cooling, wind stress, ice formation and melting, and terrestrial freshwater input. Winter ice restricts circulation patterns. Seasonal variations in the temperature and salinity are large. Freshwater discharge from various rivers and streams along the coast create an environment that is estuarine in character, especially in late spring and summer. In addition, coastal erosion and river discharge are responsible for introducing high concentrations of suspended sediment and associated terrestrial organic carbon into the nearshore zone (NOAA, 2016). Such physical and chemical gradients influence the productivity and trophic structure of the nearshore Beaufort Sea.

Sea Ice

The Arctic sea ice is undergoing rapid changes. There are reported changes in sea-ice extent, thickness, distribution, age, and freeze-up and melt duration. In general, the sea-ice extent is becoming much less in the Arctic summer and slightly less in winter; overall, the decline in sea-ice extent is increasing (NSIDC, 2017, 2016). The Arctic sea ice extent for March 2017 was the lowest in the satellite record for the month (NSIDC, 2017). In addition, the thickness of ice in the project area is decreasing (Howell et al., 2016; Mahoney et al., 2014), the distribution of ice is changing, and its overall age is decreasing (Galley et al., 2016). Ice cover is getting more and more sensitive to climate anomalies as first-year ice replaces multi-year ice. Drift speed and melt duration is increasing (Kwok, Spreen and Pang, 2013; Parkinson, 2014; Stroeve et al., 2014; Wang and Overland, 2015). The long-term trend in freeze-up is one week later per decade for the Beaufort coastal regions and break-up start is earlier by about a week per decade (Johnson and Eicken, 2016). These factors lead to a decreasing perennial Arctic ice pack and landfast ice.

Sea ice generally reaches its maximum extent in March and minimum extent in September. Ice cover consists of drifting pack ice over the middle and outer shelf and landfast ice on the inner shelf. During a brief period in the spring when the river levels increase rapidly as the snow pack melts, river water overfloods the ice. Currents during the open water period (July to mid-October) correlate with local winds, whereas during the landfast ice period, underlying shelf waters are separated from surface stresses, such as wind. Landfast ice usually starts to form in October and can extend 12 to 25 miles offshore. Stamukhi, or grounded ice, forms along the seaward edge of the landfast ice. It may help protect the inner shelf from forces exerted by pack ice. Nearshore currents are weak when landfast ice is present, and strengthen during the open water period (NOAA, 2016).

3.2.3. Climate Change

The Intergovernmental Panel on Climate Change (IPCC) held the Twelfth Session of Working Group I in Stockholm, Sweden, from September 23-26, 2013, and approved the underlying scientific and technical assessment of the IPCC Fifth Assessment Report (AR5) (IPCC, 2013). The AR5 provides a "comprehensive assessment of the physical science basis of climate change, drawing on the scientific literature accepted for publication" up to March 15, 2013. The AR5 report (IPCC, 2013) provides information from which presumptions may be made regarding the Proposed Action:

- The extent of sea ice over the Arctic Ocean continues to decrease; the most rapid decrease occurs in the summer. Therefore, ice formations should not influence Proposed Action associated operations during the 2 year time period proposed.
- Changes to habitat over the Alaska North Slope (ANS) are already evident. Shrub- and tree-lines are detected farther north, allowing species from other biomes and ecosystems to move into the Alaskan systems.
- Coastal erosion that further alters wildlife habitat could occur due to changes in ice extent. Furthermore, storm surges may produce changes in the dynamics of rivers and deltas affecting fish populations.

Existing Greenhouse Gas Emissions

Greenhouse gases (GHG) including carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O); are not criteria pollutants, but gases that EPA has determined endanger human health and the environment (75 *FR* 66496, December 15, 2009). The State of Alaska does not require the inclusion of non-criteria pollutants in its emissions inventory, therefore, a quantitative estimate of greenhouse gas emissions is not available for the affected environment. In the EP (Eni, 2017), Eni outlines the existing drilling and vessel operations from 2012- 2016 at the SID (Eni, 2017). Using those drilling times and the average support vessel operations in Table 3-1, BOEM estimates the annual GHG emissions from the existing operations are 49,194.4 tons of CO_{2e} per year in the affected environment.

Table 3-1. GHG Emissions (CO2e) Calculations for Existing Units (Average over 2012-16).

Emissions Unit	Emission Rate	Maximum Capacity	Maximum Operation or Consumption	Projected Peak Hourly Emissions (lb/hr)	Annual GHG Emissions (tpy)
Existing Doyon 15 Exploration Drilling Unit					
Rig Boiler #1	5 lb/10^3 gal	4.184 MMBtu/hr	8,760 hr/yr	0.18	0.8
Rig Boiler #2	5 lb/10^3 gal	4.184 MMBtu/hr	8,760 hr/yr	0.18	0.8
Rig Heater #1	5 lb/10^3 gal	3.5 MMBtu/hr	8,760 hr/yr	0.21	0.9
Rig Heater #2	5 lb/10^3 gal	5.0 MMBtu/hr	8,760 hr/yr	0.15	0.6
Engine #1	1.15 (lb/hp-hr)	2,523 bhp	8,760 hr/yr	2,935.95	12,859.5
Engine #2	1.15 (lb/hp-hr)	2,523 bhp	8,760 hr/yr	2,935.95	12,859.5
Engine #3	1.15 (lb/hp-hr)	2,253 bhp	8,760 hr/yr	2,935.95	12,859.5
Engine #4	1.15 (lb/hp-hr)	1,879 bhp	8,760 hr/yr	2,160.85	9,464.5
Mud Pump #3	1.15 (lb/hp-hr)	63 bhp	8,760 hr/yr	72.45	317.3
Hovercraft					
Propulsion Engine	1.15 (lb/hp-hr)	543 hp	1,217 trips/yr	624.45	126.66
Propulsion Engine	1.15 (lb/hp-hr)	543 hp	1,217 trips/yr	624.45	126.66
Lift Engine	1.15 (lb/hp-hr)	375 hp	1,217 trips/yr	431.25	87.47
Lift Engine	1.15 (lb/hp-hr)	375 hp	1,217 trips/yr	431.25	87.47
Crew Boat (Commander)					
Propulsion Engine	1.15 (lb/hp-hr)	510 hp	1,171 trips/yr	586.50	85.85
Propulsion Engine	1.15 (lb/hp-hr)	510 hp	1,171 trips/yr	586.50	85.85
Tug & Barge (Old Bull)					
Propulsion Engine	1.15 (lb/hp-hr)	385 hp	522 trips/yr	442.75	115.56
Propulsion Engine	1.15 (lb/hp-hr)	385 hp	522 trips/yr	442.75	115.56
Total Annual GHG (CO2e) Emissions from existing operations					49,194.40

3.3. Air Quality

The EPA has set numerical limits for six pollutants that define the maximum limit of affected healthful air; the pollutants are referred to as “criteria pollutants.” The existing condition of air quality in the local vicinity of the Proposed Action is largely a function of meteorological conditions, mainly wind, over the open sea and emission sources existing on the coastline of the North Slope. The offshore waters of the Beaufort Sea typically experience periods of strong winds, which have a tendency to disperse and mix air pollutants. When air pollutants are transported by wind from a source, the gases and particles disperse throughout the immediate area resulting in concentrations that are lower than when the pollutants were released at the source. The decrease in concentration reduces the environmental impact of the emissions.

Criteria Pollutants

The maximum allowable limits for criteria pollutants are established under the Clean Air Act (CAA) as the National Ambient Air Quality Standards (NAAQS) and include carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), lead, ozone (O_3), and particulate matter (PM). The State of Alaska has adopted the federal NAAQS as Alaska Ambient Air Quality Standards (AAAQS) for the six criteria pollutants and established State ambient standards for two other air pollutants, reduced sulfur compounds and ammonia under 18 AAC 50.010. Primary standards have been set to protect public health, with attention given to protecting sensitive populations such as the elderly, children, or asthmatics. When an Air Quality Control Region (AQCR) is consistently below or equal to the NAAQS, the area is designated as an “attainment area.” Any area consistently exceeding one or more of the NAAQS is designated as a “non-attainment area.” Some areas are designated as “unclassified” when sufficient information is unavailable to classify areas as non-attainment and are presumed to be in attainment. In addition to the criteria pollutants, the emissions projected for the Proposed Action include volatile organic compounds (VOC), an ozone precursor pollutant

Fine particulate matter ($PM_{2.5}$) is a subset of coarse particulate matter (PM_{10}). This means that any measurement of PM_{10} includes the $PM_{2.5}$ spectrum. An even smaller subset of $PM_{2.5}$ is elemental or ‘black’ carbon. Black carbon is most commonly created by the combustion of conventional fuels and by forest fires. The particles that comprise Black carbon can also originate in other countries and be transported to the Arctic through wind currents. Black carbon particles are short-lived in the atmosphere, with a lifetime of days to weeks. The dark color of the particles decreases albedo or reflectiveness after deposition on the ice and snow, causing incoming radiation to be absorbed. Although black carbon is not a criteria pollutant it is a small portion of the $PM_{2.5}$ spectrum, it is a contributor to climate change and plays a role in short-term climate effects in the in Arctic.

Existing Emissions Sources

Eni presently operates the Nikaitchuq Development under ADEC Minor Permit AQ0923MSS10 and Operating Permit AQ0923TVP01 Revision 2. Existing air emissions sources at the SID are from: (1) mobile sources associated with crew transportation vessels, (2) mobile sources associated with the transport of equipment and materials, (3) stationary sources associated with the drilling unit and (4) stationary sources associated with production operations. In its 2012 assessment, ADEC reviewed air dispersion modeling data of Eni’s Nikaitchuq Development (SID, OPP, NOC, and OCC). This review included background concentrations from the monitoring station at ConocoPhillips’ Kuparuk drilling site, DS1F. Eni has used this source of background concentration in previous reviews and ADEC found the approach adequate (ADEC, 2012). The use of an operating facility as background emissions allows for the inclusion of incidental vehicle emissions to be captured in the background emissions. As a result, ADEC does not require Eni to include separate vehicle and vessel emission sources in its modeling review. ADEC arrived at the following conclusions after its 2012 modeling review:

- The NO_2, SO_2, and PM_{10} emissions associated with operating EUs as proposed will not cause or contribute to a violation of the AAAQS listed in 18 AAC 50.010.
- Eni's modeling analysis complies with the showing requirements of 18 AAC 50.540(k)(3).
- Eni conducted their modeling analysis in a manner consistent with EPA'*s Guideline on Air Quality Models*, as required under 18 AAC 50.215(b)(1).

Existing Air Quality

BOEM is responsible for controlling the air emissions of OCS sources beyond the state seaward boundary for the Beaufort Sea OCS to the extent their emissions would significantly affect the air quality of any state. Under the Clean Air Act (CAA) and the authority granted by the EPA, the State of Alaska (ADEC) is responsible for administering air programs for sources within the state seaward boundary. ADEC is tasked to regulate and ensure that ambient air quality standards are maintained, and is responsible for implementing the State's Air Quality Control Plan (AQCP). The State of Alaska's AQCP addresses the requirements of the CAA and is approved by the EPA. The State's AQCP including the State Implementation Plan (SIP) has been adopted by reference into Title 18, Chapter 50 of the Alaska Administrative Code (AAC).

The affected environment is assessed by determining the current status of local air quality in onshore areas adjacent to the existing oil and gas operations at SID, and examining the sources of regulated pollutants presently modeled and permitted by ADEC. This project is located in the Alaska North Slope Borough which is included in the Northern Alaska Interstate Air Quality Control Region, classified as a Class II region, and is in attainment or unclassifiable. Emission sources likely responsible for existing air quality conditions are related to current levels of onshore and offshore industry. The existing sources of pollutants adjacent to the Beaufort Sea OCS Planning Area vary considerably in quantity and type. There are relatively few offshore and onshore sources on and near the Alaska North Slope (ANS). Most are associated with the operation of the Prudhoe Bay oil field and the several relatively small villages located along the coast of the ANS. Table 3-2 provides a summary of representative baseline ambient air data for the area that were collected as part of the CPAI Nuiqsut Ambient Air and Meteorological Monitoring Program from January 1, 2013 through December 31, 2013 (Eni, 2017). The State of Alaska has previously concluded that the affected environment is still unclassifiable (in attainment) and that Eni's past and current operations will not cause or contribute to a violation of the NAAQS/AAAQS.

Table 3-2. Background Ambient Air Concentrations and National Alaska Ambient Air Quality Standards (Eni, 2017).

Pollutant	Primary/ Secondary	Averaging Period	Measured Concentration	NAAQS[1]	AAAQS[2]	Percent of Measured Concentration to NAAQS/AAAQS
NO_2	Primary and Secondary	Annual	1 ppb	53 ppb	53 ppb	1.9%
	Primary	1-Hour[3]	22.6 ppb	100 ppb	100 ppb	22.6%
CO	Primary	8-Hour[4]	1 ppm	9 ppm	9 ppm	11.1%
		1-Hour[4]	1 ppm	35 ppm	35 ppm	2.9%
PM_{10}	Primary and Secondary	24-Hour[5]	40 μg/m^3	150 μg/m^3	150 μg/m^3	26.7%
$PM_{2.5}$	Primary	Annual[6]	1.8 μg/m^3	12 μg/m^3	15 μg/m^3	15.0%
	Secondary	Annual[6]		15 μg/m^3		12.0%
	Primary and Secondary	24-Hour[7]	6.1 μg/m^3	35 μg/m^3	35 μg/m^3	17.4%
SO_2	N/A[8]	Annual	0.1 ppb	N/A[8]	30 ppb	0.3%
	N/A[8]	24-Hour[4]	0.8 ppb	N/A[8]	140 ppb	0.6%
	Secondary	3-Hour[4]	1.8 ppb	500 ppb	500 ppb	0.4%
	Primary	1-Hour[9]	1.1 ppb	75 ppb	75 ppb	1.5%
O_3	Primary and Secondary	8-Hour[10]	0.049 ppm	0.070 ppm	0.070 ppm	70.0%

Notes:
[1] National Primary and Secondary Ambient Air Quality Standards, 40 CFR Part 50.
[2] State of Alaska Ambient Air Quality Standards, 18 AAC 50.010 (ADEC 2016b).
[3] The standard is based on the three-year average of the 98th-percentile of the annual distribution of 1-hour daily maximum NO2 concentrations.
[4] Not to be exceeded more than once per year.
[5] Not to be exceeded more than once per year on average over three years.
[6] Annual mean, averaged over three years.
[7] The form of this standard is the three-year average of the 98th percentile of annual 24-hour average concentrations.
[8] Not applicable. EPA revoked the annual and 24-hour SO2 standards on June 22, 2010 (75 FR 35520, June 22, 2010).
[9] The form of this standard is the three-year average of the 99th percentile of the annual distribution of 1-hour daily maximum SO2 concentrations.
[10] The form of this standard is the annual fourth-highest daily maximum eight-hour concentration, averaged over three years.

3.4. Water Quality

Located on Alaska's North Slope between Prudhoe Bay to the east and the Colville River delta to the west, Simpson Lagoon is a large, shallow water basin measuring approximately 35 km in length, 3 – 6 km in width, and an average depth of only 2 m (maximum 3 m). Simpson Lagoon is partially enclosed by a fringe of seaward barrier islands to the north while open to the marine environment on the east and west sides (see Figure 2-1).

The water quality of the Beaufort Sea varies greatly between the early open-water season, the mid-to-late water season, and the winter ice-covered period. Landfast ice usually starts to form in October and can extend 12 to 25 miles offshore. Variable wind speed and direction, changing water temperatures and salinities, in addition to freshwater and sediment discharge from rivers and streams, all contribute to the seasonal variation of the water quality. The Colville, Kuparuk, Sagavanirktok and other smaller rivers in the watershed contribute substantial sediment and freshwater to the lagoon, especially during spring flood events. Approximately 90% of the annual transport of total suspended solids (TSS) from the Sagavanirktok, Kuparuk and Colville Rivers occurs during the spring floods (Trefry and Trocine, 2009; Neff, 2010). Lagoon waters are diluted by freshwater runoff and are correspondingly lower in salinity (usually 4-5 parts per thousand (ppt)) and higher in temperature (usually 2- 4^{o}C) than waters immediately seaward of the barrier islands (Craig et al., 1982). In general, the nearshore waters are less saline and more turbid when compared to the deeper offshore waters of the Beaufort Sea.

The lagoon's highly variable summer salinities (1-32 parts per thousand (ppt)) and temperatures (0 - 14ºC) fluctuate as a direct influence of the prevailing westward flowing Beaufort Sea current, prevailing easterly winds and freshwater runoff. Prevailing currents continually exchange lagoon waters when aided by exceptionally strong winds. The ice-free period in the lagoon is short, lasting about 3 months, from early July to early October. During the winter, wind/current exchange diminishes as surface ice steadily increases in thickness to about 2 m. By late winter (April), about 90% of the lagoon volume is frozen solid (Craig et al., 1982).

The Colville, Kuparuk and Sagavankirktok rivers that flow into the Beaufort Sea remain relatively unpolluted by humans. However, man-made pollutants may be present near the Proposed Action. Sources of pollutants are primarily the result of industrial activities related to the petroleum industry and include wastewater discharges and accidental spills of crude, petroleum, or other substances.

Water quality monitoring performed by the ANIMIDA and the cANIMIDA projects describe the spatial and temporal extent and patterns of several water quality parameters across Stefansson Sound (Neff, 2010). The primary objectives of these projects were to monitor and characterize the marine environment of the Northstar and Liberty development areas and to evaluate potential and actual effects of these major offshore oil developments (Neff, 2010). Water quality parameters examined in these studies included: total polycyclic aromatic hydrocarbons (TPAH), metals, suspended sediments, TSS, light intensity, particulate and dissolved metals, particulate organic carbon (POC), dissolved organic carbon (DOC), salinity, temperature and turbidity.

Neff (2010) found no significant differences near the Northstar Island in concentrations of TSS or dissolved metals relative to the overall cANIMIDA study area. Additionally, there was no evidence that the measured inter-annual variations in TSS, POC, DOC and nutrient concentrations were the result of or altered by offshore oil operations, nor did the data for hydrocarbon concentration in the sediments reveal any detectable hydrocarbon input attributable to Northstar operations. Finally, concentrations of dissolved and particulate TPAH were low at all locations and within the range reported by others for nearshore marine waters worldwide (Neff, 2010).

Therefore with respect to potential contaminants, concentrations in suspended sediments, as well as dissolved and particulate metals and hydrocarbons in the development area, are primarily from terrestrial sources and are nearly always at background levels (Neff, 2010).

3.5. Vegetation and Wetlands

The Spy Island Drillsite (SID) is a man-made island barren and devoid of any vegetation or wetlands that could be impacted by the Proposed Action. The Oliktok Production Pad (OPP), an onshore process and drilling facility, resides on a ten-acre gravel pad at Oliktok Point in Simpson Lagoon.

The Arctic Coastal Plain (ACP) immediately surrounding the OPP is broadly categorized by the Circumpolar Vegetation Map as W1.1 Wetlands in Subzone C (Walker, 2005). The dominant vegetation types for this category are wet graminoid and moss communities residing on wet acidic coastal areas, a common wetland type found on the North Slope. More specifically, the U.S. Fish & Wildlife Service (USFWS) National Wetlands Inventory (NWI) classifies the wetlands immediately surrounding the OPP as Estuarine Subtidal (E1UBL) and Estuarine Intertidal/Estuarine and Marine Wetland (E2US/EM1P), in accordance with the wetland and vegetation classification system set forth by Cowardin et al. (1979).

3.6. Lower Trophic Organisms

The lower trophic organisms living within the Beaufort Sea consist of three diverse and abundant groups (Hopcroft et al., 2008). These are the pelagic, the epontic, and the benthic organisms. All three of these groups of lower trophic organisms are expected to be present in the vicinity of the Proposed Action.

The pelagic communities are comprised primarily of two groups living at the surface and near-surface levels, the phytoplankton and zooplankton. Phytoplankton are the one-celled algae adapted to living in the photic zone (the upper areas where light adequate for phytoplankton penetrates the water) in the upper layers of the ocean surface. Within Arctic waters, the combination of cold temperature, sea ice, and seasonal fluctuations in light regimes creates variation in the timing and extent of seasonal blooms. Phytoplankton blooms (including concurrent zooplankton organisms) tend to occur in two separate events, a large spring bloom in late-May or early-June and a second smaller bloom in summer, generally from July to August. The density and duration of the blooms are dependent upon weather conditions and nutrient fluxes (Horner and Schrader, 1982). Zooplankton consist of permanent residents of the planktonic mass such as copepods, and animals exhibiting complex life cycles that include a developmental stage within the spring plankton blooms such as the larvae of fish, crustaceans, barnacles, polychaetes, and mollusks (Hopcroft et al., 2008). The pelagic expanses between the surface and the benthic realms support diverse and abundant populations, including the larvaceans, pteropods, ctenophores, jellyfish, salps, squid, and other invertebrate organisms that contribute to the productivity of the region (Hopcroft et al., 2008).

The epontic organisms are the ice-dwellers, or organisms that live on or in the matrix of the ice (Gradinger, Bluhm, and Iken, 2010). These organisms include the ice algae, amphipods, nematodes, polychaetes, and euphausiids (Hopcroft et al., 2008). Ice algae blooms are essential to the primary productivity of the region (Horner and Schrader, 1982) and other epontic organisms are important contributors to the food web (Bradstreet and Cross, 1982). Relative to ice-covered and break-up months, the ice-associated organisms listed previously are not present in high abundances in the open water and early ice-up seasons.

The final group are the benthic organisms, consisting of groups living within the upper sedimentary matrix (infaunal organisms) and those living on or just above the benthic surface, or strongly associated with the benthic surface (epifaunal organisms). Offshore benthic communities can be quite diverse, but organisms commonly found in surveys include echinoderms, sipunculids, mollusks, polychaetes, copepods, sponges, corals, and amphipods (Dunton, Schonberg, and McTigue, 2009; Rand and Logerwell, 2011).

3.7. Fish

The relatively shallow and brackish waters of Simpson Lagoon and Harrison Bay support a number of anadromous and marine fishes. Fishes known to occur frequently in the area of include:

Cods. Arctic cod (*Boreogadus saida)* and saffron cod (*Eleginus gracilis).* Arctic cod is widely distributed throughout the U.S. Arctic, including the pelagic (in the open water column), demersal (near the seafloor), and nearshore environments of the Beaufort Sea. The absolute numbers of Arctic cod and their biomass is one of the highest of any finfish in the region (Logerwell et al., 2011; Frost and Lowry, 1983). Many species of vertebrates depend on Arctic cod as a major food source (Pirtle and Mueter, 2011). The abundance, wide distribution and the role in the food web of the Arctic cod in the Beaufort Sea make this species very important in the overall ecosystem of the U.S. Arctic region.

Arctic cod move and feed in different groupings – as dispersed individuals, in schools, and in huge shoals. These distribution patterns appear to be dependent on several interacting factors including season, presence or absence of ice, salinity, water temperature, surface wind, currents, length of daylight, and the underside texture of ice. Inter-annual variation also plays a role in the pattern of distributions (Welch, Crawford, and Hop, 1993; Benoit et al. 2010).

The various life stages of Arctic cod occur across a broad range of habitats. Arctic cod migrate between offshore and inshore areas for seasonal spawning and spawn under the ice during winter (Craig et al., 1982; Craig, 1984; Bradstreet et al., 1986). Arctic cod eggs and larvae develop during late winter until early summer in the pelagic surface-water environment.

During open water, pelagic yearling and older Arctic cod were found to occur in high abundance at the continental shelf-break (100 m, 328 ft), and pelagic young-of-year were found most commonly inshore (Logerwell et al., 2010). Frost and Lowry (1983) found smaller Arctic cod more often in water less than 100 m deep. Craig et al. (1982) found adult and juvenile Arctic cod in shallow nearshore waters (1-12 m) in the Beaufort Sea in summer and winter.

Arctic cod are associated with sea ice, using it at various life stages and seasons for shelter and as a forage habitat to feed on microorganisms on the underside of the ice. Amphipods on the underside of ice are an important food source for Arctic cod (Bradstreet and Cross, 1982; Lonne and Gulliksen, 1989; Gradinger and Bluhm, 2004). Rough, irregular textures of the underside-ice may provide preferred habitat for Arctic cod to avoid predators (Crawford and Jorgenson, 1993). Gradinger and Bluhm (2004) and Lonne and Gulliksen (1989) observed Arctic cod in summer months using ice crevices and cracks on the underside of textured ice floes for escape and shelter. Arctic cod also inhabit offshore and nearshore areas without ice during warmer times of year (Bradstreet and Cross, 1982; Bradstreet, 1982; Crawford and Jorgenson, 1993; Gradinger and Bluhm, 2004). Copepods and amphipods are common prey for Arctic cod in open water environments (Frost and Lowry, 1983; Benoit et al., 2010; Rand et al., 2013).

Saffron cod occur in the Beaufort Sea primarily in nearshore waters. Unlike Arctic cod, they do not specifically associate with ice. Saffron cod move seasonally from summertime feeding offshore to inshore for spawning where they enter coastal waters and tide-influenced riverine environments. Adults and juveniles forage on the epibenthos, opportunistically taking small crustaceans and fish (Morrow, 1980; Pirtle and Mueter, 2011).

Arctic Flounder (*Liopsetta glacialis*). Arctic flounder occur in the Beaufort Sea in nearshore brackish and estuarine waters, and sometimes enter freshwater rivers (Morrow, 1980; Mecklenburg et al., 2002). They exhibit seasonal movement, inhabiting offshore areas in the fall, and moving inshore at night in the spring. Spawning occurs in shallow waters from January to March in areas with strong tidal currents. Diet of arctic flounders consists of small mollusks, crustaceans, and fish (Morrow 1980).

Fourhorn Sculpin (*Myoxocephalus quadricornis*). Fourhorn sculpin are found in high abundance in shallow, nearshore habitats in the Beaufort Sea, and have been known to inhabit rivers (Morrow, 1980; Craig, 1984). Similar to Arctic cod, they enter the nearshore environment when the salinity increases in late summer. Overwintering occurs in slightly brackish coastal waters under the ice. They feed on worms, amphipods, isopods, small crustaceans, fish, and eggs. Given its high abundance, the fourhorn sculpin is likely an important part of the nearshore food web, and is occasionally eaten by humans (Morrow 1980).

Kelp snailfish (*Liparis tunicatus*). Snailfish are distributed throughout the Arctic, and kelp snailfish are commonly caught in the Beaufort Sea. They are found in nearshore areas with hard substrates. They feed on benthic amphipods, and are important prey for birds and seals (Walkusz et al., 2016).

Capelin (*Mallotus villosus*). Capelin are an important link in the Arctic food web. They are present in large numbers in nearshore waters of the Beaufort Sea in the summer. Spawning occurs in very shallow waters in July and August. Capelin consume primarily zooplankton, and are a forage fish species for upper trophic predators, such fish, birds, and mammals (Pirtle and Mueter, 2011).

Ninespine Stickleback (*Pungitius pungitius*). Ninespine stickleback occur in freshwater streams and brackish marine waters (Mecklenburg et al., 2002). They inhabit vegetated areas and are most often found in slower moving waters. Overwintering occurs in deeper water, with seasonal movements in the spring to shallow, vegetated areas where spawning occurs from May to August. Nests are built in the vegetation using algae and debris, and the young are initially reared by males. Sticklebacks feed primarily on copepods, insects, worms, and small crustaceans. Although ninespine sticklebacks are not of economic importance, they are important prey items for other fish and bird species found in the area (Morrow, 1980).

Salmonids. Salmonids are common in the vicinity of the Proposed Action, and include chars, whitefishes, and Pacific salmon. There are no commercial fisheries for any of these species; however, salmonids are an important subsistence resource.

Chars include Arctic char (*Salvelinus alpinus)* and Dolly Varden (*Salvelinus malma)*. These anadromous species primarily reside in freshwater rivers and lakes of the North Slope, using the nearshore marine environment as feeding grounds or as corridors to access feeding grounds (Craig and McCart, 1976). Spawning occurs from August to November in freshwater rivers or streams over gravel substrates. Arctic char and Dolly Varden overwinter in freshwater lakes and rivers, including the Sagavanirktok River. Arctic char are predators of salmonid eggs. Other food items include crustaceans, molluscs, and other fish (Morrow 1980). For Dolly Varden, feeding occurs primarily in the nearshore, estuarine environment on small fishes, amphipods, krill, polychaetes, and other invertebrates. Little feeding is believed to occur during the overwintering period (Morrow, 1980).

Common Whitefish *(Coregonus sp.)* include Arctic cisco, least cisco, humpback whitefish, and broad whitefish. Whitefishes use the nearshore marine environment for feeding before returning to freshwater streams to spawn (Craig, 1984). In general, spawning occurs in the fall in streams with gravel beds. Arctic cisco spawn in the Mackenzie River and the juveniles are transported to the Alaskan Beaufort Sea through wind-driven currents (Fechhelm and Griffiths, 1990). Some riverine forms of whitefish species are known to Alaska, although the fishes found in the vicinity of the Proposed Action are primarily whitefish that feed in the marine environment and overwinter in freshwater environments (Craig and McCart, 1976; Craig, 1984; Morrow, 1980). Whitefish overwintering in the Sagavanirktok River were found to feed very little, despite prey availability. Broad whitefish were observed to lose weight while least cisco were found to increase mean body weight (Schmidt et al., 1989). Similar trends were observed in the Colville River, but least cisco were also shown to have increased mean body weight (Schmidt et al., 1989). Whitefish feed on small molluscs and crustaceans (Morrow, 1980). This group of fish is commonly found in subsistence harvests.

Pacific salmon adults and juveniles occur in the Beaufort marine environment; however, their numbers are low compared to the Bering Sea. Of the five Pacific salmon species, pink salmon and chum salmon (*Oncorhynchus gorbuscha* and *O. keta*) have been the salmon species most commonly captured in the Beaufort Sea marine and nearshore environments (Craig, 1984; Craig and Haldorson, 1986; Fechhelm, et al., 2009). In the marine environment, adult pink and chum salmon in the U.S. Beaufort Sea are known to occur down to 200 m (660 ft) depth. Chum salmon and pink salmon have been documented as present in the Colville River, Fish Creek, and Kuparuk (pink only) in the Alaska Department of Fish and Game (ADF&G) Anadromous Waters Catalog (Johnson and Litchfield, 2016).

3.8. Birds

During spring, summer, and fall months, many bird species use the marine waters and coastal and terrestrial habitats in the nearshore Beaufort Sea. The shallow waters and coastal lagoon system provides important waterbird foraging and staging habitat. After migrating north over land or primarily north and east via coastal routes, waterbirds (seabirds and loons, shorebirds, and waterfowl including sea ducks) and some landbird and raptor species breed across the area during the short Arctic summer. Many species are particularly abundant as they migrate through in the spring and again in late summer/fall months. Some stage in large groups as they move through from other breeding grounds, such as elsewhere on the Alaskan or Canadian Beaufort Sea coast (Dickson and Smith, 2013).

Spring migration occurs between late March and late May, with arrival times varying by species and corresponding availability of habitat. Arrival times for many waterbirds, including eiders, typically coincide with the appearance of open water during migration to coastal breeding areas. Average spring arrival dates for many Arctic-nesting bird species have advanced by several days over recent decades (Ward et al., 2016). Movement from the local nesting area or even the fall migration period can begin in June or July for some failed breeders and nonbreeders. A few waterbird species move from tundra and freshwater habitats to molt, flightless, in lagoons along the Beaufort and Chukchi Sea coasts. Fall migration timing from the Beaufort Sea area varies among species, and often by gender and age, with most birds having departed the Beaufort Sea before the formation of sea ice in late October. Only a handful of landbird and raptor species remain year-round, particularly in the terrestrial landscape.

3.8.1. ESA-Listed Birds

Avian species that are listed as threatened and endangered under the Endangered Species Act (ESA) and regularly use the Alaskan Beaufort Sea are the spectacled eider (*Somateria fischeri)* and Alaska-breeding population of Steller’s eider (*Polysticta stelleri*) (both listed as threatened). They are both benthic-feeding sea ducks. The U.S. Fish and Wildlife Service (USFWS) provided a Biological Opinion on potential effects of certain oil and gas activities, including exploratory drilling and associated activities such as those of the Proposed Action on these ESA-listed birds in the Biological Opinion (2012 USFWS BO). The 2012 USFWS BO also includes life history information for these ESA-listed birds, as does the Biological Evaluation that preceded it (BOEMRE, 2011). This information is incorporated by reference with relevant information and status is summarized and updated below.

The spectacled eider was listed as a threatened species throughout its range under the ESA in 1993 (58 *FR* 27474, May 10, 1993). The Alaska North Slope (ANS) breeding population is the larger of the species’ two North American breeding populations, and has been stable since surveys began in the early 1990s (Bowman, et al., 2015; Larned, Stehn, and Platte, 2011). Most of the birds breed on the Arctic Coastal Plain (ACP) portion of the ANS. The best available population estimate for the ACP is about 14,500 paired birds (Stehn, Larned, and Platte, 2013). It has been estimated that almost 34,000 total spectacled eiders, including fledged (flight capable) juveniles, are present on the entire ANS in October (Stehn et al., 2006).

Spectacled eiders breed in low densities across the Alaskan ACP tundra east to between the Shaviovik and Canning Rivers (TERA, 2002, Larned, Stehn, and Platte, 2011). Pre-breeding, they arrive in the western Beaufort Sea in late May through early June (Sexson, Pearce, and Petersen, 2014; TERA, 2002). Like other sea ducks, they fly fast (average 50 mph) and low over the water during migration (Petersen and Savard, 2015). They nest primarily in non-patterned wet meadows within wetland complexes containing emergent grasses and sedges (Anderson and Cooper, 1994; Anderson et al., 1999), and it is possible that on the order of a pair or two may nest in the vicinity of Oliktok Point. The area is expected have relatively low spectacled eider nesting density (Larned, Stehn, and Platte, 2011). After hatching in mid-July (Petersen, Grand, and Dau, 2000), spectacled eider hens and broods move to deep ponds with pendant grass (*Arctophila fulva*) vegetation or shallow water sedge (*Carex aquatilis)* wetlands (Safine, 2011, 2013).

Males leave the breeding grounds along the ACP for the ocean around mid- to late June at the onset of incubation by female eiders. Males are followed by those females whose nests fail, and finally by successful breeding females and young birds in August and September. Spectacled eiders can be found in low numbers in the area throughout the open water period. They are relatively widely distributed and do not tend to occur in large flocks while in these waters (Stehn and Platte, 2000). After breeding and fledging are complete, most spectacled eiders that breed in the Beaufort Sea area are believed to migrate west along the Alaska coast and out as far as 40 km offshore. Most spectacled eiders depart the western Beaufort Sea mid-August through October, although their presence in the western Beaufort Sea has been recorded as late as mid-November (Sexson, Pearce, and Petersen, 2014). Spectacled eiders do not molt in the Beaufort or Chukchi Seas.

The Alaska-breeding population of Steller's eiders was listed as threatened in 1997 (62 *FR* 31748, June 11, 1997). A small number of Steller's eiders, possibly less than 600, breed on the ACP of Alaska. Most nests are found in the vicinity of Utqiaġvik, but nesting can range between Point Lay and the Prudhoe Bay area (Martin et al., 2015; Obritschkewitsch and Ritchie, 2015; Stehn and Platte, 2009). Post-breeding, Steller's eiders fitted with transmitters at breeding locations near Utqiaġvik moved to nearby, nearshore Chukchi Sea waters in early July (males) and August (females) prior to initiating molt migration (Martin et.al., 2015). None of the birds in this study moved in to Beaufort Sea waters post-breeding. Steller's eiders do not molt in U.S. Chukchi or Beaufort Seas. Few if any Steller's eiders are expected to be present in the area.

3.8.2. Other Birds

Waterfowl

Some of the most abundant birds in coastal waters of the Beaufort Sea are benthic-feeding sea ducks, especially long-tailed duck (*Clangula hyemalis*), king eider (*Somateria spectabilis*), and Pacific common eider (*S. mollissima v-nigra*) (Dau and Bollinger, 2011 and 2009; Fischer, Tiplady, and Larned, 2002). Greater white-fronted goose (*Anser albifrons frontalis*) and black brant *(B. bernicla nigricans)* are other locally breeding waterfowl common in nearshore coastal waters of the Beaufort and Chukchi Seas, as are scoters (*Melanitta spp*), mergansers tundra swan (*Cygnus columbianus*) and dabbling ducks (Stehn, Larned, and Platte, 2013).

Sea Ducks and Dabbling Ducks
Long-tailed duck is the most abundant benthic-foraging sea duck in the Beaufort Sea. Long-tailed ducks feed primarily on benthic invertebrates and are believed to be well adapted to shifts in prey availability, opportunistically feeding according to species availability (Johnson, 1984). They move locally among marine habitat types (e.g., nearshore vs offshore) to locate better foraging (Flint et al., 2016). As with many other waterbirds, in the late spring they migrate north and east along the Beaufort and Chukchi Sea coastlines to breeding areas on the ACP in Alaska and Canada. Long-tailed ducks are expected to arrive in the vicinity in late May (Ward et al., 2016).

The ACP long-tailed duck breeding population has been estimated at over 50,000 (Stehn, Larned, and Platte, 2013). Early July breeding season surveys typically record more long-tailed ducks than any other sea duck species in coastal ACP waters, with roughly two-thirds of these associated with mainland shorelines, and the rest with barrier islands. Hundreds of long-tailed ducks have been observed along Spy Island and nearby Thetis Island, more than at any other barrier island from the Colville River to the Canning River, during these surveys (Dau and Bollinger, 2012, 2009).

Like many eiders and loons, post-breeding long-tailed ducks generally stage in coastal areas, move into offshore waters, and then migrate westward out of the Beaufort Sea. They use lagoon and other coastal habitats heavily all along the ACP during July and August, numbering in the tens of thousands as they undergo a post-breeding flightless wing molt (Flint et al., 2016; Johnson and Richardson, 1982). The Jones/Return Islands barrier island area, between Oooguruk and Prudhoe Bay, has been one of the highest density molting areas, and long-tailed ducks are expected to number in the low thousands during July and August (Lysne, Mallek, and Dau, 2004).

Surveys suggest that the ACP population of long-tailed ducks underwent a long-term decline in the last decades of the 20th Century, stabilizing or slightly increasing more recently (Stehn, Larned, and Platte, 2013; Bowman, et al., 2015; SDJV, 2015).

Surf scoter (*M. perspicillata*), white-winged scoter (*M. fusca*), and black scoter (*M. americana*) regularly breed on the ACP and use Beaufort Sea coast barrier island habitat between June and September. Surf scoters can be especially common in high-density rafts of several hundred birds, particularly in Harrison Bay and Simpson Lagoon, and occasionally can even exceed long-tailed duck and glaucous gull in number (Fischer, Tiplady, and Larned, 2002; Dau and Taylor, 2000; Dau and Bollinger, 2012). Fischer and Larned (2004) report that Beaufort Sea coast scoters were more common in June than in August, and more common in shallow waters (<10 m).

Several species of "dabbling ducks" (i.e., those that feed by diving in shallow, usually fresh or brackish, water) breed on the ACP. Northern pintail (*Anas acuta*), is among the most common dabbling duck expected to occur in shallow nearshore marine waters and to nest in onshore wetlands (Dau and Bollinger, 2009 and 2012: Bishop and Streever, 2016). Northern pintails first arrive in late May (Ward et al., 2016).

King Eider and Common Eider
King eiders and common eiders migrate by the hundreds of thousands past Point Barrow each spring and fall (Quakenbush et al., 2009). Arrival times in the Beaufort Sea are dependent upon the location and timing of offshore leads along the Chukchi Sea. King eiders generally begin to arrive in the Beaufort Sea by the middle of May, although the occasional individual has been seen in late April (Streever and Bishop, 2014). Their earliest arrival on local nesting grounds is late May (Ward et al., 2016). King eider nesting density is expected to be average for the ACP population (Larned, Stehn, and Platte, 2006). The birds will regularly be found using the marine waters both inside and outside of the natural barrier island system throughout the open water season (Phillips et al., 2014), but most king eiders will have departed by October (Oppel, Powell, and Dickson, 2008).

Once the barrier islands are surrounded by open water, common eiders nest in loose colonies on barrier islands or spits where driftwood or other beach detritus provides some cover (Noel et al., 2005; Dau and Bollinger, 2012). Spy Island has been an area of particularly high nesting density for common eider, and nests numbering in the high tens or low hundreds are expected annually on this island and on nearby islands (Dau and Bollinger, 2012, 2009; Flint et al., 2003).

Common eider is considered highly vulnerable to climate change because of its preference for nesting on low-lying barrier islands and similar coastal areas, which are subject to overwash and erosion from the increasing frequency and severity of storms (Liebezeit et al., 2012; Sea Duck Joint Venture, 2015b). A storm surge on July 18, 2016, flooded most of the monitored common eider nests along the coast of the Arctic National Wildlife Refuge. It was the largest recorded surge before July 30th in any year since recording began in 1995 (Wiese, Latty, and Hollmen, 2016).

Successful hens seldom leave the nest to feed during incubation. However, common eiders, including failed breeders and males, are expected to be found using local nearshore waters, particularly coastal lagoon habitat, throughout the breeding season (Lysne, Mallek, and Dau, 2004). Locally breeding common eiders, at least females, may undergo their flightless molt in the Beaufort Sea (Petersen and Flint, 2002). Post-breeding males and nonbreeders along the Beaufort Sea coast begin to migrate westward through nearshore waters toward the Chukchi Sea in late June. Males are followed out of the Beaufort Sea by breeding females and their young and all are gone by late October or early November (Dickson, 2012).

Geese and Swan
Geese that may be found in the vicinity of the Proposed Action include greater white-fronted goose (*Anser albifrons frontalis*), lesser snow goose (*Chen caerulescens caerulescens*), black brant *(Branta bernicla nigricans), and* Canada goose (*B. canadensis, B. hutchinsii*). Greater white-fronted goose is a large herbivorous waterfowl and one of the earlier arriving birds on the ACP in the spring. Mean first arrival date for white-front on the Colville River Delta is approximately May 12th (Ward et al., 2016). It is one of the most abundant breeding waterbirds on the ACP (Larned, Stehn, and Platte, 2012) where it nests only loosely in colonies. Tens of nests have been recorded annually in the nearby BP oilfields (Bishop and Streever, 2016).

Lesser snow goose, an herbivorous colonial nester, has the fastest population growth rate among all ACP waterbird species (Stehn, Larned, and Platte, 2013; Ritchie et al., 2013). Black brant is also an herbivorous goose that forages on the salt-tolerant vegetation that appears to be increasing along the coast over recent time as salt water intrudes. Black brant, or simply "brant," nest in four or five small sites or colonies (approximately 1-30 nests each) in the Milne Point area (Bishop and Streever, 2016).

Both species have a mean first arrival expected around May 25-27 (Ward et al., 2016). While the central molting location for the ACP's breeding population is Teshekpuk Lake, brant are also now known to molt in nearby coastal areas as well (Flint, Meixell, and Mallek, 2014), and small numbers may undergo flightless molt in sheltered lagoon waters in the vicinity of the Proposed Action. Brant have a mildly positive growth trend on the ACP where there are 5,000 or more nesting pairs (Ritchie, et al., 2013; Stehn, Larned and Platte, 2013, 2012), with more population variability in the oil fields east of the Colville River delta (Bishop and Streever, 2016).

Tundra swan, with a broad breeding range that encompasses much of Alaska, is the largest ACP breeding waterbird. Mean first arrival date in the Proposed Action area for this territorial-breeding, herbivorous waterfowl is approximately May 21st (Ward et al., 2016). Tundra swans' ACP breeding population is growing (Streever and Bishop, 2014; Stehn, Larned, and Platte, 2013). In June, tundra swans are often found breeding in some of their highest ACP densities on the Colville River Delta and in the inland Milne Point vicinity of the Proposed Action area (Larned, Stehn, and Platte, 2011). They are observed in low numbers but wide distribution during July along the Beaufort Sea coastline (Dau and Bollinger, 2012; Stehn and Platte, 2000).

Seabirds

Glaucous gull (*Larus hyperboreus*), Arctic tern *(Sterna paradisaea*) and black guillemot *(Cepphus grylle),* breed circumpolarly in the Arctic. Glaucous gull and Arctic tern may be considered likely to nest in the terrestrial vicinity of the Proposed Action, and species may regularly occur in the local marine waters. Short-tailed shearwater *(Ardenna tenuirostris)* regularly range into the Beaufort Sea but breed elsewhere. Another type of seabird, the jaeger, is represented by three species, pomarine (*Stercorarius pomarinus*), parasitic (*S. parasiticus*) and long-tailed (*S. longicaudus*), that breed on the ACP tundra and forage in open water of the Beaufort Sea.

Glaucous gull is a pelagic surface-feeder and one of the more common and abundant Beaufort Sea breeding birds, often congregating at food sources (Kuletz, et. al, 2015; Divoky, 1987). This gull sometimes locally rivals long-tailed ducks in number. Its mean first arrival date on the local breeding grounds is approximately May 11 (Ward et al., 2016). Glaucous gulls may be encountered throughout the open water period.

Arctic terns are considered a fairly common migrant and breeder in the area, and regularly nest on barrier islands. Black guillemot is a diving seabird that is closely associated with sea ice throughout its lifetime, where it forages extensively on Arctic cod (Gall, Day, and Morgan, 2013; Sigler et al., 2011). Black guillemot nests, sometimes occurring singly or in small, loose aggregations, are often located under driftwood or other debris on barrier islands.

Short-tailed shearwaters (shearwaters, *Puffinus spp*) breed in the Southern Hemisphere and are common surface foragers in Beaufort Sea waters throughout the open water season. This is their non-breeding ("wintering") season (Kuletz et al., 2015).

Jaegers forage at sea when they are not breeding, primarily scavenging and stealing from other birds, or directly preying on, other seabirds. Three species of jaegers *(*pomarine, parasitic, and long-tailed) commonly summer in the Beaufort Sea until late September (Divoky, 1984; Divoky, 1987). Jaegers are dispersed throughout nearshore and pelagic areas of the Beaufort Sea, with high overall abundance but no known high concentration areas. All three species nest on the ACP, where pomarine and long-tailed jaegers are uniquely dependent on lemming prey on the tundra for successful breeding. Jaegers are territorial tundra nesters and it is possible but unlikely that they would breed in the Proposed Action area.

Pacific, red-throated, and yellow-billed loons breed across the ACP and regularly occur in nearshore coastal waters of the Beaufort Sea. They are all territorial lake nesters and diving foragers, primarily on fish and somewhat on invertebrates. Ward et al. (2016) found loons to have the latest mean first arrival (i.e., early June) on Colville River Delta nesting grounds of 16 avian species examined. Loons are unable to walk well on land, but are excellent swimmers that vigorously defend their aquatic breeding territory and floating nests. Large numbers of loons migrate past Point Barrow between August and October.

Pacific loons are the most abundant loon species breeding on the ACP, and a small numbers of nests are regularly observed in the nearby Prudhoe Bay oilfields (Bishop and Streever, 2016; Streever and Bishop, 2013). Pacific and red-throated loons are commonly observed between June and August during the breeding and post-breeding seasons in the Spy Island area (Dau and Taylor, 2000; Dau and Anderson, 2002; Lysne, Mallek, and Dau, 2004). Red-throated loons do not forage on nesting ponds, travelling to marine waters to forage even during breeding. Yellow-billed loon nesting distribution is clumped, with the greatest concentration of nests on the ACP occurring between the Meade and Colville Rivers (USFWS, 2014; Larned, Stehn, and Platte, 2011). Yellow-billed loon numbers were thought to be declining, but the population is now considered stable (Stehn, Larned, and Platte, 2013).

Shorebirds

Shorebirds are the dominant avifauna on the ACP in terms of both breeding species diversity and overall abundance (Liebezeit et al., 2009). After arriving in May on the river deltas and other coastal areas such as beaches, barrier islands, lagoons, and mudflats that most rely on for some portion of their lifecycle, most shorebirds breed on the tundra. Recent ACP shorebird habitat suitability maps show mainland habitat around Oliktok Point as having fairly high levels of predicted breeding shorebird species richness (Saalfeld et al., 2013; ADNR, 2014). Post-breeding, shorebird flocks stage and forage in the hundreds and thousands along the Beaufort Sea coast. This coast is rich with freshwater discharges that produce an estuarine trophic structure and high primary productivity. The flocks feed on invertebrates in the river deltas and mudflats, gravel beaches, and salt marshes. Species likely to occur in the area, particularly in the saltmarsh habitat of Oliktok Point, for either nesting or migration foraging, include semipalmated plover (*Charadrius semipalmatus*), bar-tailed godwit (*Limosa lapponica*), semipalmated sandpiper (*Calidris pusilla*), western sandpiper (*C. mauri*), least sandpiper (*C. minutilla*), stilt sandpiper (*C. himantopus*), pectoral sandpiper (*C. melanotos*), dunlin (*C. alpina*), buff-breasted sandpiper (*C. subruficollis*), and long-billed dowitcher (*Limnodromus scolopaceus*) (Powell et al., 2016; Taylor, et al., 2010; Andres, 1994). Red-necked phalarope (*Phalaropus lobaus)* and red phalarope (*P. fulicarius*) also are expected to be found in the marine waters of the Beaufort Sea coast.

Red phalarope and red-necked phalarope are among the most common ACP breeding shorebird species (Saalfeld et al., 2013; Bart et al., 2012). Phalaropes are unique among shorebirds in that rather than probing in soils while walking, they forage by swimming in nearshore and offshore waters. They primarily eat plankton but do not dive and are restricted to surface foraging. Red and red-necked phalaropes are found in the Beaufort Sea during the open-water season, and are ecologically similar to each other, appearing in mixed flocks (Kuletz and Labinski 2017 ; Kuletz et al., 2015). In the marine environment, phalaropes are common from pelagic waters to within a few meters of shore.

Buff-breasted sandpiper, uniquely among North American shorebirds, uses a lek mating system, whereby the male defends (sometimes only briefly and in succession with other males) a relatively small territory he uses only to display and attract females, providing no other resources. The females lay and brood elsewhere in the area. The Buff-breasted Sandpiper Conservation Plan (Lanctot et al., 2010), notes that the population, estimated at 40,000 on the ACP (Bart et al., 2012) has apparently substantially declined and is categorized as near threatened by IUCN/BirdLife International. Most recently, it has also been categorized as a Bird of High Conservation Concern (HCC) in the U.S. Shorebirds of Conservation Concern - 2016 (U.S. Shorebird Conservation Plan Partnership, 2016). Factors that led to these designations were a small and declining population and relatively small nonbreeding area within which birds concentrate in South America. American golden-plover, dunlin, pectoral sandpiper and semipalmated sandpiper are also on the 2016 list of HCC. The ACP breeding subspecies of dunlin, *C.a. arcticola*, has reportedly declined substantially in recent decades (Andres et al., 2012).

Landbirds

A variety of landbirds (e.g., raptors and owls, passerines, fowl or game birds) occur in the area. Some of these are top predators in terrestrial and shoreline areas. A few landbird species occur in the area year-round. Some are significant because they are common breeders in the area. Many landbird species migrate over the area, including marine waters.

Common raven (*Corvus corax*) is expected to occur in the coastal and terrestrial zones. The raven is the most abundant species occurring in nearby oilfields in the winter months. It is the only species recorded in the Audubon Christmas Bird Counts, which have taken place annually in the Prudhoe Bay area between 1987 and 2012 (Streever and Bishop, 2014).This large passerine is a generalist scavenger and also a predator on the young and eggs of other birds during the breeding season. Ravens are attracted to landfill food sources and occur year-round on the ACP (Saalfeld, Hill, and Lanctot, 2013; Powell and Backensto, 2009). Only in recent decades, as communication and oil field infrastructure increased, have ravens noticeably expanded their breeding range onto the relatively flat-featured ACP. Both the number of raven sightings during the winter Audubon Christmas Bird Count, and the number of raven nests in summer have increased over the recent years of study (1987-2012 and 2004-2014, respectively) on the Prudhoe Bay oilfields (including existing artificial drilling islands Northstar and Endicott SDI, between approximately 30 and 50 mi to the east, respectively) (Bishop and Streever, 2016).

Other landbirds common in the vicinity year-round include snowy owl (*Bubo scandiacus*) and ptarmigan. Snowy owl is an important Arctic predator on small mammals, especially lemmings, and the young of other birds during breeding season. Ptarmigan species, particularly rock ptarmigan (*Lagopus mutus*), which prefer open tundra and breed in alpine and arctic tundra, are common fowl on the ACP year-round.

Several species of passerine birds (also called songbirds) breed in Arctic habitats in the U.S., Canada, and Russia, and migrate not only north across land but in some cases also across the Beaufort Sea to and/or from their wintering grounds. Two common breeders on the ACP include Lapland longspur (*Calcarius lapponicus*) and snow bunting (*Plectrophenax nivalis*). Like other Alaskan ground-nesting passerines, the nests of these small birds are camouflaged and easily overlooked, despite their abundance. They both arrive on the ACP breeding grounds early in spring, snow bunting being one of the first Colville River Delta arrivals with a current mean arrival date of April 17^{th} (Ward et al., 2016).

Arctic passerine migrations are usually nocturnal, often wide-ranging, and intrinsically difficult to study. These long-distance flights occur in the Beaufort Sea area for species that winter in North America (“New World” migrants), and others that either breed or winter on other continents (“Old World” migrants). Passerine flights in the Arctic are sometimes “off-course” individual migrants, and other times large flocks. Data on species occurrence and distribution, including carcass retrieval, is available from monitoring programs. Passerines interact with at-sea oil and gas infrastructure and vessels, even many miles from land.

Over 40% of the bird encounters recorded on drilling and support vessels during 2012 and 2015 exploration drilling in the adjacent Chukchi Sea were passerines, including three species of Old World migrants- Arctic warbler (*Phylloscopus borealis*), northern wheatear (*Oenanthe oenanthe*), and yellow wagtail (*Motacilla tschutschensis*). Other passerines encountered include American pipit (*Anthus rubescens*), yellow warbler, (*Dendroica [Setophaga*] *petechia*), Swainson’s thrush (*Catharus ustulatus*), dark-eyed junco (*Junco hyemalis*), rusty blackbird (*Euphagus carolinus*), “sparrows,” “warblers,” and other unidentified individuals (Shell Gulf of Mexico Inc., 2012, 2015). Given the prevalence of passerine encounters in adjacent Arctic waters, many of the same species are expected to occur during migration in the vicinity of Simpson Lagoon.

3.9. Marine Mammals

This section provides information on marine mammal species that may be affected by the Proposed Action, including those currently listed as threatened or endangered under the ESA, including beluga, bowhead, and gray whales; spotted, ringed, and bearded seals; polar bears and Pacific walruses. Species considered extralimital to this area include minke, fin, humpback and killer whales, harbor porpoises, narwhals, and ribbon seals and are not discussed. The numbers of individual whales and seals that would occur between Oliktok Point and the barrier islands should be low due to shallow water depths. Shallow waters cannot normally support the quantities and types of prey marine mammals require. Landfast ice, discharge from the Colville River, debris and sediment, and strudel scour all work to destroy the benthic communities that many marine mammals feed on (Craig et al., 1984). Polar bears occasionally occur in small numbers and few, if any, Pacific walruses should occur near Harrison Bay, Alaska.

All marine mammals are protected by the Marine Mammal Protection Act (MMPA). Cetaceans and seals are managed by NMFS, while Pacific walruses and polar bears are managed by the USFWS. Threatened and endangered marine mammal species known to occur in or near Harrison Bay include the bowhead whale, bearded seal, and polar bear. The Pacific walrus is a candidate species under the ESA. Critical habitat has also been established for polar bears (*75 FR 76086*, December 7, 2010) and is located in the area.

The NMFS and USFWS Marine Mammal Stock Assessment Reports (SARs) contain detailed information on the status, distribution, seasonal distribution, abundance, and life history of each of the species mentioned in this document. The most current SARs for NMFS-managed species (cetaceans and seals) are available at http://www.nmfs.noaa.gov/pr/sars/species.htm (Muto et al., 2016). The most current SARs for USFWS-managed species (Pacific walruses and polar bears) are available at http://www.fws.gov/alaska/fisheries/mmm/stock/stock.htm. Table 3-3 lists the marine mammal species with confirmed or possible occurrence in the area.

Table 3-3. Marine Mammal Species and Stocks in the Beaufort Sea.

Common Name	Scientific Name	Status	Occurrence in Harrison Bay	Seasonality	Range
Odontocetes					
Beluga Whale (Eastern Chukchi Sea stock)	*Delphinapterus leucas*	-	Occasional	Mostly spring and fall with some in summer	Russia to Canada
Beluga Whale (Beaufort Sea stock)	*Delphinapterus leucas*	-	Occasional	Mostly spring and fall with some in summer	Russia to Canada
Mysticetes					
Bowhead Whale	*Balaena mysticetus*	Endangered; Depleted	Common	Mostly spring and fall with some in summer	Russia to Canada
Gray Whale	*Eschrichtius robustus*	-	Uncommon	Mostly summer	Mexico to the U.S. Arctic Ocean
Pinnipeds					
Bearded Seal	*Erignathus barbatus*	-	Common	Mostly seasonal with a smaller number of year-round residents	Circumpolar
Ringed Seal	*Phoca hispida*	Threatened, Depleted	Common	Mostly seasonal with a smaller number of year-round residents	Circumpolar
Spotted Seal	*Phoca largha*	-	Common	Seasonal	Bering, Chukchi and Beaufort Seas
Pacific Walrus	*Odobenus rosmarus divergens*	Candidate, Strategic Stock	Rare	Mostly summer	Bering and Chukchi Seas, occasionally Eastern Siberian and Beaufort Seas
Fissipeds					
Polar Bear (Bering-Chukchi Seas stock)	*Ursus maritimus*	Threatened, Depleted	Occasional	Year-round	Bering, Chukchi, and Beaufort Seas and adjacent coastal areas of Alaska and Russia
Polar Bear (Southern Beaufort Sea stock)	*Ursus maritimus*	Threatened, Depleted	Common	Year-round	Chukchi and Beaufort Seas and adjacent coastal areas of Alaska and Canada

3.9.1. Cetaceans

The baleen, bowhead and gray whales and the toothed, beluga whale are the only cetaceans likely to occur in or near Harrison Bay. Web sites updated by NMFS with information specific to these species can be found at http://www.fisheries.noaa.gov/pr/species/mammals/.

Bowhead Whale

The Western Arctic stock is the largest, and the only stock of bowhead whales to inhabit U.S. waters (Allen and Angliss, 2015). They prefer seasonally ice-covered, continental shelf waters, generally north of 60° N and south of 75° N in the western Arctic Basin (Bering, Chukchi, and Beaufort seas) (Braham, 1984; Moore and Reeves, 1993; Rugh et al., 2003), and migrate between the Bering Sea and the Arctic Ocean. While most bowhead whales use preferred offshore habitat, increasing numbers of animals have been observed in nearshore areas in the recent years (Clarke et al., 2015), suggesting their distribution patterns may be changing.

In spring, bowhead whales migrate from wintering areas in the Bering Sea to their feeding grounds in the eastern Beaufort Sea via offshore leads running parallel to the coast (NOAA, 2016; BLM, 2012). Consequently, they are unlikely to occur near the Proposed Action during their spring migration because nearshore waters such as Harrison Bay remain ice-covered during that time (BLM, 2012).

During the open water season, bowheads feed throughout the Beaufort Sea, but largely aggregate in the Canadian Beaufort Sea and Barrow Canyon, where upwellings concentrate prey species. Although a small feeding area has been identified slightly north of Bodfish Island (Clarke et al., 2012, 2013), most bowheads do not feed in the shallow waters of Harrison Bay. In September to mid-October, bowheads migrate from the Canadian Beaufort Sea to the Chukchi Sea, within 100 km (62 mi) of shore, north of the barrier islands in waters 15-200 m (50 to 650 ft) deep (NOAA, 2016; HAK, 2015). Likewise, during the fall season bowhead whales are not expected to occur near the area, but may be observed to the north as they migrate past in the fall, or occasionally feeding in small groups in deeper continental shelf waters.

Bowhead whales are grouped among low frequency (7 Hz – 35 kHz) functional hearing baleen whales (Southall et al., 2007; NMFS, 2016). Inferring from their vocalizations, bowhead whales should be most sensitive to frequencies between 20 Hz–5 kHz, with maximum sensitivity between 100–500 Hz (Erbe, 2002).

The bowhead whale is listed as endangered under the ESA and as depleted under the MMPA (Table 3-3). Despite these designations, the Bering-Chukchi-Beaufort (BCB) stock of bowheads has been increasing (Muto et al., 2016), even in the face of ongoing industrial activity and subsistence harvesting, and may be or approaching their pre-commercial whaling population size. There is currently no critical habitat designated for bowhead whales.

Gray Whale

The majority of the Eastern North Pacific (ENP) stock of gray whales inhabiting Alaskan waters spend their summer feeding in the northwestern Bering Sea, and in the Chukchi Seas (Rice and Wolman, 1971; Berzin, 1984; Nerini, 1984). Gray whales prefer areas with little or no ice cover and spend most of their time in water less than 200 ft (60 m) deep (Moore and DeMaster, 1997). Gray whales are generalist feeders mostly foraging on benthic prey in shallow continental shelf waters. The ENP gray whale population has increased over the past several decades, with abundance trends consistent with a population approaching carrying capacity.

Gray whales are common in the Chukchi Sea. Although not as common in the Beaufort Sea, sightings have increased over the past several years. Several gray whales were observed northwest of Camden Bay about 13 - 25 miles (21 – 40 km) from the coast (Hall et al., 1994). More recently in 2014, a gray whale was sighted immediately north of Cross Island (Clarke et al., 2015). However, gray whales remain an uncommon occurrence in the Beaufort Sea east of Barrow Canyon because the narrow continental shelf in this area provides suboptimal feeding habitat for large numbers of gray whales. For this reason, it is unlikely that gray whales will occur in the nearshore Beaufort Sea.

Gray whales are grouped in the low-frequency cetacean hearing group with an estimated auditory bandwidth of between 7 Hz to 35 kHz (Southall et al., 2007; NMFS 2016). Behavioral data for free-ranging gray whales in breeding lagoons suggests they are most sensitive to tones between 800 Hz and 1500 Hz (Dahlheim and Ljungblad, 1990). They produce broadband signals ranging from 100 Hz to 4 kHz. (NOAA, 2016).

Beluga Whale

Beluga whales are found throughout seasonally ice-covered Arctic and subarctic waters of the Northern Hemisphere (Gurevich, 1980), and are closely associated with open leads and polynyas in ice-covered regions (Hazard, 1988). Beluga whales in this region belong to the Beaufort Sea (BS) and the Eastern Chukchi Sea (ECS) stocks (NOAA, 2016). Both BS and ECS beluga whale stocks winter in the southern Chukchi Sea and Bering Sea (Suydam et al., 2001; Miller, Elliott, and Richardson, 1998; Clarke et al., 2015b). Spring migration north through the Chukchi Sea and east through the Beaufort Sea is stock-specific, with BS migration occurring in spring and ECS in summer.

The main fall migration corridor of beluga whales is over 100 km north of the coast. Satellite telemetry data show some belugas migrate west considerably farther offshore, as far north as 76ºN to 78ºN latitude (Richard, Martin, and Orr, 1997; 2001), and spend most of their time feeding on fishes, over the continental shelf break. Belugas typically migrate north of the barrier islands during their spring and fall migration; however, a few beluga whales have been observed migrating through nearshore areas July and August (LAMA and OASIS, 2011), and occasionally, a few appear in coastal areas such as lagoons and river deltas. Belugas were observed during industrial marine mammal monitoring surveys in the central Beaufort Sea (Smultea et al., 2014; Lomac-MacNair et al., 2015; Cate et al., 2015). While beluga whales have been observed north of the barrier islands in the central Beaufort Sea, few are expected to occur in nearshore area of Harrison Bay.

Beluga whales have an estimated auditory bandwidth of 150 Hz to 160 kHz. Belugas whales' social sounds are generally in the range audible to humans, from a few hundreds of Hz to several tens of kHz, but specialized clicks used in biosonar (echolocation) systems for prey detection and navigation extend well above 100 kHz (Southall et al., 2007; NMFS, 2016), and a well-developed sense of hearing. They can hear across a large range of frequencies, from about 40–75 Hz to 80–150 kHz (Richardson, 1995). Their hearing is most acute at middle frequencies, between about 10 and 75 kHz (Fay, 1988; Richardson, 1995).

3.9.2. Ice Seals

Bearded Seal

Bearded seals have a circumpolar distribution ranging from the Arctic Ocean into the western Pacific Ocean (Burns, 1981), associating with pack ice, and only rarely using shorefast ice (Burns and Harbo 1972). In Alaskan waters, bearded seals occur over the continental shelves of the Bering, Chukchi, and Beaufort seas where they feed on benthic prey (Burns, 1981; Kelly, 1988). They are typically associated with the ice edge and use the pack ice as a platform for birthing, nursing, resting, and molting. In the Beaufort Sea, they most often occur in a mixed ice environment where drifting pack ice interacts with fast ice, with open water leads, fractures, and polynyas (NOAA, 2016). Most bearded seals migrate in tandem with the presence of seasonal pack ice in the Beaufort, Chukchi and northern Bering seas. In the spring, bearded seals move north into the Chukchi and Beaufort seas from wintering areas as the pack ice recedes. In the fall, as the pack ice advances, they move south into the Bering Sea. A small portion of the bearded seal stock is believed to remain in the Beaufort Sea year round, using lead systems, polynyas, and shear zones for access to the ocean.

Bearded seals generally feed on benthic prey on the seabed in depths less than 200 m (656 feet) (NOAA, 2016). In the Beaufort Sea, they prefer areas with broken ice and water depths of 25 to 75 m (82 to 246 feet) (NOAA, 2016). Physiological limitations require bearded seals to forage in areas where they can access the seafloor; therefore, they cannot forage on benthos near or beyond the continental shelf break.

During winter, landfast ice develops which can heavily scour the sea floor of benthic life throughout much of the area. In addition, ice-gouging of the shallow bottom during spring can further reduce the abundance of remaining bearded seal food items, and the areas habitat value for bearded seals. Consequently, there is little in the way of benthic food resources for bearded seals in Harrison Bay and most of Simpson Lagoon. While bearded seals have been commonly observed during marine mammal monitoring surveys in the central Beaufort Sea, and will likely be present at certain times of the year, their abundance in the area is expected to be low because of poor habitat quality, and low food resource availability.

Underwater audiograms for ice seals suggest that they have limited hearing sensitivity below 1 kHz; but hear underwater sounds at frequencies up to 86 kHz; and make calls between 90 Hz and 16 kHz

(Richardson et al., 1995). According to Southall et al. (2007), bearded seals (as with other pinnipeds) have an estimated auditory bandwidth of 50 Hz to 86 kHz in water, and 75 Hz to 30 kHz in air.

NMFS listed the Beringia DPS of bearded seals as threatened under the ESA on December 28, 2012 (*77 FR 76740*) due to sea ice and snow cover decreases in the foreseeable future, which would result in population declines that threaten the survival of the bearded seal. The stock is also considered depleted under the MMPA by NMFS; however, no critical habitat has been designated for them.

Ringed Seal

Arctic ringed seals have a circumpolar distribution, occurring in all seas of the Arctic Ocean. They are the most widespread seal species in the Beaufort Sea and some reside there throughout the year. During fall, most ringed seals migrate from the Beaufort and Chukchi seas to overwinter in the Bering Sea. Harwood et al. (2012) tracked ringed seal migrations from the eastern Beaufort Sea to the Bering Sea, and found ringed seals made a rapid, synchronized, westward migration into the Chukchi Sea using the same migration corridor and route used by bowhead whales. In the spring, ringed seals move north as the pack ice recedes back into the Chukchi and Beaufort seas.

In the spring, ringed seals use continuous to scattered areas of sea ice for resting and molting. Ringed seals feed on pelagic prey species, such as small schooling fish and crustaceans, in the water column, but energetic limitations for ringed seals restrict how far they can forage from sea ice resting areas. Moulton et al. (2002) found the highest ringed seals densities occurred on stable, landfast ice over water depths of about 10-20 m in winter and spring, and Frost et al. (2004) found ringed seal densities greater with depths between 5 and 35 m. Factors most influencing seal densities during May through June in the central Beaufort Sea included water depth, distance to the landfast ice edge, and ice deformation. Ringed seals have been observed in or near Simpson Lagoon, usually north of the barrier islands in deeper waters, during past oil and gas industrial monitoring studies (LAMA and OASIS, 2011; Moulton et al., 2005; Richardson and Williams, 2000). Ringed seals may also be found in the area during the open water period as food resources permit.

While ringed seals generally cannot overwinter in ice-covered waters shallower than 3-5 m because of ice freezing to the seafloor and poor prey availability resulting from a limited water supply (*71 FR 9785*, February 27, 2006), subnivean seal structures have been found in waters depths of 1.5 – 3 m (5-10 ft) in the central Beaufort Sea (Perham, 2001;Williams et al., 2006), indicating that a small number of seals could use portions of Simpson Lagoon and Harrison Bay during winter. However, optimal wintering areas for ringed seals in the Beaufort Sea should occur in waters between 10 and 35 meters deep, preferably in the landfast ice close to lead systems.

The estimated auditory bandwidth of ringed seals is 50 Hz to 86 kHz in water (NMFS, 2016), and while they cannot echolocate, they can hear low-frequency sounds. (NOAA, 2016).

Spotted Seal

The Alaska stock of spotted seals are distributed along the continental shelf of the Beaufort, Chukchi, and Bering seas, mostly in shallow and/or nearshore waters (Shaughnessy and Fay, 1977; Lowry et al., 2000). They are mostly seen in bays, lagoons, estuaries, and nearshore waters (Shaughnessy and Fay, 1977). They are common in the coastal Alaskan waters in ice-free seasons, but overwinter in the Bering Sea (Lowry et al., 1998; Lowry et al., 2000). In spring, they return to the Chukchi and Beaufort seas as the sea ice recedes (Shaughnessy and Fay, 1977; Simpkins et al., 2003).

Spotted seals are less ice-dependent than ringed and bearded seals and occur in the central Beaufort Sea from July through about September (NOAA, 2016). Their presence nearshore is likely associated with summer whitefish and/or salmon spawning runs that occur in the Colville River, Sagavanirktok River, and some of their tributaries. Such food resources would be concentrated in the actual river channel and not in the marine environment, suggesting spotted seals may concentrate in the river system to feed on fish and not in the ocean. In 2014, marine mammal monitoring at the Hilcorp's Liberty prospect and SAE's 2014 Colville River 3D open water seismic survey observed spotted seals more frequently than other marine mammals species (Lomac-MacNair, Thissen, and Smultea, 2014), supporting the riverine-whitefish/salmon theory.

A Colville River haulout occurs on gravel/mud bars in the eastern edge of the Colville River Delta where spotted seals, numbering in the 10s, regularly congregate, and individuals have been observed up to 30 miles upstream from Nuiqsuit, Alaska (Owl Ridge Natural Resource Consultants, Inc., 2015). While spotted seals are likely to be present during the open water season, they would most likely feed in a few areas where their prey species aggregate, such as within a river mouth or between riverbanks and not at or around the Spy Island Drill site.

The estimated underwater auditory bandwidth of spotted seals is 50 Hz to 86 kHz (NMFS, 2016).

3.9.3. Polar Bear and Polar Bear Critical Habitat

Polar bears occur throughout the Beaufort Sea. Individuals in the area are generally part of the Southern Beaufort Sea (SBS) stock, although bears from the Chukchi-Bering Seas (CBS) stock could be encountered from the Colville River Delta area westward (USFWS, 2010a, b). The most recent estimate for the SBS population of polar bears is approximately 900 (90% C.I. 606−1,212) (Bromaghin et al., 2015). The SBS stock experienced a 25-50% decline in abundance from 2004 through 2006, but stabilized from 2008 to 2010 (Bromaghin et al., 2015). The estimate from Bromaghin et al. (2015) represents a significant reduction from the previous estimate of approximately 1,526 in 2006 (Regehr et al. 2006). The best estimate for CBS stock is 2,000 animals, based on extrapolation of aerial den surveys (Aars et al., 2006; USFWS, 2010a).

Polar bears spend most of the year on sea ice, which is important habitat for hunting, breeding, travel, and resting. They can travel great distances in search of prey, primarily ringed and bearded seals. During the open-water season a portion of the SBS polar bear stock remains onshore along the coastline or on the barrier islands. In the spring and fall, shorefast ice is often used by bears for traveling and hunting. Some bears may be observed swimming between offshore ice and the shoreline or barrier islands. Parturient polar bear females typically enter dens in the fall, give birth, and remain in or near their dens until they leave with their cubs in March or April. Dens are commonly situated in snowdrifts, formed by terrain, such as river or coastal bluffs and cutbanks that can accumulate snow. Denning polar bears could use habitat on barrier islands (the Jones Islands group) during the denning season (November to April). A small number of non-denning bears could use the area throughout the year mainly on the sea ice or barrier islands. In recent years, Eni has observed and encountered a small number of polar bears (Table 3-4).

Table 3-4. Polar Bear Sightings and Hazing at OPP and SID, 2011 – 2016 (Eni, 2017).

Year	Sightings	Hazing Incidents
2011	33	2
2012	35	1
2013	38	2
2014	51	1
2015	24	2
2016[a]	98	14

Note: [a] = Bear observations were recorded through November 24, 2016.

The continued fragmentation of sea ice habitats that is projected to occur is expected to alter previous seasonal habitat use patterns. Recent studies indicate that polar bear movements and seasonal fidelity to certain habitat areas are changing and that these changes are strongly correlated with simultaneous changes in sea ice (Rode et al., 2015; Atwood et al., 2016; Wilson et al., 2016). An increasing distance between land and sea ice over time is associated with an increasing number of bears on shore and/or an increase in the duration of time they spend on land (Schliebe et al., 2008). Historically, polar bears in Alaska were generally not known to spend extended periods of time on land except for land-denning females. However, distribution patterns have changed in recent years, and a number of Alaskan bears are remaining on land or coming ashore during increasingly ice-free summers (NOAA, 2016).

Polar bears were listed as a threatened species under the ESA in 2008 (*73 FR 28212*, May 15, 2008). In addition, polar bear critical habitat has been designated (*75 FR 76086*, December 7, 2010). The final rule identified geographic areas containing features considered essential for the conservation of the polar bear. The Primary Constituent Elements (PCEs) of critical habitat for the polar bear include sea ice, terrestrial denning, and barrier island habitats. Sea ice habitat is defined as sea ice over waters 300 m (984.2 ft) or less in depth that occurs over the continental shelf with adequate prey resources for polar bears. Terrestrial denning habitat includes topographic features, such as coastal bluffs and riverbanks, with suitable macro-habitat characteristics. This habitat occurs within 8 km (5 mi) of the mainland coast. Barrier island habitat includes all barrier islands along the Alaska coast within the range of the polar bear. Polar bear critical habitat (sea ice, terrestrial denning habitats and barrier islands) is found throughout the Proposed Action area. No polar bear denning habitat occurs near the SID; however, potential denning habitat is located on nearby Pingok Island, which is designated barrier island critical habitat.

3.9.4. Pacific Walrus

Although considered extralimital east of Point Barrow, Pacific walruses occur seasonally in very low numbers in the Beaufort Sea. Most walrus sightings in the Beaufort Sea are west of Cape Halkett (Clarke et al., 2013; Goetz, Rugh, and Mocklin, 2007, 2009; LGL, JASCO, and Greenridge, 2013; Ljungblad, et al., 1987, 1988; Treacy, 1993, 2000) but some have been observed as far east as Kaktovik and the Canadian border (Funk et al., 2010; LGL, JASCO, and Greenridge, 2013; Lomac-MacNair, Thissen, and Smultea, 2014). Walruses in the Beaufort Sea are most frequently found near the southern margins of the pack ice, though in recent years of reduced ice cover, the majority of individuals reported by industry monitoring have been more than 15 kilometers (9 miles) from the edge of the main pack ice in waters less than 50 meters deep (Funk et al., 2010; Jankowski, Patterson, and Savarese, 2009). Individuals and small groups of walruses have occasionally been documented in and near Beaufort Sea oil and gas infrastructure (Garlich-Miller et al., 2011). Oil and gas Industry monitoring data have reported only 35 walrus sightings between 1995 and 2016 in the central Beaufort Sea (*81 FR 52288*, August 5, 2016). Walruses have hauled out on Northstar Island and Endicott Causeway and have been recorded in the waters around the Endicott and West Dock causeways (Streever and Bishop, 2014; Garlich-Miller et al., 2011).

On February 10, 2011, the USFWS completed a status review of the Pacific walrus and determined that although listing the species as endangered or threatened was warranted, the listing was precluded by other higher priority actions (*76 FR 7634*, February 10, 2011). The Pacific walrus is currently listed as a candidate species under the ESA.

3.10. Subsistence-Harvest Patterns

The city of Nuiqsut is located about 12 miles inland on the Colville River, which is navigable for a substantial distance. It is located in the midst of numerous oil company facilities and industrial developments. In 1973, 27 Iñupiat families moved back to Nuiqsut from Utqiaġvik; in 1974, the Arctic Slope Regional Corporation funded construction of the community. Lands and waters traditionally and presently used for subsistence harvests by residents of Nuiqsut (Galginaitis, 2014b; SRB&A, 2010a) could be affected by the Proposed Action.

Nuiqsut is the closest community to and is approximately 35 miles southwest of the Proposed Action. The subsistence use area for Nuiqsut ranges over a 34,500-square-mile area (NSB, 2015b). Some of Nuiqsut's subsistence activities and harvest patterns overlap in time and space with the Proposed Action. This discussion of subsistence focuses on Nuiqsut.

Residents of Nuiqsut practice many subsistence activities that serve a central focus of personal and cultural identity (Redmond and Thornsohn, 2016). Subsistence harvests are group activities that maintain the cultural values of community, kinship, respect for elders, and cooperation. Subsistence activities provide social organization and integration and a rich diet that contributes to good health (Kishigami, 2013a, 2013b); subsistence foods, especially the fats therein, are healthier than store-bought foods and reduce the risk of cardiovascular disease (Nobmann et al., 2005). Subsistence harvests provide special foods for religious and social occasions, preserving traditional practices such as the Apugauti (Beaching of the Boats) festival and the Nalukataq (Spring Whaling) festival held to pay respect and honor to the harvested whales and ensure the success of future hunting seasons (Kishigami, 2013a, 2013b). These festivals include large feasts in which residents, elders, widows, and other persons partake of highly esteemed foods and reaffirm their identities as Iñupiat.

The Colville River provides access to the ocean and residents of Nuiqsut rely on the harvest of bowhead whales and ice seals. Nuiqsut hunters go looking for bowhead whales offshore from camps on Cross Island starting in late August and ending in October (Galginaitis, 2014a, 2014b). Nuiqsut residents use bearded seal meat and oil for its nutritional value, and hunters harvest ringed and bearded seals in the Beaufort Sea near the Spy Island Drillsite during the open water season, peaking in July and continuing through September.

Caribou are hunted throughout the year by residents of Nuiqsut; June through September are the predominant months for caribou hunting, using boats along the coast and the Colville River (SRB&A, 2010a; 2010b). Nuiqsut hunters use coastal areas around the Colville River delta to harvest geese and eiders (SRB&A, 2010a). Residents of Nuiqsut primarily go fishing inland in the Colville River for Arctic cisco and other species.

Galginaitis (2014b) and Pedersen (1996) reported Nuiqsut's overall total subsistence harvest almost equally divided among marine mammals (32%), terrestrial mammals (33%), and fish (34%). Subsistence activities in the marine waters of Harrison Bay include the bearded seal hunt (typically July through August, but also in June and September), hunting of eider ducks (June through August), and travel to and from Cross Island to participate in the bowhead whale hunt (August through September) (SLR, 2017).

Bowhead Whales (Aġviq)

For Nuiqsut residents, bowhead whales are a major subsistence resource (Galginaitis, 2014a, 2014b). Bowhead whales are the most critical subsistence resource in terms of importance for maintaining an intact sociocultural system. The Nuiqsut subsistence bowhead hunt is launched from a base camp about 100 miles (160 km) away from town on Cross Island, which lies approximately 50 statute miles (80 km) east of the Proposed Action. Cross Island is close to the migration path for bowhead whales and is a traditional place used for whaling activities. To reach their whaling area, the Nuiqsut whalers travel near shore by boat and pass between OPP and the SID in August and September in route to Cross Island.

The Nuiqsut harvest area for bowhead whales is deployed from Cross Island and is conducted in the marine environment ranging between the Kuparuk and Canning rivers. Nuiqsut whalers commonly state that they scout for whales as far as 30 miles from Cross Island on a regular basis and those whales are usually found within 10 miles of Cross Island (Galginaitis, 2014a). The whalers think of this area as bounded by the farthest distance from which they would be willing to tow a whale back to Cross Island. During 2001-2012, the majority of bowhead whales harvested by Nuiqsut hunters were located north to northeast of Cross Island (Galginaitis, 2009, 2014a; SRB&A, 2010a). All of their documented whale strikes have been within an area extending from about the Northstar unit in the west to Bullen Point in the east. Nuiqsut crews have landed most of their whales in a smaller core area from five miles west of Cross Island to about 30 miles east of Cross Island (Galginaitis, 2009, 2014a, 2014b; SRB&A, 2010a).

Only when whalers cannot find whales closer to Cross Island than 20 miles do they look and strike at farther distances (Galginaitis, 2014a, 2014b; Huntington, 2013).

Ringed Seals (Natchiq) and Bearded Seals (Ugruk)

For Nuiqsut, subsistence use areas for ringed seal are located west from Cape Halkett, east to Camden Bay, and up to approximately 20-25 miles (32-40 km) from shore, with some hunters traveling up to 40 miles (64 km) offshore near Thetis Island (SRB&A, 2010a). Hunting of ringed seals occurs in open water near the ice pack as seals follow the ice. Less sea ice in the future may affect seal behavior and availability for subsistence harvest. For Nuiqsut hunters, bearded seal hunting occurs between Harrison Bay and Flaxman Island with a high number of hunts occurring between the mouth of Fish Creek and Thetis Island. Hunting occurs up to 20 miles offshore (32 km) extending as far west as Cape Halkett eastward to Camden Bay, and up to 40 miles offshore at the end of April and beginning of May (64 km) (SAExploration, 2014; SRB&A, 2010a).

Nuiqsut hunters currently harvest fewer seals than in the past (Galginaitis, 2014b). An exception is for bearded seals, which are larger in size than other seals. Seal oil is still an important condiment in almost all households, and bearded seals are preferred for making seal oil, and the meat is highly prized. A small number of families with a maritime orientation catch most of the seals. There is fairly good agreement among hunters that the prime sealing area is just north of the Colville River delta and centered on Thetis Island, which is the most commonly used base camp for this area (Galginaitis, 2014b; SRB&A, 2010a). This core area extends as far west as Fish Creek and as far east as Pingok Island. Other sites used as base camps in this area are Spy Island and Pingok Island. There are stories about hunters at Pingok Island catching 20 to 40 seals (SAExploration, 2014).

Most seal hunting is in June through September by boat and concentrates on *ugruk*. Nuiqsut hunters tend to take seals locally near Thetis Island and the Colville River delta during open-water periods. According to seal hunters, the bearded seals follow three primary currents that run nearby along the shore, following the fish that also travel these currents (SAExploration, 2014). In August, the seals are seen close to shore. Bearded seals haul out on the shore because there are not enough islands in the sea to use as resting places (SAExploration, 2014). In August, the daylight hours decrease, and seal hunters hunt near the mouth of the Colville River and close to shore (SAExploration, 2014). The number of seal hunting boats in the water depends on the weather conditions and price of fuel; seven to ten boats with multiple hunters in each will be in the water for eight to twelve hours per day. The hunters communicate via radio or cell phone.

Caribou (Tuttu)

Caribou are an important subsistence resource for the residents of Nuiqsut, providing a substantial amount of subsistence foods and other materials for the community on an annual basis (Braem et al., 2011; Fuller and George, 1997; Galginaitis, 2014b; SRB&A, 2010a). For Nuiqsut, caribou hunting peaks in July and August, tapering off in September (SRB&A, 2010a). Summer caribou are hunted by boat, along the coastline or shores of barrier islands where groups of caribou congregate for relief from insects and heat.

Hunting for caribou for Nuiqsut occurs throughout the year with June through September being primary harvest months (SRB&A, 2010a). Nuiqsut has hunted caribou from the Beaufort Sea coast south to the foothills of the Brooks Range and from the Sagavanirkok River and Prudhoe Bay in the east to Utqiaġvik and Atqasuk in the west (SRB&A, 2010a). The core caribou hunting area for Nuiqsut is primarily along the Colville, Itkillik, Chandler, Anaktuvuk, and Kikiakrorak rivers; along the coast between Atigaru Point and Oliktok Point; and in overland areas surrounding Fish and Judy creeks and the Colville River to the west and Itkillik River to the east (SRB&A, 2010a). The Proposed Action Area is spatially near the northern and eastern portions of the primary caribou hunting area for Nuiqsut (SRB&A, 2010b). Specific harvest locations indicate the primary harvest areas for caribou include the immediate Nuiqsut locality, Colville River delta, Nigliq Channel, and Fish and Judy creeks (Braem et al., 2011; Brower and Hepa, 1998; SRB&A, 2010b).

Migratory Waterfowl

Geese are an important food resource on the North Slope because these provide fresh meat after a long winter and goose soup is a favorite of hungry whaling crews. Most Nuiqsut residents use waterfowl for subsistence purposes, and the primary species hunted are white-fronted geese (niġliq), Canada geese (israqġutilik), and snow geese (kaŋuq) (Fuller and George, 1997; SRB&A, 2010a). Fuller and George (1997) also reported harvest of brants (niġliñġaq) by Nuiqsut hunters. Using snowmachines, residents of Nuiqsut harvest geese April through June with most harvests occurring in May. Nuiqsut hunters go for geese in coastal areas just west of the mouth of the Colville River, including its tributaries and parts of the delta (SRB&A, 2010a). Geese hunters prefer to stay close to town if the birds are nearby. The core goose hunting areas for Nuiqsut are located on Fish Creek, along the Colville River at various places south of town, and north of the community along Nigliq Channel.

Nuiqsut residents hunt for king eiders (qiŋalik) and common eiders (amauligruaq) (Fuller and George, 1997; SRB&A, 2010a). They tend to combine eider hunting with hunting seals offshore north of the Colville River delta (SRB&A, 2010a). For Nuiqsut, eider season starts in May and ends in September with most effort occurring in June and July. Nuiqsut residents reported hunting eider ducks in the Beaufort Sea between Atigaru Point and the mouth of the Kuparak River and farther east in an area overlapping Nuiqsut's bowhead whaling territory north and east of Cross Island (SRB&A, 2010a). Other popular hunting areas for eider ducks include Fish Creek, near Ocean Point in the Colville River, and along the Colville River delta. Residents reported travelling offshore over 30 miles when hunting eiders in the ocean; the core eider hunting area for Nuiqsut is a smaller area up to ten miles offshore of the Colville River delta and east to Thetis Island (SRB&A, 2010a).

Subsistence Fishing

Fishing is a major component of the annual subsistence round for Nuiqsut. Carothers, Cotton, and Moerlein (2013) documented that the primary motivations for subsistence fishing on the North Slope reflect the core Iñupiaq values of food gathering, sharing, and connection to the land. The primary species of importance for Nuiqsut include Arctic cisco (qaaktaq), Arctic char (iqalukpik), and broad whitefish (aanaakłiq) (SRB&A, 2010a).

Arctic cisco are important to the culture of Iñupiat people living on the North Slope, and the subsistence Arctic cisco fishery on the Colville River delta provides a major source of food for residents of Nuiqsut (ARB, Inc. et al., 2007; Fuller and George, 1997; SRB&A, 2010a). Each spring a large number of Arctic cisco leave the Mackenzie River and travel to the central Beaufort Sea where they feed in summer in nearshore waters; a substantial number of these fish overwinter in the Colville River for approximately seven years, feeding in the sea near shore each summer before returning to the Mackenzie River to spawn when mature (ARB, Inc. et al., 2007; SRB&A, 2010a).

Nuiqsut is uniquely located for harvesting Arctic cisco. Nuiqsut residents primarily go fishing for Arctic cisco September through December, using snowmachines and nets (SRB&A, 2010a). Fishing occurs in the Colville River delta, including Nigliq, Kupigruak, and the easternmost channels of the delta. Residents of Nuiqsut fish at their camps and near the community depending on time of season and their family situation. Subsistence catches of Arctic cisco in the Colville River vary yearly from an estimated low of 3,935 fishes in 2001 to a high of 46,944 fishes in 1993 (ARB, Inc. et al., 2007). In 1992, researchers estimated that 45,402 Arctic cisco were harvested from the Colville River (Fuller and George, 1997).

Broad whitefish are an important resource that contributes highly to Nuiqsut's annual subsistence harvests (SRB&A, 2010a). Residents fish for broad whitefish before freeze-up, using boats and nets; summer harvests of broad whitefish are used to make dried fish used during long winters as food and for sharing. Those who catch large amounts of broad whitefish are given status in the community because people prefer to eat and give away broad whitefish during the spring whaling festival and for holiday feasts (Carothers et al., 2013). Nuiqsut residents reported accessing broad whitefish areas between May and November; the peak season for broad whitefish occurs June through August with July being the most popular month (SLR, 2017; SRB&A, 2010a). Nuiqsut residents fish for broad whitefish in the Colville River between its mouth and Sentinel Hill; they use Fish Creek, Itkillik River, Chipp River, and some area lakes for harvesting broad whitefish. Residents reported setting nets in the Nigliq Channel south of the community and in the easternmost channel of the Colville River delta. Subsistence fishers have noticed some broad whitefish from the Colville River and Nigliq Channel near Nuiqsut have patchy fungal-like lesions on the exterior surface; the lesions are caused by a common water mold (*Saprolegnia*) which is not exotic to the NSB (ADF&G, 2013).

Subsistence fishing for Arctic char is a common activity for residents of Nuiqsut, but these fish contribute less to the total subsistence harvest than Arctic cisco and broad whitefish (SRB&A, 2010a). Using boats, nets, and rod and reel, residents of Nuiqsut primarily go fishing for Arctic char in August and September; some char are harvested in the peripheral months of May, June, July, October, and November (SRB&A, 2010a). Subsistence fishers from Nuiqsut harvest Arctic char north of town on Nigliq Channel and south of town along the Colville River to Sentinel Hill and at the mouth of the Chandler River.

3.11. Sociocultural System

In the context of rural Alaska, a social, cultural, or economic system is a set of interacting, interrelated, or interdependent parts that form a collective whole (Wolfe, 1983). A breakdown in any part of the system may cause social disruptions, community dysfunctions, and economic hardships (Wolfe, 1983).

Sociocultural systems and rural subsistence practices are inseparable in northern Alaska. Iñupiat peoples comprise the majority of the population in northern Alaska (Hunsinger and Sandberg, 2013). Subsistence contributes to cultural continuity, well-being, identity, and life satisfaction in northern Alaska (Martin, 2012). Subsistence is a dominant component of Iñupiaq socioeconomics and holds at least equal importance to that of the cash and wage earning sectors; the subsistence and monetary components of these systems have become irrevocably intertwined (Galginaitis, 2014b; Huskey, 2004). Both subsistence and commercial-wage activities contribute to community survival, well-being, and the way of life so highly valued in rural communities (BurnSilver et al., 2016; Huskey, 2004; 2009; Martin, 2012; Wolfe and Walker, 1987). For residents of Nuiqsut, living and travelling near the Proposed Action, harvest and sharing of wild resources compose the major sociocultural focus of households, families, and hunters (Galginaitis, 2014b; Kofinas et al., 2016; Pedersen et al., 2000; SRB&A, 2010a; 2013).

It is primarily through damage to subsistence resources and disruptions to subsistence activities that impacts to the sociocultural system of the North Slope can be assessed. Using a subsistence lens, this section summarizes important components of the sociocultural system for Nuiqsut. Using the umbrella of subsistence, the discussion focuses on social organization, cultural values, and formation of formal institutions, which are closely tied to the mixed subsistence-cash economy of Nuiqsut.

Social organization demonstrates how people are divided into social groups and networks. This component of the system corresponds most closely to existing structure at the household and community levels. Structure refers to how individuals, families, and extended kinships interact to manage vital resources, which includes subsistence harvests but also encompasses other economic resources and involves the broader market economy (Huskey, 2004). The analytic focus is on households, families, and wider networks of kinship and friends that are embedded in groups responsible for harvesting, distributing, and consuming available local resources. Social organization describes the nongovernmental characteristics of a community that enable it to function and continue through time. For most residents of Nuiqsut, subsistence is the expression of cultural and spiritual identity (ICAS, 1979; Redmond and Thornsohn, 2016), and production, distribution, and sharing of subsistence foods are the activities around which social organization and transmission of cultural traditions occur across generations.

Cultural values reflect the norms and most desirable behaviors of people in a society and are widely shared by members of a social group. Cultural values correspond to the Iñupiat traditional emphasis on maintaining a close relationship with natural resources (ICAS, 1979). They place particular emphasis on kinship, maintenance of the community, spirituality, humility, respecting elders, hunting traditions, cooperation, and sharing (ICAS, 1979; NSB, 2015a). Differences in sociocultural systems and cultural values between outsiders and local residents can lead to substantial communication barriers (Brooks and Bartley, 2016; EDAW AECOM, 2009; Jacobs and Brooks, 2011). Residents of Nuiqsut place high value on social cohesion and group cooperation as expressed through subsistence activities. Subsistence is a central activity that embodies and actualizes all Iñupiaq values, with bowhead whale hunting being the paramount offshore subsistence activity for Nuiqsut. Iñupiaq cultural and spiritual values are played out in everyday life when residents practice subsistence activities on the land (Galginaitis, 2014a).

Institutional formation corresponds to the structure and function of the borough, city, and tribal governments that provide services to communities. This part of the system includes formal organizations such the NSB, Alaska Native regional and various village for-profit and not-for-profit corporations, and nongovernmental organizations. Many Iñupiat are enrolled as shareholders in the for-profit Native corporations, and they are citizens of the NSB, which derives revenues from property taxes on industrial facilities at Prudhoe Bay (ICAS, 1979). Nongovernmental entities may work in conjunction with governmental organizations. For example, the AEWC, NSB, and the Nuiqsut Whaling Captain's Association play important roles in the management of natural resources vital to the sociocultural needs of Nuiqsut. These formal institutions are largely formed by Alaska Native peoples who are aware of and respect the traditional knowledge of their elders and have a present-day awareness of their own beliefs and cultural foundations. Many of the leaders of institutions currently live or have lived a subsistence way of life and have a clear understanding of why and how to protect subsistence resources.

3.12. Population and Economy

Nuiqsut is an Iñupiaq community located on the west bank of the Nigliq Channel of the Colville River. The Colville River empties into Harrison Bay where the SID is located. The Colville delta has traditionally been a gathering and trading place; the old village of Nuiqsut was abandoned in the 1940s because there was no school at the site. Following the passage of ANCSA, Nuiqsut was resettled by 27 families in 1973 (ADCCED, 2016).

The population of Nuiqsut was 415 in 2010 and comprised 88 percent Iñupiat, 8 percent Caucasian, and 3 percent other minorities (NSB, 2011). The median age was 23 years.

The NSB is a mixed economy, characterized by a traditional cash economy and subsistence economy and has high unemployment. OCS oil and gas activities generate economic benefits for the NSB in the form of direct and indirect employment, increasing personal income, and various types of revenues to the local government. NSB receives revenues primarily from property taxes from onshore oil and gas infrastructure. For a more detailed description of the structure and composition of the NSB economy, see the *North Slope Economy, 1965 to 2005* (USDOI, MMS, 2006).

In 2010, the labor force was 236 individuals (based on residents between 16 and 64 years of age, removing those still in school), with unemployment at 30 percent. The majority of employed residents of Nuiqsut work for the NSB (46%), Kuukpik Corporation (19%) or the NSB school district (16%) (NSB 2011). Most income in Nuiqsut is from wages and corporate dividends. In 2016, median household income for Nuiqsut was $85,833, and the rate of people living below the poverty level was 3 percent (USCB, 2017).

3.13. Community Health

A large majority of NSB residents either self-reported or were reported to have good general health; infant mortality rates have declined since the late 1970s; cases of vaccine-preventable illnesses and infectious diarrheal illnesses have decreased since the 1980s; since 2003, cigarette smoking has decreased; self-reported prenatal alcohol use has declined since the early 1990s; and Alaska Native peoples living in the NSB have one of the lowest rates of type II diabetes in Alaska and a substantially lower rate of type II diabetes than most Native Americans living in the lower 48 states (McAninch, 2012). In 2010, the leading self-reported chronic health problems among adults were arthritis and/or chronic pain; high blood pressure; high cholesterol; and chronic respiratory problems. The leading admitting diagnoses to the hospital in Utqiaġvik in 2008-2009 were pneumonia, chronic obstructive pulmonary disease, and congestive heart failure (McAninch, 2012).

As reported by McAninch (2012) and ADHSS (2015), the five leading causes of death in the NSB have remained constant since the early 1990s with small changes in rank order over the years and include cancer, heart disease, chronic lower respiratory disease, unintentional injury from accidents, and suicide. Accidents and suicides are the leading causes of premature deaths in the NSB (McAninch, 2012). The NSB has demonstrated some positive community health achievements in these areas. Adults' self-reported mental health in the NSB is among the best in Alaska, and deaths rates from unintentional injuries have declined since the late 1970s.

In the NSB, subsistence foods anchor cultural wellbeing and nutritional health, and security of all food resources is a key issue of public concern (HHIC, 2014, p. 25; McAninch, 2012). Traditional foods are foods that originate in the local environment such as seal, whale, caribou, birds, and fish, whereas foods found in the community store, for example, are imported (Vaktskjold et al., 2009). Food security is related to subsistence harvest, diet, nutrition, and community health outcomes in the NSB (Loring and Gerlach, 2009). Food security includes physical and economic access to sufficient, nutritious, and healthy foods (i.e., traditional and/or imported foods) to meet dietary needs and food preferences for an active and healthy life (Power, 2007).

People who are food insecure report they cannot afford enough food, and they commonly skip meals or eat less than they need (HHIC, 2014). Food security depends on availability of sufficient quantities of food on a consistent basis; having sufficient resources or income to obtain appropriate foods for a nutritious diet; and appropriate uses of foods based on knowledge of basic nutrition and health (FAO, 2006). There are other factors that may affect food security, including poverty and unemployment; educational attainment; changes in food sharing networks; vulnerability to global climate change; thawing of permafrost in which foods are stored; access to subsistence hunting lands; loss of traditional knowledge; and readily available imported foods (ANTHC, 2014; Bersamin et al., 2007; Power, 2007). Imported foods do represent a degree of food security for rural Alaskans, but it remains questionable if imported foods in the NSB are sufficient to support an acceptable level of overall community health and cultural wellbeing (Loring and Gerlach, 2009, p. 470).

Many local traditional foods provide inexpensive and readily available nutrients, essential oils, antioxidants, calories, and protein; other benefits to health from traditional foods include protection from diabetes, improved maternal nutrition, and neonatal and infant brain development (Egeland, Feyk, and Middaugh, 1998; McAninch, 2012; Smith et al., 2009). Traditional foods contribute more protein, monounsaturated fat, polyunsaturated fat, healthy fatty acids, vitamin B12, and iron than imported foods (Ballew et al., 2006; Bersamin et al., 2007). Seal oil was shown to be the main sources of omega-3 fatty acids for all individuals eating traditional foods; 69 percent of traditional food energy intake was from marine sources such as seal oil and fish (Bersamin et al., 2007). Bowhead whale tissues used as foods have been found to be rich in protein, omega-3 fatty acids, and important elements such as iron; the skin of the bowhead whale has been found to contain high amounts of dietary fiber (Ballew et al., 2006; McAninch, 2012). Traditional foods provide other health benefits in addition to good nutrition

(AMAP, 2009, p. 22), including maintenance of social norms, wellbeing, and local culture; exercise; cost savings at the local store; and spirituality.

Cultural wellbeing in communities plays an important role in overall health and stability of sociocultural systems (Vaktskjold et al., 2009). Rapid social, cultural, economic, and environmental changes in Inuit communities can adversely affect community health through changes in living conditions and ways of life (Curtis, Kvernmo, and Bjerregaard, 2005, p. 449). Maintaining cultural values and a positive cultural identity has been linked to positive health outcomes in rural communities in Alaska (McAninch, 2012). Preservation of and respect for the Iñupiaq language, respect for elders, participation in subsistence activities, sharing, and family stability are cultural values that remain strong. Iñupiaq language is spoken in Nuiqsut, and its use can strengthen cultural identity and wellbeing for residents of Nuiqsut.

Environmental conditions such as air and water quality are important determinants of community health. In 2010, the Alaska Native Tribal Health Consortium found no evidence that industrial development is causing harmful levels of air or water pollution (NSB, 2015c, p. 35):

- Twenty-eight of the 45 air samples (62.2 percent) contained VOCs, but none of the samples exceeded air quality standards.
- The VOCs associated with crude oil development that were detected were in very low concentrations.
- Three of the 40 water samples (7.5 percent) had VOCs, but none of the samples exceeded ADEC water quality standards.

Between 2008 and 2010, air quality monitoring recorded three instances where National Ambient Air Quality Standards were exceeded; there were two instances in the summer of 2009 and one occurrence in the summer of 2010. Windblown dust from natural sources was the likely cause of these exceedances (NSB, 2015c, p. 36). Inhaling wind-borne dust can cause health problems, especially in those affected by heart or lung disease and respiratory issues. Eye and nose irritation, asthma, and respiratory problems are aggravated by inhaling dust, and these symptoms are greater in children and the elderly (NSB, 2016).

Health care services in the communities of the NSB are comprised of health clinics staffed by health aides. The Samuel Simmonds Memorial Hospital was built in Utqiaġvik in 2010. Resource development projects may improve availability of health care services by providing funding through tax revenues. In 2013, the total number of patient visits to health clinics and the Samuel Simmonds Memorial Hospital was 7,862 for Nuiqsut (HHIC, 2014). Residents of Nuiqsut have to travel or be transported to a hospital or other healthcare provider in Fairbanks, Anchorage, or Seattle if they need more extensive care than the local clinic or the hospital in Utqiaġvik can provide.

Median household income levels can be used as a determinant of community health. The oil and gas industry is a major economic driver in the NSB, and jobs in this industry can affect income and health status of these communities in beneficial ways (HHIC, 2014; McDowell Group, 2012).

There are currently new challenges with infrastructure in the North Slope, including sinking homes, erosion of city lands, damage to buried water lines, and failure of traditional underground ice cellars used to store wild foods (ANTHC, 2014). It is difficult for rural residents to accommodate these unprecedented and unpredictable changes. During the life of the Proposed Action, residents of Nuiqsut will most likely continue to experience challenges related to environmental variability associated with a changing Arctic climate.

3.14. Environmental Justice

The purpose of doing an Environmental Justice (EJ) analysis is to determine if a Proposed Action would impact low-income and minority populations to a greater extent than it would impact the general population of an area or community (Bass, 1998; ICPG, 2003).

On February 11, 1994, the President of the United States outlined a policy on EJ in Executive Order (EO) 12898 entitled Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (*59 FR 7629*, February 16, 1994). The intent of EO 12898 is to promote fair treatment of people of all races and income levels, so no person or group of people bears a disproportionate share of negative effects from government programs.

EO 12898 is especially pertinent to Federal actions that propose to develop natural resources, and for which environmental assessments or environmental impact statements are required under the National Environmental Policy Act (USDOI, 1995, 2016).

The Iñupiat people of the NSB are a recognized minority (CEQ, 1997) and the predominant year-round residents of the NSB (Hunsinger and Sandberg, 2013). The United States Census Bureau (USCB) (2014) defined minority to be individual(s) who are members of population groups of American Indian or Alaska Native; Asian or Pacific Islander (or Native Hawaiian); or African American, not of Hispanic (or Latino) origin. Low-income populations are defined as groups of people living below poverty level.

The CEQ (1997) identifies groups as minority or low income populations when either:

- The minority or low-income population of the affected area exceeds 50%.
- The minority or low-income population percentage in the affected area is meaningfully greater than the minority population percentage in the general population (e.g., Alaska).

The NSB and potentially affected communities both had aggregate minority populations larger than that for Alaska as a whole in 2010 (Table 3-5). This was not the case for the Deadhorse-Prudhoe Bay area. Table 3-5 shows the minority compositions of Nuiqsut, Kaktovik, and Utqiaġvik meet the 50 percent population threshold based on their proportional total minority membership (CEQ, 1997; USCB, 2013). Utqiaġvik and Kaktovik have a meaningfully higher estimated poverty rate than that of the NSB and State of Alaska, while Nuiqsut and the Deadhorse-Prudhoe Bay area have a lower estimated poverty rate than the NSB and Alaska (Table 3-6; USCB, 2014; 2017).

Table 3-5. Percent of Ethnic Composition of Potentially Affected Communities.[1]

Percent of Population[2]								
Group	Caucasian[3]	Alaska Native and American Indian[4]	Asian[4]	Hispanic or Latino[5]	African American[4]	Native Hawaiian and other Pacific Islander[4]	Some other Group[4]	Minority[6]
Area								
Utqiaġvik	16.9	68.6	10.9	3.1	2.0	3.4	1.1	83.8
Kaktovik	10.0	90.0	0	0	0	0	0	90.0
Nuiqsut	10.0	89.6	0	0	0.7	0	0	90.0
Deadhorse-Prudhoe Bay	85.2	8.6	2.2	4.0	2.3	0.4	1.7	16.6
North Slope Borough	33.4	58.5	5.5	2.6	1.8	1.6	0.9	67.4
State of Alaska	66.7	19.5	7.1	5.5	4.7	1.6	2.1	35.4

Notes: [1] Compared to the North Slope Borough and Alaska, 2010.
[2] Percent of population based on population size for each area, not adjusted for differential population sizes.
[3] Alone
[4] Alone or in combination with one or more other groups
[5] Of any group
[6] Minority = Total - (Caucasian alone + some other group alone + two or more groups + Caucasian and some other group) + (Hispanic or Latino, Caucasian alone + Hispanic or Latino + some other group alone).

Sources: Hilcorp, 2015; USCB, 2013

Table 3-6. Poverty Rates for Potentially Affected Communities.[1]

Area	Percent of Residents Living below Poverty Line	Percent Margin of Error (+/-)
Utqiaġvik	12.3	5.2
Kaktovik	14.8	13.3
Nuiqsut	3.0	3.4
Deadhorse-Prudhoe Bay[2]	3.5	7.7
North Slope Borough	10.2	2.5
State of Alaska	10.1	0.3

Notes: [1] Rates are compared to the North Slope Borough and Alaska, 2010 through 2014.
[2] Figures for Deadhorse-Prudhoe Bay area are from the 2007-2011 five-year U.S. Census estimates as reported in Hilcorp (2015).
Sources: American Community Survey, Five-Year Estimates (USCB, 2014; 2017).

Utqiaġvik, Kaktovik, and Nuiqsut qualify as minority or low-income populations, and therefore BOEM considers these to be EJ communities.

CHAPTER 4. ENVIRONMENTAL CONSEQUENCES

This chapter analyzes the environmental, social, and economic impacts that could occur as a result of the Proposed Action, and the No Action Alternative. Under each resource category, there is analysis of the potential effects associated with each alternative.

The analyses in this chapter apply a scale to categorize the potential impacts to specific resources and evaluate the significance of those impacts. The scale takes into account the context and intensity of the impact based on four parameters: detectability, duration (i.e., short-term or long-lasting), spatial extent (i.e., localized or widespread), and magnitude (i.e., less than severe or severe, where the term "severe" refers to impacts with a clear, long lasting change in the resource's function in the ecosystem or cultural context).

Subject matter experts used the best available information and their professional judgment to determine where a particular effect falls in the continuum on a relative scale from "negligible" to "major." Impacts that fall in the category of "major" are considered to be significant under NEPA.

The impacts scale is as follows:

- Negligible: little or no impact
- Minor: impacts are short-term and/or localized, and less than severe
- Moderate: impacts are long lasting and widespread, and less than severe
- Major: impacts are severe

In applying this scale and the terms that describe impact categories (levels of effect), analysts took into consideration the unique attributes and context of the resource being evaluated. For impacts to biological resources, attributes such as the distribution, life history, and susceptibility of individuals and populations to impacts were considered, among other factors. For impacts to subsistence activities, factors considered include the fundamental importance of these activities to cultural, individual and community health, and well-being. Based on these unique characteristics, impacts to subsistence activities are considered long-lasting and severe, and thus, major and significant, if they would disrupt subsistence activities, make subsistence resources unavailable or undesirable for use, or only available in greatly reduced numbers for a substantial portion of a subsistence season for any community.

Finally, BOEM analyzes potential cumulative impacts. Each resource-specific section discusses potential impacts from past, present, and reasonably foreseeable future actions, and analyzes the incremental contribution of the Proposed Action to cumulative impacts. A list and description of potentially relevant past, present, and reasonably foreseeable future actions is provided in the cumulative impacts scenario in Appendix B.

Analysis of Accidental Oil Spills

The environmental effects analysis also includes consideration of the effects from oil spills. Oil spills are accidental, illegal, and increasingly uncommon events. However, they are also an inherent risk of exploration drilling. The potential effects of small spills are also analyzed in each resource-specific section. Appendix A describes in further detail the technical information concerning potential oil spills that could occur from the Proposed Action such as the size, composition, and frequency of oil spills assumed to occur for the purpose of analysis.

Small Spills

BOEM defines small oil spills as <1,000 bbls. A review of historic Beaufort Sea OCS and Chukchi Sea OCS data suggests that one or more small spills is likely to occur from the Proposed Action. The estimated small spill rate for exploration drilling on the Arctic OCS is about one small spill per well drilled. Historically, all Arctic OCS spills have been ≤20 bbl and 95.8% of all OCS petroleum spills are

<1 bbl. Data from analogous activities also indicates that most small spills are refined oil (i.e., diesel fuel) as opposed to crude oil. The majority of small spills are cleaned up prior to reaching marine waters using standard spill prevention and response measures, as described in Appendix A (section A-5.1.2). To analyze the unlikely event that a small spill does reach the environment and is not cleaned up immediately, BOEM calculates the fate of the oil spilled using an oil-weathering model. Based on oil weathering model estimations, a 50 bbl spill, if not cleaned up, is estimated to persist less than 3 days on open water, less than 20 days during melt-out, and at least 20 days on landfast ice.

For purposes of this analysis, BOEM assumes that over the two-year duration of the Proposed Action, up to four small diesel spills could occur with a combined volume of no greater than 50 bbl. These spills may occur during any season.

Large Spills and Very Large Spills

BOEM defines large oil spills as ≥1,000 bbl. Very large oil spills, a subset of large oil spills, are defined as ≥150,000 bbl. The chance of a large or very large oil spill during exploration drilling is statistically small. No large oil spills have occurred during exploration drilling on the Arctic OCS or on the Alaska North Slope. Since 1971, there has been one large/very large crude oil spill on the OCS out of more than 15,000 exploratory wells drilled. This was the *Deepwater Horizon* event, which resulted from a loss of well control during temporary abandonment. Based on historical data, BOEM considers a large or very large exploration spill to be highly unlikely, and estimates that the number of large or very large oil spills that would occur from the Proposed Action is zero. However, to ensure that the decision-maker and the public are fully informed about all potential consequences of the Proposed Action, BOEM provides an analysis of the potential impacts of a hypothetical large oil spill and a hypothetical very large oil spill in Appendix A. These analyses tier from prior BOEM analyses of large and very large oil spills in the Beaufort Sea and incorporate new and site-specific information as appropriate.

4.1. Air Quality

Air Quality Jurisdiction

The State of Alaska, Department of Environmental Conservation (ADEC) is responsible for administering air quality programs for sources that are within 3 nautical miles of the state seaward boundary. ADEC is tasked to regulate and ensure that ambient air quality standards are maintained and is responsible for implementing the State's Air Quality Control Plan (AQCP). The Proposed Action would alter the existing emissions inventory, to include two additional engines for the drilling unit, and the levels of vessel traffic. BOEM based its analysis on the following ADEC report: ADEC Technical Analysis Report (TAR), for Minor Permit AQ0923MSS11, June 12, 2017 (ADEC, 2017). This ADEC TAR is an update of the air dispersion modeling by Eni which previously demonstrated compliance with EPA/ADEC regulations in 2012.

In this revision, Eni submitted an updated emissions inventory, associated emissions limits and modeling results to demonstrate continued compliance and protection of air quality. The TAR is the official evaluation of the submitted air quality data, which is summarized throughout this air quality assessment and is incorporated here by reference. The analysis of potential impacts to air quality from the Proposed Action assumes the operation of all proposed emissions sources described in the EP without further regulatory controls. BOEM accounts for emissions from sources associated with the facility as well as from all other emissions sources described in the EP (e.g., vessels, aircraft, vehicles).

4.1.1. Proposed Action

The primary contributors of emissions and resulting impacts to air quality from the Proposed Action are the drilling rig and support vessels. For the Proposed Action, the Doyon Rig No 15 requires updating, increasing the rigs capacity and overall emissions (Eni, 2017). As a result of the Proposed Action, vessel traffic is also expected to change.

All existing emissions sources (such as the drilling unit, support vehicles and vessels, generators, etc.) use ultra-low sulfur diesel as the fuel source. Diesel fueled engines emit mostly nitrogen oxides (NO_X), carbon monoxide (CO), and particulate matter (PM). Behavior of the pollutants will vary depending on whether the source is stationary or mobile, and the location, duration, and timing of the emissions. Stationary sources usually create steady emissions, whereas mobile sources produce emissions relative to the thrust and power rating of individual emitters (e.g., vehicle, boat, aircraft). Moving sources result in emissions discharged over some distance, with elongated plumes of pollutants expanding horizontally and vertically. The ground-based impact from emission sources decreases as the distance from the source increases, due in part to dispersion and diffusion.

New Area Sources

The Proposed Action includes the addition of two new engines to the emissions inventory for the Doyon 15 Exploration drilling unit. This addition would increase the drilling unit's cumulative engine capacity from 9,511 brake-horsepower (bhp) to 14,383 bhp. Due to these proposed changes to the emissions inventory an update and modeling review was required from ADEC (ADEC, 2017).

In its 2012 modeling review, ADEC stated that Eni demonstrated compliance with the annual nitrogen dioxide (NO_2) Alaska Ambient Air Quality Standards (AAAQS), the 3-hour, 24-hour, and annual sulfur dioxide (SO_2) AAAQS, and the 24-hour PM_{10} AAAQS (ADEC, 2012). All of the sulfur dioxide ($SO_{2)}$ impacts were less than 20-percent of the SO_2 AAAQS. As a result, ADEC stated that Eni could limit the revised analysis to just the two worst-case pollutants, the annual NO_2 and 24-hour PM_{10}, as long as the increase in potential SO_2 emissions remain below 10 tons per year (ADEC, 2017).

Ozone (O_3) is not directly emitted by any source. Rather, O_3 is formed through a photochemical process that depends on available volatile organic compounds (VOC) and NO_X, abundant sunlight, and heat. The atmospheric conditions necessary for ozone formation (sunlight, ozone precursors, and background emissions of VOC that would produce an NO_X-sensitive atmosphere) are not present over the Beaufort Sea OCS or over adjacent lands. Therefore, ozone is not a pollutant of concern for air quality impacts on the eastern ANS due to the Proposed Action.

Primary sources of airborne lead are ore, metals processing, and combustion of fuels containing lead-based additives. None of the fuels used will contain lead additives and only trace levels of lead would originate from equipment lubricants containing lead or engine wear. Therefore, lead emissions from the project would be negligible and would not cause or contribute to a violation of the lead National Atmospheric Air Quality Standards (NAAQS).

ADEC agreed that Eni could use the previous 2012 air dispersion modeling parameters as a starting point but also provided a list of exceptions and alterations to the modeling inputs and methodologies to include the use of the more modern and approved models and meteorological inputs (ADEC, 2017, Section 2.3). In the final review of Eni's updated modeling results, ADEC approved the updated Minor Permit AQ0923MSS11 and Operating Permit AQ0923TVP01 Revision 3 and concluded that:

- the emissions from the Nikaitchuq stationary source will not cause or contribute to a violation of the annual NO_2 or 24-hr PM_{10} AAAQS listed in 18 AAC 50.010;
- Eni's modeling analysis fully complies with the ambient demonstration requirements of 18 AAC 50.540(k)(3)(C); and
- Eni conducted their modeling analysis in a manner consistent with the guidelines, as required under 18 AAC 50.215(b)(1).

Support Vessels

Table 4-1. outlines support vessel use during the Nikaitchuq development and production operations in State waters from 2012-2016 and estimated proposed vessel usage under the Proposed Action from 2017-2019. Anticipated support vehicle usage under the Proposed Action would be reduced compared to previous years. In previous years, Eni has been conducting year-round development and production of oil from Alaska State waters. Those operations require a higher and consistent volume of materials and personnel than would be required for seasonal exploration operations. However, in 2016 Eni was conducting only production activities, leading to lower levels of traffic and associated emissions.

Table 4-1. Support Vessels from Nikaitchuq and Nikaitchuq North Developments.

Year	Hovercraft Trips	Crew Boat Trips	Tug/Barge Trips
Nikaitchuq Development and Production (baseline)			
2012	1,094	1,215	658
2013	1,162	1,286	672
2014	1,364	1,459	765
2015	1,610	1,280	508
2016	855	614	8
Average	**1,217**	**1,171**	**522**
Nikaitchuq North (Proposed Action)			
2017 (Est.)	1,163	614	152
2018 (Est.)	1,163	1,378	108
2019 (Est.)	862	614	8
Average	**1,063**	**869**	**89**
Proposed Action - Baseline	**-154**	**-302**	**-433**

The State of Alaska, in its review process, does not require separate accounting for support vehicles in individual permits. However, support vehicle emissions are effectively captured as part of the background sources used in the air dispersion modeling from the monitoring station at ConocoPhillips' Kuparuk Drill site, DS-1F. The State has previously concluded that Eni's present operations will not cause or contribute to a violation of the NAAQS/AAAQS (ADEC, 2012).

Small Oil Spills

The impacts of a small spill would depend on: the time of year, size, location, and duration of the spill; meteorological conditions (wind speed and direction) and the reaction time and effectiveness of oil spill response operations. As the diesel spill evaporates over time, a portion of the vapor emitted in the immediate vicinity of the spill would be VOC. The possible impact from increased emissions of VOC from any oil spill is the formation of ozone. However, the volume of VOC emissions resulting from such small spills, when considering the levels of NO_X emissions likely already emitted during exploration, is not expected to be sufficient to create conditions favorable for the formation of ozone. For these types of spills, there would be little to no impact from the other criteria pollutants (NO_X, SO_X, CO and PM) since these pollutants are produced via combustion not evaporation. Small spills, their resulting VOC release, and the potential interaction of the VOC with NO_x resulting in ozone, would not impact onshore air quality and impacts would be negligible.

Conclusion

ADEC has reviewed updated air dispersion modeling of the impacts of the Proposed Action. Those impacts to the AAAQS are less than those modeled in previous evaluations (ADEC, 2017). These results show little to no change in Eni's contribution to the NAAQS/AAAQS. Overall, the impacts of the Proposed Action including small oil spills would be negligible on air quality.

4.1.2. No Action Alternative

Under the No Action Alternative, BOEM would not approve Eni's EP and this would preclude Eni from evaluating the oil and gas resource potential of their federal leases within the Nikaitchuq North Harrison Bay Block 6423 Unit. This would also avoid the environmental impacts disclosed under the Proposed Action.

4.1.3. Cumulative Effects

A description of past, present, and reasonably foreseeable future actions is provided in Appendix B. Those actions relevant to air quality are discussed here. The evaluation of cumulative effects on air quality focuses on the impacts to the nearest community to the Nikaitchuq development area, Nuiqsut. The release of exhausts from the combustion of fuels into the atmosphere results in impacts to air quality. There are many sources of emissions already existing on the North Slope. Most of these emission sources can be characterized as mobile or stationary sources; actions that require aerial surveys using helicopters and small aircraft, transportation by motor vehicles, other over-ice types of vehicles, or use of marine vessels are mobile sources. However, since each plan is evaluated on an individual basis using the most recent background emissions, none of these actions produce air emissions that cause an exceedance or violation of the NAAQS or AAAQS. Research activities in the future would likely remain relatively consistent with past and present levels, though cumulative additions due to longer open water seasons are possible. The effects from past, present and reasonably foreseeable actions on air quality tended to be localized to the areas near the activity, and so, are geographically and temporally dispersed.

Regardless of whether the Proposed Action occurs, Eni expects to initiate year-round development activities in State waters. This would involve continuation of barge traffic at current levels, and the associated impacts to the onshore air quality of the North Slope. This and other future offshore oil and gas exploration and development would add to the cumulative emissions that can affect air quality across individual localized areas. However, reasonably foreseeable future actions would not occur in the same space or time with activities associated with the Proposed Action. In addition, most emissions from past actions would already have dispersed throughout the atmosphere prior to the Proposed Action taking place. Lastly, emissions from the Proposed Action would also have ceased and been dispersed throughout the atmosphere before most of the reasonably foreseeable actions would begin.

"Air quality is strongly dependent on weather and is therefore sensitive to climate change" (Jacob and Winner, 2009). Over time, climate change may indirectly affect air quality through increasing ambient air temperatures resulting in weaker global circulation. Changes to global circulation may lead to localized changes in precipitation levels. Changes in precipitation could lead to wetter than normal conditions in some locations and drier conditions in others. In locations with drier conditions may experience increased levels of particulate matter through increased levels of natural dust. In addition, increased wildfires caused by drier than normal conditions can lead to increases in air quality impacts. Increasing ambient temperatures could lead to higher water vapor content, which is expected to decrease natural ozone levels. Increasing ambient temperature may also lead to increased levels of natural VOC emissions, which may interact with anthropogenic NO_x emissions leading to anthropogenic ozone formation. Particulate matter (including black carbon) is "much more complicated and uncertain than ozone" (Jacob and Winner, 2009). Although black carbon is a small portion of the $PM_{2.5}$ spectrum, it is a contributor to climate change in Arctic regions. When black carbon is deposited on snow, it reduces the reflectivity of the white snow, which causes it to absorb the solar radiation. This effect on a large enough scale may lead to a localized increase in ambient air temperatures causing a positive feedback, perpetuating the cycle. The Proposed Action is only 2 years in length and black carbon is a very small portion of the PM_{10} spectrum and the emissions of PM_{10} over the lifetime of the project below the NAAQS/AAAQS.

Greenhouse Gas

The activities under the Proposed Action would produce GHG emissions, including carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), that would contribute to climate change. The following analysis quantifies projected GHG emissions that would occur from the Proposed Action. These projected GHG emissions serve as a proxy for assessing the Proposed Action's contribution to climate change. For this analysis, the potential GHG emissions for the Proposed Action are expressed as CO_2

equivalents (CO_{2e}) which are based on potential carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) emissions and their respective global warming potential (GWP) values.

In its project description, the EP outlines the drilling times over two seasons for mainbores NN01, NN02 and its subsequent sidetracks as 85 and 101 days, respectively. Using the average drilling times, the average support vessel operations and their respective emissions factors, BOEM estimates the amount of annual GHG emissions from the Proposed Action in Table 4-2. BOEM estimates the annual GHG emissions from the proposed action at 18,506 tons of CO_{2e} per year. As the Proposed Action does not entail the production or consumption of any hydrocarbons from the Nikaitchuq North reservoir, hypothetical GHG emissions from such activities are not quantified here.

Because some GHG gases, such as CO_2, may persist in the atmosphere for up to a century, the potential impacts of any source may extend well beyond the active lifetime of the Proposed Action. How these emissions will impact the affected environment will depend on emissions from the Proposed Action together with emissions on a national and global scale. According to the EPA's Greenhouse Gas Reporting Program (GHGRP) in 2015 the U.S. oil and gas industry as a whole released 231 million metric tons (MMT) of CO_{2e} (EPA, 2016*a*). The contribution to the 2015 GHGRP oil and gas segment from offshore production was 7 MMT CO_{2e} (EPA, 2016*a*).

Table 4-2. GHG Emissions (CO_{2e}) Calculations for New Units under Proposed Action (Averaged over 2017-2019).

Emissions Unit	Emission Rate	Maximum Capacity	Maximum Operation or Consumption	Projected Peak Hourly Emissions (lb/hr)	Annual Emissions (tpy)
Existing Doyon 15 Exploration Drilling Unit					
Rig Boiler #1	5 lb/10^3 gal	4.184 MMBtu/hr	2,232 hr/yr	0.18	0.20
Rig Boiler #2	5 lb/10^3 gal	4.184 MMBtu/hr	2,232 hr/yr	0.18	0.20
Rig Heater #1	5 lb/10^3 gal	3.5 MMBtu/hr	2,232 hr/yr	0.21	0.23
Rig Heater #2	5 lb/10^3 gal	5.0 MMBtu/hr	2,232 hr/yr	0.15	0.16
Engine #1	1.15 (lb/hp-hr)	2,523 bhp	2,232 hr/yr	2,935.95	3,276.52
Engine #2	1.15 (lb/hp-hr)	2,523 bhp	2,232 hr/yr	2,935.95	3,276.52
Engine #3	1.15 (lb/hp-hr)	2,253 bhp	2,232 hr/yr	2,935.95	3,276.52
Engine #4	1.15 (lb/hp-hr)	1,879 bhp	2,232 hr/yr	2,160.85	2,411.51
Mud Pump #3	1.15 (lb/hp-hr)	63 bhp	2,232 hr/yr	72.45	80.85
Doyon 15 Exploration Drilling Unit Additions					
Engine #5	1.06 (lb/hp-hr)	2150 bhp	2,232 hr/yr	2,275.50	2,539.46
Engine #6	1.02 (lb/hp-hr)	2722 bhp	2,232 hr/yr	2,781.00	3,103.60
Hovercraft					
Propulsion Engine	1.15 (lb/hp-hr)	543 hp	1,063 trips/yr	624.45	110.63
Propulsion Engine	1.15 (lb/hp-hr)	543 hp	1,063 trips/yr	624.45	110.63
Lift Engine	1.15 (lb/hp-hr)	375 hp	1,063 trips/yr	431.25	76.40
Lift Engine	1.15 (lb/hp-hr)	375 hp	1,063 trips/yr	431.25	76.40
Crew Boat (Commander)					
Propulsion Engine	1.15 (lb/hp-hr)	510 hp	869 trips/yr	586.50	63.71
Propulsion Engine	1.15 (lb/hp-hr)	510 hp	869 trips/yr	586.50	63.71
Tug & Barge (Old Bull)					
Propulsion Engine	1.15 (lb/hp-hr)	385 hp	89 trips/yr	442.75	19.70
Propulsion Engine	1.15 (lb/hp-hr)	385 hp	89 trips/yr	442.75	19.70
Nikaitchuq North (Proposed Action)					
Total Annual GHG (CO2e) Emissions					18,506.66

Conclusion

For the life of the project, impacts to air quality from the Proposed Action and cumulative activities would be negligible. The direct effects from the Proposed Action on Air Quality tend to be localized to the area near the activity. Activities associated with the Proposed Action along with other past, present, and reasonably foreseeable future actions in the Region, may have an additive effect on the impacts of climate change to air quality in the Region. However, the Proposed Action is unlikely to impact the overall rate of climate change. Therefore, the effects of all activities associated with the Proposed Action to the overall condition of air quality on the North Slope is negligible, as is the Proposed

Action's contribution to all past, present, and reasonably foreseeable future actions. When combined with other past, present and reasonably foreseeable activities, the cumulative impact on air quality would remain negligible.

4.2. Water Quality

4.2.1. Proposed Action

Water quality impacts from the Proposed Action of drilling four exploratory wells, consisting of two extended reach mainbores and two sidetracks, from the SID are not expected to occur.

Point-source pollutant discharges are regulated by the USEPA and authorized States, through the National Pollutant Discharge Elimination System (NPDES) permit program, in accordance with Section 402 of the Clean Water Act (CWA) of 1972, as amended. In Alaska, authority for the NPDES program in State waters was transferred through the Department of Environmental Conservation (DEC) Alaska Pollutant Discharge Elimination System (APDES) beginning in 2008. The phased transfer was completed in October 2012.

The Proposed Action does not include any new point-source discharges. The Proposed Action would contribute to ongoing point-source operational discharges occurring in State waters under State permitting authority. The State of Alaska, Department of Environmental Conservation (ADEC) has issued Individual APDES Permit AK0053767 for sanitary/domestic and desalination waste water discharges to be used only as a contingency when routine discharge to the Class I Underground Injection Control (UIC) well is not available, and APDES General Permit AKG332000 for discharges of storm water, gravel pit and construction dewatering. In accordance with the provisions of Alaska Statutes (AS) 46.03; the Alaska Administrative Code (AAC) as amended; and other applicable State laws and regulations, these permits set forth the authorization to discharge pollutants into Simpson Lagoon in the Beaufort Sea. The effluent limits established in these permits are protective of human health and aquatic resources as mandated by the Alaska Water Quality Standards, 18 AAC 70 (ADEC, 2017).

During summer months when vessels or barging equipment are operating from Oliktok Point to the SID in support of the Proposed Action, incidental discharges and deck runoff could cause degradation of water quality in localized surface water and near-surface water due to particulates and contaminates. Concentrations would be highest near the vessel at the point of discharge from the vessel. Accordingly, EPA regulates discharges incidental to the normal operation of commercial vessels (greater than 79 feet in length) through the NPDES Vessel General Permit (VGP).

Small Oil Spills

Small unintentional spills during the Proposed Action are possible. Any small spills that occur on the SID would be contained on the gravel island, and are not expected to impact adjacent marine waters.

There exists the potential of spilling diesel during refueling of marine vessels in the open-water season. Increased hydrocarbon levels in the surface water would occur initially, however due to the volatilization of these light hydrocarbons, these concentrations would be short-lived. Light refined products, such as diesel, are narrow-cut fractions that have low viscosity and spread rapidly into thin sheens. Nearly 100% of such a fuel spill is estimated to evaporate or disperse to very low levels within 48 hours.

During winter, small spills would be contained to the spill area by snow and ice and cleaned up immediately.

Conclusion

The Proposed Action does not include any new point-source discharges that would directly impact marine sediment or marine waters. All operational waste streams resulting from the Proposed Action would be discharged in accordance with currently permitted point-source wastewater discharges under existing State permits. Therefore, absent any direct disturbance to marine sediment or marine waters, water quality impacts are considered negligible.

Refueling and routine operations are a risk for potentially small, incidental spills of diesel or petroleum products. If not cleaned up immediately, these small spills would impact marine surface waters, but due to the expected short duration for these spills, any impacts are considered negligible. During winter, small spills would be contained to the spill area by snow and ice, cleaned up immediately, resulting in negligible impacts.

4.2.2. No Action Alternative

Under the No Action Alternative, BOEM would not approve Eni's EP and this would preclude Eni from evaluating the oil and gas resource potential of their Federal leases within the Nikaitchuq North Harrison Bay Block 6423 Unit. This would also avoid the environmental impacts disclosed under the Proposed Action.

4.2.3. Cumulative Effects

The potential impacts on water quality of past, present and reasonably foreseeable activities in the region include seismic surveys, scientific research, shipping traffic, exploration drilling, and offshore operations that include a variety of permitted point-source discharges (see Appendix B).

The Proposed Action does not include any new point-source discharges to marine or fresh waters and therefore, impacts from the Proposed Action are considered negligible.

Climate change in the Arctic is currently affecting sea surface temperatures, thickness and extent of sea ice and seawater pH. Warming air temperatures in the Arctic decrease sea-ice formation resulting in a greater surface area of marine waters exposed to atmospheric carbon dioxide (CO2). As more CO2 is absorbed into seawater, hydrogen ion concentration increases and pH levels lower. This acidification process is predicted to cause changes in ecosystem processes and present additional stressors to organisms in the Arctic (Mathis et al.,2015; Mathis et al., 2014; AMAP, 2013; Kroeker et al., 2013; Steinacher et al., 2009; Bednaršek et al.,2014; Fabry et al., 2008, 2009). The long lasting effects of climate change, i.e., a warmer, wetter, more variable environment that results from a number of regional and global drivers, will affect water quality. However, water quality is not expected to change as a result of these impacts during the two-year duration of the Proposed Action.

For the life of the project, impacts to water quality from the Proposed Action, cumulative activities and effects from climate change would be negligible. The effects of all activities associated with the Proposed Action to the overall condition of water quality is negligible, as is the Proposed Action's contribution to all past, present, and reasonably foreseeable future action. When combined with other past, present and reasonably foreseeable activities discussed in Appendix B, the cumulative impact on water quality would remain negligible.

4.3. Vegetation and Wetlands

4.3.1. Proposed Action

The Proposed Action would have no direct impacts to vegetation and wetlands, either at the SID or OPP. Due to the complete absence of any vegetation or wetlands residing on or in the near proximity to the SID, this alternative would have negligible impacts on this resource. Additionally, the Proposed Action does not include any modifications resulting in additional wetland fill at OPP.

Small Oil Spills

Coastal habitats are not likely to be affected by small offshore spills. Snow and ice assist in protecting coastal vegetation and wetlands from spills during the winter and melt-out seasons. During the open water season when coastal vegetation and wetlands would be exposed and unprotected, these small spills would disperse quickly from the surface waters and contact with coastal habitats would be unlikely.

When transporting equipment and personnel from OPP to SID, there exists the possibility that an incidental small spills could impact the nearby low-lying gravel beach and adjacent vegetation and wetlands. Impacts to vegetation and wetlands from these small incidental spills may not require extensive cleanup; however, refined hydrocarbons such as diesel are toxic if they contact any part of a plant.

Conclusion

Because the man-made gravel island (SID) is barren of any vegetation and wetlands and resides 3.2 miles from the onshore production and processing facility at Oliktok Point, the Proposed Action would have negligible impacts to vegetation and wetlands.

Any incidental spills or minor discharges during routine activities would likely be contained to the island and cleaned up immediately. Small fuel spills that may occur during refueling operations at the OPP dock would most likely be localized to the immediate marine environment and onto the adjacent gravel island and would most likely not impact coastal wetlands.

4.3.2. No Action Alternative

Under the No Action Alternative, BOEM would not approve Eni's EP and this would preclude Eni from evaluating the oil and gas resource potential of their Federal leases within the Nikaitchuq North Harrison Bay Block 6423 Unit. This would also avoid the environmental impacts disclosed under the Proposed Action.

4.3.3. Cumulative Effects

Past, current and reasonably foreseeable activities that could impact vegetation and wetlands include oil and gas exploration and production, seismic surveys, scientific research, subsistence, and mining activities (see Appendix B). Direct impacts, such as gravel fill in wetlands, could occur and would require the appropriate permits and approvals from both State and Federal agencies that have jurisdictional mandates for the use of, or impacts to, the waters of the State and/or Waters of the U.S. (WOUS, as defined in 40 CFR 230.3).

The Proposed Action does not include any impacts to, or gravel fill in, vegetation and wetlands. Therefore, impacts from the Proposed Action to vegetation and wetlands are considered negligible.

Climate change has been implicated in changing weather patterns from a number of regional and global drivers. The Arctic Coastal Plain (ACP) immediately surrounding the OPP is one of permafrost and tundra, with low-lying coasts that are vulnerable to erosion and storm surge inundation (AMAP, 2017). The tundra ecosystems have evolved in response to low temperatures, little precipitation, nutrient limitation, short growing and reproductive seasons and widespread permafrost (AMAP, 2017). Consequently, shifts in temperatures can easily affect sensitive arctic tundra ecosystems. Vegetation in the Arctic is being affected by summer land-temperature increases that are likely associated with rapid sea ice declines (Bhatt et al., 2010). The largest absolute increases in summer land temperature were found in the Bering and Chukchi regions, when compared against other Arctic regions. When expressed as a percentage change the summer warmth index (SWI: the sum of monthly-mean temperatures >0^oC) increased an average of 24% for the Arctic as a whole, with greater warming occurring in North America (Bhatt, 2010). Increased vegetation productivity, as a result of land warming and sea ice decline, known as 'Arctic Greening' has generally increased in recent decades (AMAP, 2017). Vegetation strongly affects the insulation of soils. In some cases a shift to denser and woodier plant canopies and thicker organic soils may offset the effects of warmer air temperatures, thus slowing permafrost thawing however positive feedbacks between summer warming, increased vegetation, decreased snow cover and decreased ice extent may reduce albedo and exacerbate permafrost thaw (BLM, 2011). The long lasting effects of climate change, i.e., a warmer, wetter, more variable environment that results from a number of regional and global drivers, will affect vegetation and wetlands. However, vegetation and wetlands are not expected to change as a result of these impacts during the two-year duration of the Proposed Action. The incremental contribution to cumulative impacts to vegetation and wetlands from the Proposed Action, when combined with the effects of past, present and reasonably foreseeable activities, including climate change, would be negligible.

There will be no effects from the Proposed Action on vegetation and wetlands. For the life of the project, impacts to vegetation and wetlands from the Proposed Action and cumulative activities would be negligible. Therefore, the effects of all activities associated with the Proposed Action to the overall condition of vegetation and wetlands is negligible, as is the Proposed Action's contribution to all past, present, and reasonably foreseeable future action. When combined with other past, present and reasonably foreseeable activities, the cumulative impact on vegetation and wetlands would remain negligible.

4.4. Lower Trophic Organisms

4.4.1. Proposed Action

The Proposed Action does not include any point-source discharges into marine or fresh waters. Impacts to lower trophic organisms in the nearshore Beaufort Sea from any short-term discharges that may occur will be negligible. The Proposed Action does not include a cooling water intake structure; therefore, no impact will occur. No alteration of the ice environment or the seafloor is expected as a result of the Proposed Action. The level of impacts from these factors on lower trophic organisms would depend on the particular circumstances of the change, but likely would be negligible.

Vessel Traffic

The Proposed Action would include trips by crew transfer vessels and hovercrafts transporting equipment and materials. Pressure waves from vessel hulls could displace plankton and cause injury or mortality. The number of individual plankton that is expected to be impacted by vessels is small relative to the overall number in the Beaufort Sea, and population level impacts from the Proposed Action are unlikely.

Small Oil Spills

During the Proposed Action, small, accidental spills have the potential to occur. These small spills would likely be contained on the gravel island or by snow/ice, and/or cleaned up immediately. If a small diesel spill did reach marine waters, it would most likely evaporate and disperse within hours to a few days due to weathering (see A-5). Consequently, adverse effects to benthic organisms are unlikely because small spills, if not cleaned up immediately, would evaporate and/or disperse before entering the water column.

Conclusion

Overall, the impacts of the Proposed Action would be negligible on lower trophic organisms in the nearshore Beaufort Sea.

4.4.2. No Action Alternative

Under the No Action Alternative, BOEM would not approve Eni's EP and this would preclude Eni from evaluating the oil and gas resource potential of their federal leases within the Nikaitchuq North Harrison Bay Block 6423 Unit. This would also avoid the environmental impacts disclosed under the Proposed Action.

4.4.3. Cumulative Effects

On-going natural activities that disturb the ocean floor affect the baseline conditions of lower trophic organisms, and include: ice gouging, strudel scours, sediment deposition on the seafloor, and the effects of loss of landfast ice on receding shorelines. Past anthropogenic impacts include the discharge of drilling muds and sediments from cuttings, and habitat loss. Research activities in the future would likely remain relatively consistent with past and present levels, though cumulative additions due to longer open water seasons and changes in onshore hydrology are possible. In addition, future offshore oil and gas exploration and development would add to the cumulative impacts of numerous ocean floor disturbances that affect lower trophic habitat across individual localized areas. The effects from past and present actions on lower trophic levels tended to be localized to the areas near the individual activities, which were geographically and temporally dispersed.

Regardless of whether the Proposed Action occurs, Eni expects to initiate year-round development activities in State waters. This would involve continuation of barge traffic at current levels, and the associated impacts to the lower trophic communities of the Beaufort Sea. This and other future offshore oil and gas exploration and production will likely contribute to the accumulation of persistent contaminants from multiple sources and has the potential to affect lower trophic levels in the reasonably foreseeable future. Overall effects of past, present, and reasonably foreseeable future impacts on lower trophic resources is considered to be negligible due to the reproductive capabilities of most lower trophic organisms and the constant movement and influx of nutrients and larval stages from advection caused by currents over the Bering Sea, Sea of Anadyr, and the Arctic Ocean.

The influences of climate change on lower trophic levels are arguably of the most concern in cumulative effects analysis. The change in seasonality and decrease of the extent of the Arctic ice pack directly impacts the epontic, pelagic, and benthic communities. Climate change may result in impacts to lower trophic level organisms through habitat modification and ocean acidification. Impacts on lower trophic level organisms include direct synergistic impacts such as changes in the timing and magnitude of plankton blooms, physiological changes from altered ocean pH and temperature, and habitat modification that could occur as a result of melting ice, shoreline erosion, and sea level rise. Climate change is likely to affect the habitat, behavior, abundance, diversity, and distribution of populations of marine mammals, fish, and other wildlife within the Proposed Action Area. Invasive species could spread in the affected area as a result of climate change, or from introduction through industry activities. Although the effects of climate change would be long-term, the current communities of lower trophic organisms are not expected to change substantially due to these effects because the life of the project spans only two years.

For the life of the project, impacts to lower trophic organisms from the Proposed Action and cumulative activities would be negligible. The Proposed Action is unlikely to impact the overall rate of climate change. The direct effects from the Proposed Action on lower trophic organisms tend to be localized to the area near the activity. Therefore, the effects of all activities associated with the Proposed Action to the overall condition of Lower Trophic resources is negligible, as is the Proposed Action's contribution to all past, present, and reasonably foreseeable future actions.

4.5. Fish

4.5.1. Proposed Action

The Proposed Action does not include any point-source discharges into marine or fresh waters. Impacts to fish resources in the nearshore Beaufort Sea from any short-term discharges that may occur would be negligible. The Proposed Action does not include a cooling water intake structure; therefore, no impact will occur. Withdrawal of water from lakes to support construction of ice roads could have effects on fish species within the lakes. However, construction of an ice road between the Oliktok Production Pad and the SID occurs during most winters would not result in increased impacts from current levels. No alteration of the under ice environment or the seafloor is expected as a result of the Proposed Action. The level of impacts from these factors on fish resources would likely be negligible.

Noise

Additional noise will occur in the area as a result of drilling activities in the Proposed Action. Fish rely heavily on sensory perceptions of sound and pressure for many activities vital for survival, such as feeding, navigation, spatial orientation, predator avoidance, and communication. Effects on fish from noise can include hearing loss from continuous (e.g., drilling) or impulsive sound (such as pile driving or seismic surveys) (Halvorsen et al., 2012), chronic behavioral and physiological effects to fish at less intense sound levels, and acute effects for individuals within a few meters of a sound source. In the short-term, noise may frighten, annoy, or distract a fish and lead to physiological and behavioral disturbances (Dalen and Knutsen, 1987; McCauley, Fewtrell, and Popper, 2003; Pearson, Skalski, and Malme, 1992), which in turn can lead to reduced fitness of individual fish. Over the long-term, this impact could be naturally mitigated by habituation of fish to the noise produced by the drilling activity. It is expected that fish also will exhibit immediate avoidance behaviors, thereby decreasing the number of individuals affected.

The noises produced by the Proposed Action could affect fish, causing them to leave the source location or adjacent area. Because drilling noises would be somewhat regular in type and source, it is possible that some fish species may become habituated to them and the zone of displacement may be reduced over time. The increases in noise from drilling are expected to be short-term and localized, with no lasting effects on fish or fish populations.

Vessel traffic may result in noise-related impacts, such as startle or avoidance behaviors, as described above. Physical and behavioral effects on fish and fish prey may occur as a result of vessel and drilling noise. However, noise may have a greater impact if it occurs during spawning or migratory periods. Juvenile and subadult Arctic cisco migrate each fall to overwintering habitat in brackish waters of the Colville River, where they remain until spring thaw (Murphy et al. 2007). Though noise from hovercraft trips could affect the behavior of migrating fish, most of these trips are expected to occur after the migration has ended, therefore, effects would be negligible.

Overall, these impacts are not expected to have a population level effect, as adult and juvenile fish are mobile and are expected to avoid the louder, infrequent sounds and to habituate to the constant (i.e., drilling) noises. Because the general impacts are expected to have little to no lasting effect, the overall impacts of sound on fish from the Proposed Action would be negligible.

Vessel Traffic

The Proposed Action would include trips by crew transfer vessels and hovercrafts transporting equipment and materials, but levels would be reduced as compared to those supporting Nikaitchuq in recent years. Fish species in the coastal and marine environments could be disturbed by the presence and passing of vessels during roundtrips during the open-water season. Vessels cause a path of physical disturbance that could affect the behavior of fish species. Free-swimming fish in the immediate vicinity of such vessels are expected to exhibit avoidance behavior. Pressure waves from vessel hulls could displace fish and cause injury or mortality to non-swimming and weak swimming fish life stages and fish prey (Hawkins and Popper, 2012). The number of individual fish that are expected to be impacted by vessels is small relative to the overall number in the Beaufort Sea, and population level impacts from the Proposed Action are unlikely.

Small Oil Spills

During the Proposed Action, small, accidental spills have the potential to occur. These small spills would likely be into containment (e.g., contained by the gravel island or by snow/ice), and/or cleaned up immediately. If a small diesel spill did reach marine waters, it would most likely evaporate and disperse within hours to a few days due to weathering (see A-5). Consequently, adverse effects to fish are unlikely because small spills, if not cleaned up immediately, would evaporate and/or disperse quickly.

While it is anticipated that a small spill would not enter marine waters via adherence to standard spill prevention and response measures, oil is toxic to fish at high concentrations and can have toxic effects even in low concentrations to certain sensitive species. If pelagic and demersal fish adults, juveniles, eggs, and larvae are present, there could be acute physiological effects on these various life stages for the fish species. In general, the early life stages of fish (eggs and larvae) are most sensitive, juveniles are less sensitive, and adults least so (Rice et al., 2000). However, as described above, it is anticipated that small spills would be contained and immediately cleaned up. If an oil spill occurs during this time of year and escapes containment/cleanup, it is expected to evaporate or dissipate before contact becomes likely.

Conclusion

Overall, the impacts of noise, vessel traffic and other factors associated with the Proposed Action will be negligible on fish species in the nearshore Beaufort Sea.

4.5.2. No Action Alternative

Under the No Action Alternative, BOEM would not approve Eni's EP and this would preclude Eni from evaluating the oil and gas resource potential of their federal leases within the Nikaitchuq North Harrison Bay Block 6423 Unit. This would also avoid the environmental impacts disclosed under the Proposed Action.

4.5.3. Cumulative Effects

Research activities in the future would likely remain relatively consistent with past and present levels, though cumulative additions due to longer open water seasons and changes in onshore hydrology are possible. Though commercial fishing is not currently authorized in the U.S. Arctic, subsistence fishing activities may impact the area in the future through the removal of fish from the ecosystem in addition to potential disturbances and contamination from the presence and operation of vessels. However, Murphy et al. (2007) found no evidence that fishing affects the long-term average level of recruitment or catch rates for Arctic cisco in the Prudhoe Bay and Colville River area.

Cumulative impacts from this and other oil and gas development, both on and offshore, and the potential of construction of infrastructure would likely be negligible. The effects from oil and gas activity in the reasonably foreseeable future on fish tend to be localized to areas near the activity, with no lasting effects on fish resources.

Fish in the Beaufort Sea and nearshore areas could be affected by increasing vessel traffic from global shipping vessels, oil and gas vessels, commercial, and research vessels. Increased shipping increases the occurrence of small spills, the risk of introducing aquatic invasive species, and the possibilities of oil spills or vessel groundings, all of which would affect fish, fish habitat, and fish prey. Onshore development and mining activities, to include associated construction and maintenance projects and facilities, would also affect fish, fish habitat, and fish prey via stream, pond, and lake habitat alteration; water withdrawals; permitted discharges; construction of support facilities; construction of roads, ice roads; and construction of pipelines.

The influences of climate change on fish are of the most concern in cumulative effects analysis. Climate change is likely to affect the habitat, behavior, abundance, diversity, and distribution of fish. The change in seasonality and decrease of the extent of the Arctic ice pack directly impacts lower trophic communities that make up the prey species for fish. Warming ocean temperatures associated with climate change may increase all types of plankton growth rates and generation times in the region of the Proposed Action, and change the composition of lower trophic populations as warmer seas, open water, and increased radiative energy from the sun increases. These cumulative changes in the composition of lower trophic populations create changes in energy levels and nutrients available for growth and reproduction of higher trophic predators, such as fish.

Several studies have examined the effects of climate change (including ocean acidification) on fish. These studies emphasize: the implications of decreasing Arctic sea ice; potential range expansions of fish species into the Arctic; the effects of warming sea surface temperatures on fish biomass; possible changes in fish species complexes; effects on commercially important species; shifts in prey availability and shifts in food webs; and the particular vulnerability of coastal areas in Alaska (Amundsen et al., 2013; Cheung et al., 2009; Mathis et al., 2014; Mann, Cott, and Horne, 2009; Sherman et al., 2009). Shifts in the food web as a result of changing climate could result in major ripple effects on fish, with some predators forced to eat non-optimal prey items, or preferred feeding spots becoming unavailable. Rising ocean acidity also affects the basic functions of fish, squid, invertebrates, and other marine species, including detrimental effects on metabolism, respiration and photosynthesis, which can thwart their growth and lead to higher mortality (Fabry, et al., 2008). Although the effects of climate change will be long-term, the effects that would occur in the life of the project are not expected to considerably impact fish.

For the life of the project, impacts to fish resources from the Proposed Action and cumulative activities would be negligible. The direct effects from the Proposed Action on fish resources tend to be localized to the area near the activity. The Proposed Action is unlikely to impact the overall rate of climate change. Therefore, the effects of all activities associated with the Proposed Action to the overall condition of fish resources is negligible, as is the Proposed Action's contribution to all past, present, and reasonably foreseeable future actions.

4.6. Birds

4.6.1. Proposed Action

Birds that may potentially be affected by the Proposed Action include populations that are most susceptible to repeated disturbance in foraging, nesting, and molting areas and/or collisions during migration, particularly those with small and/or potentially vulnerable populations (e.g., eiders, brant, red-throated loon, buff-breasted sandpiper, phalaropes, and other shorebirds). For each category of impact, ESA-listed eiders are considered separately, and then the effects on all birds including ESA-listed eiders are summarized.

Potential effects of the Proposed Action on birds are described in categories of:

- disturbance and displacement caused by vessel and vehicle traffic,
- light attraction and collision, and
- small oil spills.

Disturbance and Displacement from Traffic

Vessel and vehicle traffic can disturb and displace birds. Beside behavioral effects, this can have fitness and productivity consequences. Traffic can also have direct mortality effects on birds.

Vessel Traffic

Many birds avoid close contact with vessels while swimming in coastal or pelagic waters, and can be temporarily displaced from local areas when support vessels approach or transit through the area (Burke et al., 2005). Besides disturbance and displacement, birds can collide with lighted vessels under certain environmental conditions, an effect that is discussed separately (Light Attraction and Collisions).

As described in Section 2.1.1. and in the Eni EP (Eni, 2017a), vessel traffic will support the Proposed Action. During the two open-water seasons between approximately July through September or mid-

October, marine vessels consisting of crew boats and a tug and barge transport equipment, personnel, and supplies to the SID (EP, Sections G and L, and Appendix O) (Eni, 2017a), and support oil spill preparedness and response operations (EP, Section G)(Eni, 2017a). A hovercraft performs similar functions for a potentially longer period over the shoulder seasons of May and June, and October through as late as January. Daily vessel rate for personnel transport is expected to be similar to previous or ongoing SID operations, at approximately 14 trips a day for one open water season (1,378 crew boat + 108 barge trips / 3.5 mos.) (Eni, 2017, Appendix O, Tables 2-1 and 2-4) and 6 or 7 hovercraft trips a day during two shoulder seasons (1,163 hovercraft trips / 6 mos.).

Flocks of long-tailed ducks and common and king eiders, Pacific and red-throated loons, and glaucous gulls are among the birds most likely encountered by vessels in Harrison Bay. Vessels would also commonly encounter scoters, mergansers, phalaropes, Arctic terns, and black guillemots. Most birds will paddle away from vessels or take flight. While concentrations of molting waterfowl and brood-rearing brant are relatively high on the lagoon side of the barrier islands, flightless birds are capable of slowly moving away from slow-moving vessels via paddling or diving. Vessel disturbances and speeds at which species are displaced vary, and many birds return quickly. Other birds, including some scoters and king eider, can be displaced from preferred foraging habitats for 6-8 hours or more (Agness et al., 2013; Lacroix et al., 2003; Merkel et al., 2009; Frimer, 1994; Schwemmer et al., 2011). During break-up and freeze-up the probability of disturbance and displacement of birds could increase if open water availability is restricted and potential spatial overlap of birds with marine transit routes increases, because the hovercraft can be larger and louder above the surface than open water-season vessels. From July-September, open water is extensive enough that birds and vessels are not restricted to narrow leads, and relatively few birds would be disturbed along the proposed vessel routes.

Vessel disturbance during brood rearing can have a possible negative impact on chick-provisioning rates of individual Pacific and red-throated loons and other piscivorous waterbirds that breed in the vicinity of the Proposed Action (Hentze et al., 2006; Schoen et al., 2013). However, because loons and other piscivores do not forage locally in high-density flocks, they are unlikely to be disturbed by vessels in large numbers. Overall, there are not expected to be measurable impacts to fitness or survivorship of swimming birds alone from vessel disturbance.

Common eider or black guillemot nesting populations on local barrier islands could be measurably, albeit temporarily, disturbed by vessel wakes during the summer breeding season. Vessels are expected to stay in a defined route 560 ft from the shoreline of Spy Island, although the proposed route includes a 90-degree turn at the SID approach and parallel travel with Spy Island, which could result in wake disturbance of nests (Eni, 2017, Section F; Section J, Stipulation No. 5; Appendix O - 2.1.5, Fig. 2-3).

In summary, individuals and flocks would be disturbed by vessels in low numbers relative to populations. The impacts of these disturbances on the productivity or fitness of birds is not likely to be measurable, except potentially for some temporary and localized impacts to local populations of nesting common eider and other birds affected by wakes and related vessel disturbances.

Vehicle Traffic

Vehicle traffic and heavy equipment operations in terrestrial environments can impact birds with associated noise, human activity, and collisions. Similar to vessel traffic, vehicle traffic can disturb nesting birds or cause birds using an area for foraging or rest during migration to avoid the area and be displaced to less favorable areas. Ground traffic occurs year-round on the local established gravel road system and would continue to be used to transport freight (e.g., drill pipe), equipment, and personnel at no greater rates than have been occurring. Some transport of freight and personnel will occur during the winter and on marine ice roads, when and where only a few adult ptarmigan might be displaced with no measurable population effects.

Vehicle traffic that continues until areas of surrounding tundra become snow-free and birds arrive on tundra or adjacent intertidal areas potentially impacts birds, particularly early-nesting birds. Traffic during the spring and summer on the coastal salt marsh road of Oliktok Point may impact a few of the hundreds of molting brant using the area, or natural movement patterns of other nesting waterfowl and shorebirds and their broods, or destroy a brood or two of flightless chicks. Broods may also avoid crossing a road on their way to the safety of aquatic habitat, and predation risk is increased when they remain exposed.

Besides snow geese and brant, most brooding birds in the Proposed Action area are not colonial breeders, however, and do not occur in any large concentrations that would put them at measurable risk along local roads. Likely mitigated by speed restrictions and personnel training, a maximum of single-digit vehicle collision numbers were reported for any bird species in the BP North Slope oil fields between 2010-2014 (Bishop and Streever, 2016; Streever and Bishop, 2014 and 2013). Existing speed restrictions and personnel training for the existing roads are still assumed. This is expected to result in similar single digit maximum collision impacts and little measurable vehicle disturbance impacts from the Proposed Action. This would represent no measurable change from the recent rates on the same existing roads.

ESA-Listed Species

A few spectacled eiders may encounter traffic-related disturbances from the Proposed Action, first from hovercraft during break-up, and then potentially other vessels in more open water when the birds use coastal migration routes as the water opens up. A few male eiders disturbed while in nearshore waters would react to the disturbances similarly to other sea ducks, by diving, flushing, or temporarily avoiding the area. The nearshore Beaufort Sea waters are not habitat for high densities of foraging spectacled eiders. Marine vessel traffic is therefore expected to impact only a few individual spectacled eiders at most.

Terrestrial vehicle traffic can displace spectacled eiders, similarly to other previously described waterfowl, from preferred habitats during pre-nesting, nesting, and brood rearing (approximately June 5–August 15) (Götmark and Ählund, 1984; Livezy, 1980; Stehn et al., 1998; Phillips and Powell, 2009). Summer vehicle traffic may impact spectacled eider broods by disturbing passage to preferred habitats and waterways, exposing broods to increased risk of predation, or causing direct mortality via collisions. The Oliktok Point vicinity is an insignificant fraction of the total spectacled eider ACP breeding range (Larned, Stehn, and Platte, 2006) however, and breeding density is low enough there that it is unlikely that more than one or 2 broods could be impacted over the life of the Proposed Action. In summary, spectacled eiders may be disturbed and displaced by vessel traffic in marine waters or vehicle traffic on nesting grounds, but population level impacts are not likely to be measurable. Furthermore, only existing roads with no increased levels of traffic are included in the Proposed Action.

Steller's eider is unlikely to nest near or migrate through the area, so no vehicle impacts would occur. Any vessel impacts to Steller's eider would only be temporary disturbance, with no impact to the population.

Light Attraction and Collisions

The physical presence of facilities and drilling equipment has the ability to impact birds, including listed species. One of the impact risks is in-flight collisions, including collisions caused by attraction to artificial light and gas flaring during migration. Structures in otherwise open areas, including the existing SID, drill rig and crane booms, and larger associated vessels, are collision hazards for flying birds. Structure and vessel lighting is widely understood to exacerbate the hazard for many species. This is especially true during migration and under poor-visibility conditions (e.g., as it can be with storm, fog, precipitation, or during certain lunar phases) (Erickson et al., 2001; Hüppop et al., 2016), and can result in attraction, exhaustion, and injury and mortality from collisions (Crawford, 1981; Day et al., 2015; Greer, Day and Bergman, 2010; Day, Prichard, and Rose, 2005; Ronconi, Allard, and Taylor, 2015; Montevecchi et al., 1999; Verheijen, 1981; Wiese et al., 2001) (BOEM conservatively assumes all collisions are fatal). Strong headwinds can also increase collision risk by influencing migrating birds to fly lower (Richardson, 2000).

Some waterfowl and other birds are particularly prone to collisions with structures and vessels because of their typical flight pattern or attraction to artificial light. Day, Prichard, and Rose, 2005, for example, found that eiders on the ANS in September flew at a mean altitude of 6m, and as low as 1m, and long-tailed ducks flew at a mean altitude of 2m. They found that in the Point Barrow and Prudhoe Bay areas (as elsewhere), collisions of migrating waterfowl, especially eiders, with wires and other infrastructure are common, particularly so during periods of heavy fog. Long-tailed ducks and king and common eiders migrate in large numbers along the coast, flying fast and low above the water, and have histories of strikes at Beaufort Sea oil field facilities. Most of the migrating waterfowl are from larger populations outside the local area. Landbirds and seabirds including ptarmigan, rough-legged hawk, the year-round resident common raven and the locally common glaucous gull are among species with a history of oil and gas facility collisions. Smaller passerines (e.g., American robin, Lapland longspur, snow bunting, and dark-eyed junco), which are typically nocturnal migrants, have demonstrated high relative rates of light attraction and strikes in the Alaskan Arctic waters and elsewhere (Bishop and Streever, 2016; Streever and Bishop, 2014, 2013; USDOI, BOEM, 2015; Shell Gulf of Mexico Inc., 2012, 2015; Bruinzeel, van Belle, and Davids, 2009). Based on their local habits and histories, individuals of all of the aforementioned species are at risk of strike at Proposed Action facilities.

Besides individual strikes, strike events of flocks (i.e., multiple individuals of one or more of many species) also occur. For example, at least 16 common and king eiders have been reported together in one event at Endicott SDI (USFWS, 2010). Groups of long-tailed ducks have been reported, including at the existing SID, where a small group of sanderlings was also downed (Eni, 2017, Appendix O, Table 3-6).

Collision events consisting of individual and small flocks are expected to occur at both the offshore and onshore Proposed Action facilities. Most will occur during the early and late months of migration when skies are darker and under environmental conditions of otherwise lowered visibility. Exposure risk would not differ from existing conditions, however, as the same or similar collision and attraction hazards would be in place. Strike mortalities are not expected to exceed tens per year per several species of waterfowl, shorebirds, passerines, raptors, and other birds, with highest numbers expected for waterfowl species. Given that these numbers are negligible relative to overall sizes of the populations, no population level effects are expected, particularly within the lifetime of the Proposed Action.

ESA-Listed Species

Migrating spectacled and Steller's eiders, like all eiders that typically migrate at low altitudes along the coast with high flight speeds and low maneuverability (Day et al., 2005) are particularly susceptible to collision-caused mortality. No strikes of listed eiders have been reported in over six years of data collection at Eni's existing facilities. Despite their low populations and densities relative to the other eider species, however, spectacled and Steller's eiders have been reported to collide with powerlines and other infrastructure on the ACP. One strike of a spectacled eider was reported on a vessel associated with the limited Chukchi Sea oil and gas exploration activities in 2015. The collisions, often as flocks, of similar species (e.g., common and king eiders, and long-tailed duck), with offshore oil infrastructure and vessels in northern waters are well-documented (USFWS, unpublished data, as reported in Miller et al., 2016; Stout and Cornwell, 1976; MacKinnon and Kennedy, 2011; Merkel and Johansen, 2011). King eiders and long-tailed ducks, including flocks, have struck Northstar Island and other oil and gas facilities in the Beaufort and Chukchi Seas (Shell Gulf of Mexico Inc., 2012, 2015). Based on these results, potentially one or two spectacled eiders may collide with the existing infrastructure or vessels during the life of the Proposed Action. Exposure risk would not differ from existing conditions, as the same or similar collision and attraction hazards would be in place, and no measurable population level effects are anticipated from collisions associated with the Proposed Action.

Small Oil Spills

Accidental small spills could potentially affect a very small amount of habitat, but many species of birds. If a small accidental spill occurred during summer, in open water, and escaped containment and response measures, limited mortality could occur. Seabirds and diving sea ducks are initially most vulnerable to small spills because they spend the majority of their time in marine waters and often, as in the case of molting sea ducks, aggregate in dense flocks. Other waterfowl and shorebirds may be most susceptible to spills that reach the beach intertidal zone, coastal lagoons, or inshore wetland habitats where these species frequently forage, raise young, and stage and stopover in flocks on migration. Limited mortality of locally breeding common eiders, although considered unlikely, could have temporary and localized effects.

For much of the year, Simpson Lagoon is covered in ice, and only a few birds may be present. Given their sparse numbers, it is unlikely that these birds would be at risk of exposure to spills in winter. During the seasons when large numbers of birds are present in the Beaufort Sea vicinity, the volume and temporal extent of a small spill associated with the Proposed Action is expected to be such that no more than a few birds would potentially be exposed. Overall, a small spill or spills with a combined total of no more than 50 bbl would not be expected to have measurable impacts on non-listed bird populations.

ESA-Listed Species

Spectacled eider vulnerability to small spill exposure tends to be lower relative to some other sea duck species, because they are relatively widely distributed and do not tend to occur in large flocks while in these waters (Stehn and Platte, 2000). It is possible that a spectacled eider or two could be impacted by a small spill associated with the Proposed Action, but this is considered unlikely.

Conclusion

Vessel and vehicle traffic associated with the Proposed Action is expected to have few measurable impacts to most avian populations. A few non-listed populations may experience at most a localized and temporary effect. The expected level of impact to ESA-listed eiders from vessel and vehicle traffic is negligible due to their extreme low abundance in the vicinity. From November to early April, most birds are absent from the Beaufort Sea coastal areas (onshore and marine) and would not be affected by traffic.

The facilities and physical presence associated with the Proposed Action present on-going hazards to individual listed and non-listed birds. Many collisions will be the result of nighttime light attraction. Besides individual strikes, a few flock collision events of small groups, especially passerines and sea ducks, are expected to occur. The potential for attraction and collisions is expected to be greatest during periods of fog and low visibility that may occur during the early spring and late summer and fall months of migration. Strike exposure risk is the same or similar to what it has been as long as existing facilities have been in place. This risk level depends on on-going use of mitigation achieved by non-reflective matte paint and down-shielding of some of the exterior lights on the SID (i.e., the wall-mounted module lights and approximately 12 flood lights) (Eni, 2017, Appendix O - Section 3.10). The number of birds affected over two years would be few relative to most ACP populations, and collision hazards will be below population levels of non-listed birds and listed eiders.

Minimum information for strike reporting for ESA-listed eiders is defined in the Terms and Conditions of the 2012 USFWS BO. Development, with BOEM and the USFWS, of a standard monitoring and reporting plan for bird strikes would confirm these estimates and inform adaptive management on a finer scale, potentially further mitigating hazards for individual birds.

Overall, the impacts of routine activities and small oil spills associated with the Proposed Action on non-listed birds and ESA-listed eiders are expected to be primarily insignificant or immeasurable at the population level, and therefore negligible. There could potentially be temporary and localized and therefore minor effects for one or two vulnerable populations such as locally-breeding common eider. The overall level of impact to birds would range from negligible to, in potentially a few cases, minor.

4.6.2. No Action Alternative

Under the No Action Alternative, BOEM would not approve Eni's EP and this would preclude Eni from evaluating the oil and gas resource potential of their federal leases within the Nikaitchuq North Harrison Bay Block 6423 Unit. This would also avoid the environmental impacts disclosed under the Proposed Action.

4.6.3. Cumulative Effects

There are a variety of factors that influence bird populations in the Beaufort Sea region. The great majority of birds are migratory, spending much of each year in distant regions where they may be subject to additional environmental impacts outside the scope of the present analysis. Many of the relevant past, present, and reasonably foreseeable future actions and events of the Arctic that could contribute to cumulative impacts on birds are provided in Appendix B.

The effects of analogous activities associated with past, present, and reasonably foreseeable future oil and gas exploration and development in the Beaufort Sea as well as hunting, fishing, commerce, transport, and research are expected to be similar to the impacts on birds described above in section 4.6.1. These activities are sources of cumulative impacts to birds because they will contribute to the physical presence and sound disturbances from vessel and aircraft traffic, create collision risks and habitat alteration, and potentially increase the number of oil spills. These impacts are anticipated to be somewhat localized relative to the general proportions of many bird populations. There could be more widespread impacts in habitats where significant numbers of migratory birds aggregate. Some activities could be on-going and long-term.

The greatest source of impact to Arctic-nesting birds associated with reasonably foreseeable future actions and events is predicted to be climate change (Wauchope et al., 2016; Liebezeit et al., 2012). Climate change is anticipated to impact environments globally, but particularly the Arctic environments of birds in a variety of long-term and widespread ways. These include, but are not limited to loss of breeding habitat through coastal erosion and permafrost destabilization (Shur et al., 2003); and causing snow cover to melt and disappear in the spring earlier, exposing prey and habitat out of synchrony with the ecology of migratory species (Therrien et al., 2015). Common eider may experience loss of its low-lying barrier-island nesting habitat, for example, as severity and frequency of storm surges increase erosion. Species of seabirds that depend on ice for their marine foraging are also expected to be impacted (Saalfeld and Lanctot, 2015; Meltofte et al., 2007). Some climate change impacts to birds have begun (Ward et al., 2016) as well as are expected to increase in the reasonably foreseeable future; however, they would not be measurable within the period of the Proposed Action.

Ingestion of lead shot, hunting, and changes in predation patterns are suspected as primary contributors to past substantial declines experienced by some populations of tundra-nesting birds (e.g., spectacled eider, Steller's eider) (USFWS 2010, 2002). Increased levels of predator abundance are associated with increasing numbers of infrastructure and industrial use sites. Tundra-nesting waterbirds, particularly eiders, are believed to have been the birds most impacted from the effects of past and present actions. Most of these impacts have been persistent and widespread, although some of the causal factors have somewhat abated and some populations have stabilized, but at a lower level.

The Proposed Action is unlikely to significantly alter the overall rate of climate change impacts to birds. The direct effects from the Proposed Action on birds tend to be limited to individuals. For the life of the project, impacts to birds from the Proposed Action would be negligible to minor. The contribution of impacts from the Proposed Action to the overall cumulative effect on bird populations is likely to be immeasurable and negligible. When combined with other past, present, and reasonably foreseeable activities in Appendix B, the cumulative impact on birds for the life of the project would be negligible to minor.

4.7. Marine Mammals

4.7.1. Proposed Action

Potential effects to marine mammals from the Proposed Action include:

- disturbance and displacement from the physical presence of and noise produced by marine and on-ice transportation and by drilling activities;
- human-wildlife interactions; and,
- small spills.

Open water season

Sources of underwater noise associated with the Proposed Action during the open water season include heavy equipment on the SID and the transportation of equipment and personnel via vessels and hovercraft between Oliktok Point and the SID. The underwater ambient noise level will vary with activity.

An underwater acoustics study, to determine if noise from construction and supporting vessel activities could be detected, was conducted in the waters surrounding the Oooguruk Production Island (OPI). Underwater sound levels from the OPI, located to the west of SID, were recorded between the ranges of 105.9-109.9 dB re µPa (Laurinolli et al., 2008). These sound levels fall below the 120 dB minimum behavioral disturbance threshold for continuous noise established by NMFS for all marine mammals (NMFS, 2016). Link and Rodrigues (2009) found little underwater sound propagation from non-vessel and non-seismic activities at the OPI. The industrial noise originating from the production island only measured a few tones, such as, 30 Hz and 60 Hz, which are outside the estimated auditory bandwidth of beluga whales, and near the lowest audible tone recorded for bearded, ringed, and spotted seals (NMFS, 2016; Sills, Southall, and Reichmuth, 2015; Sills Southall and Reichmuth 2014). Sound levels produced by activities at the SID are expected to be comparable at the source, but would attenuate more rapidly, as the shallow water in Harrison Bay is less conducive to low frequency sound propagation, limiting the distance sound can travel.

During the open water season, vessel traffic along an existing corridor between Oliktok Point and the SID will transport crew and supplies. Normally, vessels produce continuous low frequency sounds (around 160 dB) that are perceptible to marine mammals. Acoustic measurements of vessels, including two source vessels, three cable lay vessels, and two crew-change/support vessels were recorded in 9 m of water during an Eni/PGS 2008 seismic survey (Warner et al., 2008). Their 120 dB 1 µPa (Acoustic Disturbance - Level B Harassment) threshold distances were 280 - 1,300 m (0.8 mi). The overall distance from an operating support vessel in coastal waters to 120 dB re µPa was 0.73 km (0.43 mi) (NOAA, 2016). Since low-frequency noise levels quickly attenuate in shallow marine environments, comparable vessels operating in the shallow waters of Harrison Bay would produce a small noise footprint. The underwater noise produced by hovercraft may vary, but remains less than the noise produced by other marine vessels (Blackwell and Greene, 2005). Zykov, Hannay and Link (2008) observed that vessel sounds for barges, tugs, and support vessels at the OPI were between 162.8 dB RMS - 182.9 dB RMS within 1 m (3 ft) from the source. This level of noise would not produce any injury to marine mammals, such as a Temporary Threshold Shift (TTS) or Permanent Threshold Shift (PTS). However, marine mammals located within close proximity to the vessel would likely move to avoid the approaching vessel.

The number of marine mammals present near the SID or the vessel traffic corridor during the open water season is expected to be very small. Baleen whales do not occur between Spy Island and the Alaskan coast (Clarke et al., 2017). No bowhead whales, gray whales, beluga whales, or Pacific walrus are expected to occur close enough to the SID or the vessel traffic corridor to experience impacts. Bowhead whales migrate about 30 to 70 km (19 to 43 mi) offshore in water depths ≥20 m (65 ft), far north of the Proposed Action (Treacy et al., 2006). There have been few sightings of bowheads in depths <20m (65 ft) (Link and Rodrigues, 2009), and BOEM's ASAMM/BWASP flights have not detected a bowhead or gray whale between the SID and Oliktok Point (Clarke et al., 2017). Gray whales are uncommon in the central Beaufort Sea and cannot use shallow water nearshore areas south of Spy Island. Beluga whales have been recorded offshore of Spy Island (Williams, Reiser, and Link, 2007) and occasionally occur in Harrison Bay; but rarely south of Spy Island (Clarke et al., 2017). Occasionally, a beluga whale might briefly visit the shallow waters and be exposed to vessel noise. Under such circumstances, the beluga whale would most likely respond to vessel noise/presence by avoiding the approaching vessel, but would not experience any meaningful energetic losses. The SID location is unlikely to affect migrating whales as it is within the barrier islands in very shallow water, outside main migration paths of bowhead, grey, or beluga whales, and devoid of the large quantities of prey species required by bowhead and grey whales (Clarke et al., 2017). Although some bowhead, beluga, and gray whales may occasionally travel near the SID in deeper waters north of Spy Island, noise associated with industrial activities should not affect them. Industrial sound would rapidly attenuate in the shallow waters inside the barrier islands (MMS, 2002; Laurinolli et al. 2008; Greene, Blackwell, and Link 2009), and the barrier islands would block noises south of Spy Island from spreading into waters north of the barrier islands. The effects from vessel traffic and industrial activity, would be similar with Eni's past and/or existing operations, such as vessels used, trip duration, number of trips, transportation corridors/routes, and routine industrial activity. Hence, the Proposed Action should result in no additional impacts to bowhead, beluga, or gray whales.

Pacific walruses are extralimital to the central Beaufort Sea and rarely occur in the vicinity of the Proposed Action, so are unlikely to be affected. If detected, they would most likely be seaward of the barrier islands. The greatest potential effect to any walruses that may be seasonally present would be displacement from the vessel presence or noise. As with the cetaceans, vessel traffic and industry noise would not produce a TTS or a PTS, and would be unlikely to change established behavioral patterns among Pacific walruses. Therefore, effects would be negligible.

A small number of ice seals might occur in areas ensonified by the SID or support vessels. Low numbers of ice seals occur in eastern Harrison Bay because the shallow water south of Spy Island generally lacks the food resources and haulout habitat ice seals prefer. No ringed or bearded seal haulouts occur near the vessel traffic corridor between Oliktok Point and the SID. Spotted seals occur primarily near their haulout on Oarlock Island in the Colville River Delta, away from the noise or disturbance effects produced during SDI operations. Food sources are limited for the bearded seal south of the barrier islands because the sea floor is scoured by broken ice during spring and is landfast ice during winter. The dynamic process of scouring prevents the development of benthic communities, which are an important food source for bearded seals. In addition, the debris, sediment and fresh water flushing out of the Colville River either buries benthic organisms or injures them by exposure to fresh water. Though low numbers of seals occur in Harrison Bay, ringed seals are the most likely to be present as well as a few spotted seals.

Even though a small number of ringed, spotted, and bearded seals may encounter vessels, the effects are discountable. Green and Moore (1995) and NMFS (2013) concluded that the effects of vessel traffic on seals are generally negligible to non-existent when they are in the water. Further, the SID and its supporting activities have been in constant operation in Simpson Lagoon since the SID was constructed in 2008 and began producing oil in 2011. After 6 years of operation, sometimes at higher activity levels than the Proposed Action, pinnipeds would have habituated to the anthropogenic activities or learned to avoid the area. Pre-existing levels of vessel activity have not been shown to adversely affect seals. However, some ringed and spotted seals may be using the lagoon area during the open water season and could be marginally affected by the presence of noise from vessels. At most, vessel noise would briefly interrupt a seals behavior until the vessel moved away from the seal; however, such an effect would not disrupt the immediate or long-term behavior of the affected seal. Furthermore, there should be little or no energetic costs to any seals from vessel traffic in the area, since food sources for ice seals are scarce in the shallow waters along the vessel transit route. As vessels have been using an established route for years in an effort to minimize impacts to marine mammals, no seals outside the transit corridor should be disturbed by vessels or hovercraft. Consequently, vessel traffic and noise should have little to no effect on bearded, ringed, and spotted seals.

Polar bears occur, in low population densities, year-round in both the on- and offshore areas surrounding the Proposed Action. Polar bears are most likely to be encountered along the coastline during the late summer/fall period (August through October). Bears use the barrier islands near the SID (i.e., Spy and Pingok islands) July to September as resting areas and travel corridors. The majority of the polar bear sightings from SID occur during this time period. Polar bears can become tolerant and habituated to anthropogenic activity, but could still be affected by the Proposed Action. The greatest effect on polar bears is the potential for human-wildlife interactions, if attracted to the SID. Human-bear interactions can lead to deterrence actions to move the bear away from humans in a safe manner, thereby limiting negative consequences for workers and bears. Mitigation measures outlined in Eni's required incidental and intentional (deterrence) "take" authorizations from the USFWS would minimize potential impacts to polar bears. This type of disturbance is expected to be temporary and likely to result in little or no impact to polar bears. Vessels could also encounter polar bears transiting through the project area either in the marine environment or on land, but these disturbances are also expected to result in little to no and thus negligible effects to polar bears.

Ice-covered (winter) season

A limited number of polar bears (transient and denning) and ringed seals are expected to be in the immediate vicinity of the Proposed Action during the ice-covered, winter season; the Proposed Action could potentially affect individual animals in the area.

Exploration drilling would only occur in the ice-covered, winter season. Data from similar drilling operations suggest that noise from drilling would be perceptible to marine mammals only within close proximity to the SID. Link and Rodrigues (2009) found no evidence of tones associated with drill string rotation when measuring sound characteristics associated with industrial activities from the OPI. In addition, Zykov, Hannay, and Link (2008) detected only intermittent, low-frequency noise between 10 Hz and 60 Hz one mile from the OPI. The noise was attributed to heavy equipment operations on the island, and was undetectable 4 miles from the source. The maximum absolute broadband level of these sounds was 92 dB re μPa (Zykov, Hannay, and Link, 2008) and was believed to propagate mainly through the seabed, suggesting a rapid decay with distance.

As described earlier, some ringed seals are year-round residents in the Beaufort Sea. While the majority of the lagoon system of the barrier islands becomes landfast ice during the winter and is precluded from use by ringed seals, in some nearshore areas subnivean structures, such as lairs and breathing holes, have been documented (Williams et al., 2006), suggesting that some seals can exploit marginal habitat using under-ice channels. Seal structures could be found in water depths as shallow as 1.5 m (5 ft) (Williams et al., 2006, Perham, 2001).

For this reason, individual seals can be affected by winter industrial activities. The construction of ice roads can remove a minute amount of habitat from use by seals to build lairs or breathing holes. Williams et al. (2006) found that two seal structures within a few meters of the centerline of an ice road were "abandoned" after flooding began. Conversely, the closest structures to the active ice road were two basking holes, 11 and 15 m from the centerline, suggesting that seals may become habituated to types of anthropogenic activity. Individual seals may create structures near the SID or the ice road connecting the SID to the mainland during the Proposed Action and should remain unaffected.

Williams et al. (2006) found Northstar activities, including drilling, had no effect on ringed seals use of subnivean structures. Industrial noise, including noise generated by drilling activities from the Proposed Action, is expected to decay rapidly in the environment. Winter-only drilling, data establishing the lack of noise propagation from underwater drilling at the analogous Oooguruk drilling islands (Link and Rodrigues, 2009), and well characteristics, such as well depth, drilling from inside a building, etc., restricting the production of in-air noise, no marine mammals are expected to be affected by drilling noise from the SID.

While limited polar bear sightings will occur during the proposed winter drilling activities, non-denning, transient bears attracted to the SID could be disturbed or displaced from the immediate vicinity of the Proposed Action by deterrence actions. This type of human-bear interaction would cause short-term behavioral changes to the bear.

On the North Slope, pregnant polar bears generally select den sites away from anthropogenic activity. For denning females, the nearest potential polar bear denning habitat is approximately 12 km (7 mi) away from the SID on the barrier islands and 7 km (4 mi) away in remote sections of the mainland coastline devoid of industry activity. This distance is sufficient to minimize potential disturbance for pregnant bears to successfully raise cubs through the denning period (Amstrup, 1993). Further, polar bears have successfully denned in areas close to industrial activity (81 FR 52292, August 5, 2016). For example, in 2011, during the construction of the SID an active maternal polar bear den was discovered on the island. The operator then employed USFWS-approved mitigation measures, and the bear family successfully denned. Industry use of deterrence methods combined with potential bear denning habitat being removed from the SID and support facilities, industrial activities associated with the proposed Action are expected to have negligible effects on denning and non-denning polar bears.

The SID is not designated as polar bear critical habitat because it is a man-made island; however, it is located near barrier island critical habitat. Even so, the effect of the Proposed Action on polar bear critical habitat would be negligible because the disturbances from industrial noises and vessel traffic associated with the Proposed Action are expected to be minimal, and if bear dens were discovered, USFWS would apply additional mitigation measures, as necessary. This is evidenced by the fact that polar bears have continued using barrier island critical habitat near the SID for resting, denning, and travel corridors.

Small Oil Spills

Small diesel spills could affect marine mammals through direct surface contact, inhalation of fuel or its volatile components, or ingestion (directly or by consumption of contaminated prey/carcasses). Such pathways could lead to decreased health, reproductive fitness, and longevity. Additionally, some marine mammal species may experience increased vulnerability to disease. A small spill could also result in a localized reduction, disappearance, or contamination of prey species. Spill timing, location and extent would determine which species would be affected.

Small open water diesel spills contacting the marine environment would not affect many marine mammals since the spill would contaminate a relatively small area and volatize rapidly. Though small spills in open water may contact and affect a few marine mammals, such localized impacts would not be meaningful at a population level.

Small spills during melt-out could impact seals to a greater degree than whales, while a spill concentrated on the SID or coastline could only affect polar bears. Individual pinnipeds and polar bears could be directly exposed to small spills on ice or in coastal areas. During periods of broken ice, an occasional beluga whale, polar bear, or seal could encounter a small spill near the SID.

A winter spill could potentially affect a limited amount of habitat and a few polar bears or ringed seals. While a small spill during the winter season may contact a few ringed seal or polar bears, potentially causing mortality to one or two bears, such localized impacts, limited to a few individuals, would not be meaningful at a population level.

Conclusion

Overall, effects on marine mammals, their populations, and their habitat from the Proposed Action are expected to be negligible. The area in the vicinity of the SID is not preferred habitat for any marine mammal species, so limited numbers would likely be exposed to vessels or other industrial activities. Additionally, the location of the SID, well characteristics, rapid decay of noise shallow water, and the lack of noise propagation from drilling ensure drilling a vessel noises remain undetectable beyond the barrier islands.

Effects of human-wildlife interactions, such as those caused by deterring polar bears away from the SID and support structures, would have negligible to minor impacts on polar bears because impacts of the action would be short-term and localized to individual bears.

By implementing relevant mitigation measures described by NMFS in their 2013 Biological Opinion (NMFS, 2013) such as, posting PSOs onboard vessels during transit between Oliktok Point and the SID, seals or the rare walrus, beluga whale or polar bear could be more easily detected and avoided. Likewise, vessel avoidance protocols and speed restrictions would also aid in reducing the level of effects on marine mammals. By posting PSOs on any structure producing noise levels exceeding the 120 dB (non-impulse noise) or 160 dB (impulse noise) thresholds described by NMFS (2016), the area could be monitored for instances where marine mammals become exposed to excessive noise. Collectively the mitigation measures described would lower the existing level of effects such that no unauthorized takes of marine mammals, including incidents of Level A or Level B harassment could occur.

The effects of small diesel spills would be negligible to minor because mortality may occur to individual marine mammals, such as polar bears, where these localized impacts would not be meaningful at the population level.

4.7.2. No Action Alternative

Under the No Action Alternative, BOEM would not approve Eni's EP and this would preclude Eni from evaluating the oil and gas resource potential of their federal leases within the Nikaitchuq North Harrison Bay Block 6423 Unit. This would also avoid the environmental impacts disclosed under the Proposed Action.

4.7.3. Cumulative Effects

Climate change effects to the environment are typically analyzed at a regional level and often vary at the local level. Most models predict gradual shifts in marine mammal habitat out to 2050, and more rapid changes after 2050 (Regehr et al. 2016). Over the two year duration of the Proposed Action, some greenhouse gasses would be produced, but not enough to measurably change the local environment (see Section 4.1.3).

Cumulative Effects on Cetaceans

The main sources for cumulative effects for cetaceans (bowhead, gray, and beluga whales) are from vessel traffic, subsistence harvest, oil and gas activities, and scientific research activities (see Appendix B). Vessel traffic from subsistence hunting, oil and gas activities, and scientific research activities are a source of noise and disturbance that can cause whales to change their behavior, and sometimes temporarily change their habitat use, including migration paths. The presence of vessels and associated anthropogenic noise would be temporary and transient, and would not have an additive effect combined with the addition of vessel activity associated with the Proposed Action. Bowhead and beluga whales have been historically hunted by Alaska Native peoples throughout the Arctic and subarctic waters of Alaska (Stoker and Krupnik, 1993). Subsistence take for bowhead whales is regulated by a quota system under the International Whaling Commission. No similar quota has been deemed necessary for beluga whale stocks in the U.S. Beaufort Sea. The continued subsistence take of bowhead whales by indigenous hunters represents the largest known human-related cause of mortality in this population at the present time. Available information suggests it is likely to remain so for the duration of the project. Due to the continued interest of oil and gas companies to explore and develop oil and gas resources, seismic surveys, other exploratory activities, and development projects are expected to continue. There is no data to suggest exploratory drilling, development, or seismic surveys for oil and gas exploration activities have had adverse population-level effects on any cetacean species in the Arctic. Hence, the combined effects of all activities associated with the Proposed Action would have a negligible incremental contribution to the overall effects of past, present, and reasonably foreseeable future activities on cetaceans. When combined with the impacts of the past, present and reasonably foreseeable activities described in Appendix B, the cumulative impact on Cetaceans would be negligible.

Cumulative Effects on Ice Seals

Past and present activities that could impact ice seals in the central Beaufort Sea include marine seismic surveys, ancillary activities, exploration drilling, and production activities. Ice seals could be impacted by noise disturbance, such as, vessel, airgun, and aircraft noise, as well as, disturbance to seals through the physical presence of vessels. The effects of noise and vessel presence from those activities appear to be temporary, and have had no apparent residual effects on seals. Other activities that occur in the Beaufort Sea include barge traffic carrying supplies to communities along the Beaufort Sea coast, scientific studies and surveys, USCG operations, oil and gas activities, and subsistence activities. Exploratory drilling from the SID has limited potential to affect ice seals. The combined effects of all activities associated with the Proposed Action would have a negligible incremental contribution to the overall cumulative effects of past, present, and reasonably foreseeable future activities on ice seals. When combined with the impacts of the past, present and reasonably foreseeable activities described in Appendix B, the cumulative impact on ice seals would be negligible

Cumulative Effects on Pacific Walrus

Pacific walruses are extralimital to the Beaufort Sea. The past, present, and reasonably foreseeable future activities described in Appendix B could impact individual walruses resulting in temporary disturbances and possibly displacement. This impact would have negligible effects to the Pacific walrus population because walruses seldom occur in the area surrounding the Proposed Action. In addition, the probability of subsistence harvest of Pacific walruses in the region is immeasurably low because they are extralimital. Any opportunistic harvest would have no individual or population-level impacts to walruses. The Proposed Action would have a negligible incremental contribution to past, present and reasonably foreseeable future actions. Cumulatively, the overall effects on walrus would remain negligible.

Cumulative Effects on Polar Bears

Appendix B describes past, present and reasonably foreseeable actions that when combined with the Proposed Action could affect polar bears. With the exception of subsistence harvest results in the removal of individual animals from the population, oil and gas related activities and climate change are those most likely to impact polar bears by causing disturbance that elicits a behavioral response. Potential human-bear interactions that cause behavioral responses include deflections away from areas of activity, attraction to areas of offshore and onshore activity, and interruptions to foraging, and resting or other behaviors.

Temporary disturbances resulting from activities associated with the Proposed Action could add incrementally to short-term, localized displacement and disturbance of individual polar bears. However, this incremental contribution to the effects of cumulative activities to the CBS stock and the SBS stock would be negligible as direct effects would only occur in the immediate vicinity of the Proposed Action. The Proposed Action would have a negligible incremental contribution to the effects of subsistence harvest, as polar bear subsistence hunting does not occur near the Proposed Action.

The primary concern for polar bear critical habitat from the Proposed Action is loss of sea ice. The USFWS identified three areas or units as critical habitats that require special management or protection: barrier island habitat, sea ice habitat and terrestrial denning habitat. The Proposed Action would not affect polar bear critical habitat because the SID and its support infrastructure have currently been operating near polar bear critical habitat since 2012 with no known impacts to critical habitat.

For polar bears, the Proposed Action would have a negligible incremental contribution to the overall cumulative effects of past, present, and reasonably foreseeable future activities on the CBS and SBS polar bear populations, since so few individuals could be affected and the level of impact on individual animals would be low. When combined with the past, present and reasonably foreseeable activities described in Appendix B, the impacts on polar bears would be negligible.

Conclusion

For the life of the project, impacts to marine mammals from the Proposed Action would be negligible to minor. The direct effects from the Proposed Action on marine mammals tend to be localized to the area near the activity. The Proposed Action's contribution to all past, present, and reasonably foreseeable future actions is negligible; therefore, when the impacts from the Proposed Action are combined with past, present and reasonably foreseeable future actions, the effect to marine mammals is expected to be negligible.

4.8. Subsistence-Harvest Patterns

4.8.1. Proposed Action

For impacts to subsistence activities and harvest patterns, BOEM considered the fundamental importance of subsistence to Iñupiaq cultural, individual and community health, and well-being. Due to these unique characteristics of subsistence practices, impacts to subsistence activities and harvest patterns are considered major if they would disrupt subsistence activities, make subsistence resources unavailable or undesirable for use, or only available in greatly reduced numbers for a substantial portion of a subsistence season or more.

There are three harvest patterns that overlap both temporally and spatially with the Proposed Action: seal hunting, eider hunting, and travel to and from Cross Island during the fall bowhead whale hunt. The Proposed Action will have no effect on subsistence bowhead whaling because there is no spatial overlap between the Proposed Action area and the actual whale hunting area used by Nuiqsut, which is located north and east of Cross Island. Nuiqsut's fall whaling activities typically occur between late August and September at Cross Island. Nuiqsut whalers travel down the Colville River to Harrison Bay, then east to Cross Island. The route is typically within the barrier islands and passes between OPP and SID. Crew boats and barges are typically used during the times when whalers are travelling to Cross Island. The Proposed Action includes associated support-vessel traffic such as barge trips between OPP and SID during the open water season (SLR, 2017). Support vessels would be present in the vicinity while whalers travel to and from Cross Island. There is potential for interference and conflict to occur between whaling vessels and vessels used to support the Proposed Action. BOEM anticipates these impacts would be localized and short-term, and thus minor. BOEM does not anticipate that minor impacts from support vessels would disrupt subsistence whaling, make bowhead whales unavailable or undesirable for use, or only available in greatly reduced numbers for a substantial portion of a whaling season or more. Minor impacts could potentially be avoided by frequent and effective communication and coordination between whalers and industry support vessels. This would ensure that potential effects to whalers in route to the Cross Island are avoided or minimized.

Residents of Nuiqsut hunt bearded seals, ringed seals, spotted seals, and eider ducks during the open water season (SRB&A, 2010a; SAExploration, 2014). Support vessels would be present in the vicinity while hunters were actively pursuing seals and eiders. There is potential for interference and conflict to occur between subsistence vessels and vessels used to support the Proposed Action. BOEM anticipates these impacts would be localized and short-term, and thus minor. BOEM does not anticipate that minor impacts from support vessels would disrupt seal and eider hunting, make seals and eiders unavailable or undesirable for use, or only available in greatly reduced numbers for a substantial portion of a subsistence season or more. Minor impacts could potentially be avoided by frequent and effective communication and coordination between subsistence hunters and industry support vessels. This would ensure that potential effects to seal and eider hunting are minimized.

Nuiqsut residents hunt for caribou along the coast June through September near OPP (SRB&A, 2010a; 2010b). Nuiqsut hunters have harvested caribou at Oliktok Point; however, the OPP area is not part of their primary caribou hunting area (SRB&A, 2010b). Contact between caribou hunters in boats and vessels supporting the Proposed Action would most likely be negligible. There is no spatial overlap between geese hunting and the Proposed Action. There is no spatial overlap between subsistence fishing and the Proposed Action. BOEM expects there would be no impacts (i.e., negligible) from the Proposed Action to geese hunting or subsistence fishing.

Small Oil Spills

Small spills associated with the Proposed Action could have short-term and localized impacts on seal and eider hunting for Nuiqsut. However, there would likely be little to no impact to subsistence hunting for caribou as small diesel spills are not expected to reach the shore. Additionally, hunters would be able to pursue caribou at different areas away from the spill.

For subsistence fishers in Nuiqsut and those with whom they share fish, stress and negative perceptions of contaminated fish such as Arctic cisco, Arctic char, and broad whitefish could be short-term and localized. Small spills associated with the Proposed Action are not expected to occur where people fish. Contamination of subsistence fish resources resulting from small spills would not be expected.

Small spills would not disrupt subsistence activities, make subsistence resources unavailable or undesirable for use, or only available in greatly reduced numbers for a substantial portion of a subsistence season or more.

Conclusion

Impacts to subsistence activities and harvest patterns from the Proposed Action could be minor for seal hunting, eider hunting, and travel to and from Cross Island for whaling. BOEM expects no impacts (i.e., negligible) to subsistence whaling in the Cross Island area from the Proposed Action. For caribou hunting, BOEM anticipates negligible impacts from the Proposed Action. For geese hunting and subsistence fishing, BOEM anticipates negligible impacts from the Proposed Action. The overall impact to subsistence activities and harvest patterns from small spills associated with the Proposed Action would be negligible to minor. Overall, BOEM expects negligible to minor effects to subsistence activities and harvest patterns for Nuiqsut from the Proposed Action.

4.8.2. No Action Alternative

Under the No Action Alternative, BOEM would not approve Eni's EP and this would preclude Eni from evaluating the oil and gas resource potential of their federal leases within the Nikaitchuq North Harrison Bay Block 6423 Unit. This would also avoid the environmental impacts disclosed under the Proposed Action.

4.8.3. Cumulative Effects

Subsistence seal hunting by residents of Nuiqsut could be affected by the Proposed Action; there would be minor effects on subsistence seal hunting. BOEM anticipates the Proposed Action would have negligible to minor effects to bearded, ringed, and spotted seals. Past actions in this area have included marine seismic surveys, ancillary activities, and exploratory drilling; the effects of which were temporary with no apparent residual impacts to ice seals. Other activities include barge traffic, crew boat traffic, scientific research, USCG operations, and oil and gas activities. The Proposed Action would have a negligible incremental contribution to cumulative effects to ice seals used for subsistence purposes.

Subsistence eider hunting by residents of Nuiqsut could be affected by the Proposed Action; there would be minor effects on subsistence eider hunting. The Proposed Action will contribute only a relatively small fraction of the overall oil field traffic disturbance, light attraction and collision, and predation impacts to birds such as eiders. Subsistence eider hunting primarily occurs offshore from boats in conjunction with seal hunting. Potential effects from onshore activities due to present and reasonably foreseeable actions would not affect eider hunting. Effects of past actions to eider hunting were temporary and no longer have potential to impact subsistence harvests of eiders.

Potential effects to travel in the fall by subsistence whaling crews from Nuiqsut to Cross Island could be minor. Exploratory drilling activities, including support-vessel traffic, would occur for two seasons. The amount of support-vessel traffic in the open water season for the two-year Proposed Action would be similar to the current amount of vessel traffic given current oil and gas activities in State of Alaska waters and may increase overtime as additional discoveries are made in State waters. The presence of these vessels and associated anthropogenic noise would be temporary and have no additive effect combined with other vessel activity in the Proposed Action. Whalers from Nuiqsut pass between OPP and SID in route to Cross Island. Routine vessel traffic between OPP and SID will not substantially increase beyond what is currently anticipated as a result of present and future activities. The Proposed Action would not contribute a noticeable amount of vessel traffic beyond what is already operating in the central Beaufort Sea. Therefore, BOEM anticipates a negligible incremental contribution to cumulative effects to transportation of subsistence whaling crews as a result of the Proposed Action.

The cumulative impacts of all existing and future activities in the Proposed Action area could be additive and synergistic to those from local and global human activities that contribute to global climate variability. Climate change will likely continue to affect the habitat, behavior, abundance, diversity, and distribution of populations of subsistence species, thereby indirectly affecting subsistence harvest patterns. In the long-term, additive and synergistic impacts from climate variability could be short-term and localized or long lasting and widespread. The degree of adverse effects would depend on the extent to which availability of and access to subsistence resources are adversely affected by unpredictable climatic and environmental variability. The Proposed Action is unlikely to impact the overall rate of climate change. The duration of the Proposed Action is short-term, and climate change is not expected to increase the incremental contribution of the Proposed Action to cumulative effects on subsistence harvest patterns for Nuiqsut.

While oil and gas exploration projects and associated vessel traffic have the potential to adversely affect subsistence resources and harvest patterns, the additive impact of the Proposed Action would be negligible because the duration of the project is short-term.

For the life of the project, impacts to subsistence harvest patterns for Nuiqsut from the Proposed Action would be negligible. Therefore, the effects of all activities associated with the Proposed Action to the overall condition of subsistence activities and harvest patterns are negligible. The Proposed Action’s contribution to all past, present, and reasonably foreseeable future actions is negligible. Overall, the incremental contribution of the Proposed Action to cumulative effects to subsistence activities in Nuiqsut and the NSB is expected to be negligible. When combined with other past, present and reasonably foreseeable activities discussed in Appendix B, the cumulative impact on subsistence-harvest patterns would remain negligible.

4.9. Sociocultural System

4.9.1. Proposed Action

The Proposed Action would make use of the existing project facilities and would not include development of new facilities. It would result in several months of increased activities during winter 2017-2018 and winter 2018-2019. This may result in some minor increases in employment or use of support services during this time period. The Proposed Action does not include development of oil and gas resources, and it is unlikely to result in impacts to the sociocultural system for Nuiqsut.

For caribou hunting, seal hunting, eider hunting, and travel to and from Cross Island, the Proposed Action could have negligible to minor effects. BOEM does not expect such potential effects to disrupt subsistence activities, make subsistence resources unavailable or undesirable for use, or only available in greatly reduced numbers for a substantial portion of a subsistence season or more. There would be no impacts to whaling in the Cross Island area because the whaling area does not spatially overlap with the Proposed Action. There would be little to no impacts to social organization, cultural values, and formal institutions in Nuiqsut caused by impacts to subsistence activities related to the Proposed Action.

Small Oil Spills

BOEM anticipates little to no impacts to the sociocultural system for Nuiqsut from small oil spills. Disruptions to subsistence activities would be so mall and localized, they would not affect the sociocultural system. Small spills would not disrupt subsistence activities, make subsistence resources unavailable or undesirable for use, or only available in greatly reduced numbers for a substantial portion of a subsistence season or more.

Conclusion

In Nuiqsut, a functioning sociocultural system depends on intact and undisturbed subsistence harvest patterns. BOEM anticipates negligible impacts to the sociocultural system in Nuiqsut because subsistence activities would not be disrupted and there would be little to no effects to social organization, cultural values, and formal institutions from the Proposed Action. Small spills associated with the Proposed Action would have negligible impact to the sociocultural system in Nuiqsut. Overall, there would be negligible impacts to the sociocultural system in Nuiqsut from the Proposed Action.

4.9.2. No Action Alternative

Under the No Action Alternative, BOEM would not approve Eni's EP and this would preclude Eni from evaluating the oil and gas resource potential of their federal leases within the Nikaitchuq North Harrison Bay Block 6423 Unit. This would also avoid the environmental impacts disclosed under the Proposed Action.

4.9.3. Cumulative Effects

Present and reasonably foreseeable future oil and gas activities could generate impacts to the sociocultural system in Nuiqsut by impacting subsistence harvest patterns and population and economy. The Proposed Action is short-term and would have negligible to minor effects to subsistence harvest patterns and negligible effects to population and economy. The Proposed Action would have negligible impacts to social organization, cultural values, and local institutions. The Proposed Action is unlikely to impact the overall rate of climate change. Climate change could have negligible effects to sociocultural systems during the two-year lifetime of the Proposed Action, however it is not expected to increase the incremental contribution of the Proposed Action to the sociocultural system of Nuiqsut.

For the life of the project, impacts to the sociocultural system of Nuiqsut from the Proposed Action would be negligible. The Proposed Action is unlikely to impact the overall rate of climate change. Therefore, the effects of all activities associated with the Proposed Action to the overall condition of the sociocultural system are negligible. The Proposed Action's contribution to all past, present, and reasonably foreseeable future actions is negligible. Overall, the incremental contribution of the Proposed Action to cumulative effects to sociocultural systems in Nuiqsut and the NSB is expected to be negligible. When combined with other past, present and reasonably foreseeable activities, the cumulative impact on sociocultural systems would remain negligible.

4.10. Population and Economy

4.10.1. Proposed Action

The Proposed Action is short-term, involves low levels of employment and associated income, and no generation of property tax revenues would be realized by the NSB or State of Alaska. The Proposed Action would make use of the existing project facilities and would not include development of new facilities. The population of Nuiqsut is not expected to grow or decline due to the Proposed Action. The Proposed Action does not include development and production of oil and gas resources, and it is unlikely to result in economic impacts.

Small Oil Spills

Small spills associated with the Proposed Action are isolated and brief, and are not expected to result in changes of employment, income, and revenue.

Conclusion

The Proposed Action is expected to have negligible effects on population, employment, income, and revenue in the NSB and Nuiqsut. Small spills associated with the Proposed Action would have negligible impacts on population and economy in Nuiqsut. Overall, there would be negligible effects to the economy and population of the NSB and Nuiqsut from the Proposed Action.

4.10.2. No Action Alternative

Under the No Action Alternative, BOEM would not approve Eni's EP and this would preclude Eni from evaluating the oil and gas resource potential of their federal leases within the Nikaitchuq North Harrison Bay Block 6423 Unit. This would also avoid the environmental impacts disclosed under the Proposed Action.

4.10.3. Cumulative Effects

Current and reasonably foreseeable future oil and gas actions in the NSB could extend existing employment and labor income opportunities into the future, providing employment for construction, drilling operations, and maintenance during production. The Proposed Action is expected to have negligible effects to population and economy. Much of the employment and income supporting the Proposed Action and other oil and gas projects on the North Slope would most likely go to workers commuting from population centers outside the NSB, where state and national impacts to employment would be negligible, due to the large employment bases in those areas. NSB businesses and residents have historically provided certain types of support activities for oil and gas projects for decades, and reasonably foreseeable new projects would most likely sustain rather than increase employment opportunities for current and future residents of Nuiqsut and the NSB. The Proposed Action is likely to contribute little to no incremental cumulative effect to the population and economy of the NSB. Additive effects are anticipated to be negligible to the State population and economy and negligible to the population and economy of the NSB. The Proposed Action is unlikely to impact the overall rate of climate change. Climate change would have negligible effects to population and economy during the two-year lifetime of the Proposed Action, however it is not expected to increase the incremental contribution of the Proposed Action to the population and economy of Nuiqsut.

For the life of the project, impacts to population and economy of Nuiqsut from the Proposed Action would be negligible. The Proposed Action is unlikely to impact the overall rate of climate change. Therefore, the effects of all activities associated with the Proposed Action to the overall condition of the population and economy is negligible. The Proposed Action's contribution to all past, present, and reasonably foreseeable future actions is negligible. Overall, the incremental contribution of the Proposed Action to cumulative effects is expected to be negligible. When combined with other past, present and reasonably foreseeable activities in Appendix B, the cumulative impact on population and economy would remain negligible.

4.11. Community Health

4.11.1. Proposed Action

Adverse effects on subsistence activities and harvest patterns could result in increased food insecurity and nutritional deficiencies (DHSS, 2011, p. 61), which could increase the risk of chronic illnesses related to diet and nutrition such as diabetes, high blood pressure, and cardiovascular disease (i.e., metabolic disorders). Risk of developing metabolic disorders increases with decreasing intake of subsistence foods (Curtis et al., 2005; McAninch, 2012; McGrath-Hanna et al., 2003; Reynolds et al., 2006; Wernham, 2007). The combination of diet (e.g., lean protein sources, low sugar levels, healthy fatty acids) and active lifestyle (i.e., physical exercise) associated with subsistence hunting, fishing, and gathering is the most important protective factor against developing metabolic disorders. Adverse effects to metabolic health could occur in Nuiqsut if subsistence resources became unavailable or undesirable for use as foods, or subsistence areas were avoided due to the Proposed Action. BOEM expects negligible to minor effects to subsistence activities and harvest patterns for Nuiqsut from the Proposed Action. If these potential impacts to subsistence activities were realized, effects to metabolic health and nutritional status would be negligible to minor for residents of Nuiqsut.

Social cohesion, interconnectedness, and stability in cultural identity and social institutions make up the core of community health and well-being in Nuiqsut, and research has shown connections between sociocultural continuity and mental health in the Arctic (Curtis et al., 2005). The process of sociocultural change, especially if dramatic and rapid, can cause stressors such as loss of traditional food resources and practices, unemployment, loss of cultural practices, psychological stress, and out migration. These experiences may overwhelm individuals in a community with feelings of loss of control, leading to depression, anxiety, substance abuse, and suicide (Curtis et al., 2005). BOEM does not expect the Proposed Action to dramatically or rapidly change the Iñupiaq culture of Nuiqsut or reduce cultural well-being. BOEM anticipates little to no impacts to social organization, cultural values, and formal institutions from the Proposed Action (Section 4.8.1). Therefore, there would be negligible impacts to sociocultural well-being and health in Nuiqsut from the Proposed Action.

Community members from Nuiqsut have expressed concerns about adverse health impacts due to air pollution emitted from oil and gas developments near the community (Ahtuangaruak, 2015; BLM, 2014, p. 462-463; NSB, 2015c; SRB&A, 2009). The most common health effects include causing and exacerbating respiratory illnesses such as asthma, cardiac arrhythmias, coronary artery disease, and excess mortality among vulnerable groups of people. Particulate matter is associated with increased respiratory symptoms, including irritation of the airways, coughing or difficulty breathing, chronic bronchitis, and decreased lung function (EPA, 2016). However, emissions from the Proposed Action are expected to have a negligible effect on air quality in Nuiqsut and other onshore locations (Section 4.1.1). There would be negligible impacts from accidental small oil spills to air quality; and the overall air quality analysis indicates negligible effects from the Proposed Action (Section 4.1.1). Emissions of air pollutants from the Proposed Action are not expected to result in losses of subsistence harvest opportunities or disruptions to sociocultural systems. BOEM anticipates no impacts to community health due to air pollution emissions.

A reduction in water quality as a result of the Proposed Action could impact community health if it occurred in waters used for subsistence hunting and fishing activities. It is expected that the Proposed Action will have negligible effects on marine water quality because there is no planned discharge of drilling wastes into the marine environment. The Proposed Action is not expected to impact drinking water supplies in Nuiqsut. BOEM expects no loss of subsistence harvest opportunities or disruptions to sociocultural systems due to increases in turbidity. Therefore, BOEM anticipates no impacts on community health related to water quality.

Potential effects to the economy could occur if the Proposed Action alters employment or income characteristics of the area, increases tax revenue, changes the population demographics of the area, or changes the workforce for residents of Nuiqsut. Income and employment also could strengthen community and cultural ties and improve diet and nutrition through better funded subsistence activities and more affordable and healthier imported foods. BOEM does not expect increases in employment, tax revenue, and economic growth in Nuiqsut or the NSB from the Proposed Action (Section 4.10.1). Resource development projects have potential to increase demand on local health care services, due to in-migration of workers or by increasing exposure of local residents to communicable diseases (HHIC, 2014). BOEM anticipates little in-migration of workers due to the Proposed Action (Section 4.10.1). During the 2-year life of the Proposed Action, therefore, impacts to community health from employment, income, and revenue would be negligible in Nuiqsut.

Small Oil Spills

Small spills have the potential to impact community health by disrupting subsistence harvest patterns. BOEM expects few impacts to subsistence activities from small spills. These disruptions to subsistence activities are not expected to affect community health.

Conclusion

BOEM does not anticipate that potential minor effects to subsistence would result in impacts to overall community health. Other important activities such as whale and caribou harvesting and sharing would not be affected. Overall, there would be negligible impacts to community health in Nuiqsut from the Proposed Action.

4.11.2. No Action Alternative

Under the No Action Alternative, BOEM would not approve Eni's EP and this would preclude Eni from evaluating the oil and gas resource potential of their federal leases within the Nikaitchuq North Harrison Bay Block 6423 Unit. This would also avoid the environmental impacts disclosed under the Proposed Action.

4.11.3. Cumulative Effects

Present and reasonably foreseeable future oil and gas activities could generate impacts to community health by impacting subsistence harvest patterns and sociocultural systems. The Proposed Action is short-term and would have negligible to minor effects to subsistence harvest patterns and negligible effects to sociocultural systems and community health. The Proposed Action will not benefit local community health due to construction of medical facilities, healthcare facilities, schools, or modern energy efficient homes. Air quality impacts (which could affect community health) from the Proposed Action, when combined with past actions and emissions from those actions, would have a negligible level of cumulative effect to onshore air quality. The Proposed Action does not include any intentional discharges to offshore waters; unintentional discharges would be small and impacts would to be negligible, and all permitted discharges would be regulated through Section 402 of the Clean Water Act to ensure compliance with State Water Quality Standards. The incremental contribution to cumulative impacts to water quality (which could affect community health) from past, current and reasonably foreseeable future activities is expected to be negligible. The Proposed Action is unlikely to impact the overall rate of climate change. Climate change could have negligible effects to community health during the two-year lifetime of the Proposed Action, however it is not expected to increase the incremental contribution of the Proposed Action to community health.

For the life of the project, the effects of all activities associated with the Proposed Action to the overall condition of community health are negligible. The Proposed Action's incremental contribution to all past, present, and reasonably foreseeable future actions is negligible. When combined with other past, present and reasonably foreseeable activities in Appendix B, the cumulative impact on community health would remain negligible.

4.12. Environmental Justice

4.12.1. Proposed Action

There is an important nexus between a subsistence way of life and Environmental Justice (EJ) communities. In the Alaska OCS Region, BOEM primarily focuses EJ analyses on Section 4-4 of EO 12898, entitled Subsistence Consumption of Fish and Wildlife (USDOI, BOEM, 2014). The EJ analysis addresses human populations with differential patterns of subsistence consumption of fish and wildlife (*59 FR 7629*, February 16, 1994, p.7631).

Subsistence continues to be the central organizing element of Iñupiaq society, and it is primarily through damage to subsistence resources and disruptions to subsistence activities and harvest patterns that environmental justice concerns can be assessed for Iñupiaq communities on the North Slope. Any major disruptions to local subsistence practices, sociocultural systems, or community health from the Proposed Action could cause disproportionately high and adverse impacts to EJ communities.

Overall, BOEM anticipates negligible effects to sociocultural systems, negligible to minor impacts to subsistence harvest activities, and negligible effects to community health as a result of the Proposed Action. These effects would not constitute disproportionately high and adverse impacts to EJ communities.

Conclusion

There would be no disproportionately high and adverse impacts to EJ communities from the Proposed Action.

4.12.2. No Action Alternative

Under the No Action Alternative, BOEM would not approve Eni's EP and this would preclude Eni from evaluating the oil and gas resource potential of their federal leases within the Nikaitchuq North Harrison Bay Block 6423 Unit. This would also avoid the environmental impacts disclosed under the Proposed Action.

4.12.3. Cumulative Effects

Iñupiat peoples are a recognized minority and the predominant residents of Beaufort Sea coastal communities in the NSB. Cumulative impacts from past, present, and reasonably foreseeable future actions are most relevant for the Iñupiaq community of Nuiqsut because it is located nearest the Proposed Action. BOEM expects negligible effects to sociocultural systems, population and economy, and community health for Nuiqsut as a result of the Proposed Action. For subsistence harvest practices, BOEM anticipates only negligible to minor effects to a limited range of harvest activities, particularly seal and eider hunting. The Proposed Action is short-term and will have no disproportionately high and adverse effects to human health and the environment in Nuiqsut (Section 4.12.1.). The effect of all actions associated with the Proposed Action to the overall condition of environmental justice communities is negligible. BOEM does not anticipate, in this relatively short timeframe, that climate change will alter the impacts of the Proposed Action to environmental justice communities during its 2-year life.

For the life of the project, the effects of all activities associated with the Proposed Action to the overall condition of environmental justice communities are negligible. The Proposed Action's incremental contribution to all past, present, and reasonably foreseeable future actions is negligible. Overall, when combined with other past, present and reasonably foreseeable activities in Appendix B, the cumulative impact on environmental justice communities would remain negligible.

CHAPTER 5. CONSULTATION AND COORDINATION

The following sections describe formal and informal consultations undertaken by BOEM with respect to the Proposed Action, as well as public involvement in the development of this Environmental Assessment. Also provided is a list of EA preparers and reviewers.

5.1. Endangered Species Act Consultation

Section 7(a)(2) of the Endangered Species Act (ESA) requires each Federal agency to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the adverse modification of designated critical habitat. BOEM consults with USFWS and NMFS for listed species under each Service's jurisdiction.

On May 8, 2012, the USFWS issued a Biological Opinion (2012 BO), which described the effects of certain oil and gas leasing and exploration activities in the U.S. Beaufort and Chukchi Seas to polar bears (*Ursus maritimus*), polar bear critical habitat, spectacled eiders (*Somateria fischeri*), spectacled eider critical habitat, Steller's eiders (*Polysticta stelleri*), Kittlitz's Murrelets (*Brachyramphus brevirostris*), and yellow-billed loons (*Gavia adamsii*). Similarly, NMFS, on April 2, 2013, issued a Biological Opinion (2013 BO), which described the effects of certain oil and gas leasing and exploration activities in the U.S. Beaufort and Chukchi Seas to bowhead whales (*Balanea mysticetus*), fin whales (*Balaneoptera physalus*), humpback whales (*Megaptera novaeangliae*), North Pacific right whales (*Eubalaena japonica*), Arctic ringed seals subspecies (*Phoca hispida hispida*), Beringia Western DPS bearded seals (*Erignathus barbatus barbatus*), and Western DPS Steller sea lions (*Eumetopias jubatus*).

To comply with Section 7 of the ESA, BOEM assessed whether additional consultation with either agency was required prior to rendering a decision on the EP. Both the USFWS BO and the NMFS BO set forth four circumstances under which BOEM would need to reinitiate Section 7 consultation.

After review, BOEM determined that the exploration activities proposed within Eni's EP are within the scope of activities analyzed in both the USFWS 2012 BO and the NMFS 2013 BO, and none of the circumstances warranting reinitiation of formal consultation are implicated here.

5.2. Essential Fish Habitat Consultation

The Magnuson-Stevens Fishery Conservation and Management Act (as amended) requires Federal agencies to consult with NMFS regarding actions that may adversely affect designated Essential Fish Habitat (EFH). This section evaluates the potential for "adverse effect" on EFH from the Proposed Action.

Essential Fish Habitat Assessment

The Magnuson-Stevens Fishery Conservation and Management Act (16 USC §§ 1801 to 1882) established regional Fishery Management Councils (FMCs) and mandated that Fishery Management Plans (FMPs) be developed to responsibly manage exploited fish and invertebrate species in Federal waters of the United States. Upon reauthorization of the act in 1996, the National Marine Fisheries Service (NMFS) was charged with designating and conserving Essential Fish Habitat (EFH) for species managed under existing FMPs. This requirement is intended to minimize, to the extent practicable, adverse effects on habitat caused by fishing or non-fishing activities, and to identify other actions to encourage the conservation and enhancement of such habitat.

"Essential fish habitat" as defined in the Magnuson-Stevens Act includes "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Regulations promulgated by the NMFS in 2002 (50 Code of Federal Regulations (CFR) §§ 600.805 to 600.930) further clarify EFH with the following definitions: "waters" refers to aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; "substrate" refers to sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" refers to the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" refers to stages representing a species' full life cycle.

The EFH regulations define an adverse effect as "any impact which reduces quality and/or quantity of EFH...[and] may include direct or indirect physical, chemical, or biological alterations of the waters or substrate, and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components if such modifications reduce the quality and/or quantity of EFH. Adverse effects to EFH may result from action occurring within EFH or outside of EFH and may include specific or habitat wide impacts, including individual, cumulative, or synergistic consequences of actions."

The North Pacific Fishery Management Council (NPFMC) is responsible for managing fisheries and habitat in the waters of the Beaufort Sea. NPFMC has produced several FMPs that identify EFH for Alaska waters. Those FMPs relevant to the Proposed Action are for salmonids (NPFMC, 2012) and the Arctic and saffron cods (NPFMC, 2009). Sometimes, within designated EFH, particular areas are identified as Habitat Areas of Particular Concern (HAPCs). No HAPCs are present in the vicinity of the Proposed Action.

Salmonids. The salmon species (family Salmonidae) for which EFH has been identified are pink salmon (*Oncorhynchus gorbuscha*), chum salmon (*O. keta*), coho salmon (*O. kisutch*), sockeye salmon (*O. nerka*), and chinook salmon (*O. tshawytscha*) (NPFMC, 2012). Although there is some interspecific variation, all five salmon species have anadromous life histories, with mature adults living in the sea and ascending coastal streams and rivers to spawn. EFH designations for marine juveniles, subadults, and mature adults of all five species include the Arctic Ocean. Alaska Department of Fish and Game maintains the Anadromous Waters Catalog of Alaska (AWC), which publishes an ongoing record of anadromous waterbodies documented by ADF&G to date in Alaska (Johnson and Litchfield, 2016). Anadromous freshwaters listed in the AWC are also considered EFH for salmon. Based on the data in the AWC (Johnson and Litchfield, 2016), there are several anadromous waters documented for salmon (primarily for pink and chum salmon) along the Beaufort Sea coastline from Point Barrow to Demarcation Bay at the U.S.-Canada boundary. EFH for eggs, larvae, freshwater juveniles, and freshwater/spawning adults, primarily for chum and pink salmon, is limited to streams and rivers outside of the Proposed Action.

Cods. The Arctic Fishery Management Plan (2009) designated EFH for late juvenile and adult life stages of Arctic cod (*Boreogadus saida*) in the Beaufort Sea from the Alaska coastline out to the Exclusive Economic Zone (EEZ). EFH for late juvenile and adult saffron cod (*Eleginus gracilis*) includes the nearshore environment ranging out to the 50 m contour (NPFMC, 2009). No EFH descriptions are available for eggs or larvae.

Impacts to Essential Fish Habitat

Noise

The Proposed Action may result in increased noise associated with drilling. Noise related impacts to fish are described in section 4.5.1. Drilling and vessel noise are expected to have little to no adverse effect on EFH or the managed species present in the area, although they would contribute to the overall background noise or noise pollution of the pelagic habitat (Slabbekoorn et al., 2010; Radford, Kerridge, and Simpson, 2014). Effects on managed species present in the area of the Proposed Action would be temporary, and only negligible effects on EFH are expected. Fish generally react to noise produced by swimming away or habituating (Jørgensen et al., 2004). Due to the short duration of this project and the fact that the Proposed Action impacts are already present in the existing environment, impacts to EFH are expected to be negligible.

Vessel Traffic

Vessel traffic is anticipated to remain at comparable levels to those supporting Nikaitchuq in recent years and would not lead to increased impacts on EFH in the Proposed Action area. Fish would be expected to exhibit avoidance behavior, and would return to the area after vessels have moved away (DeRobertis et al., 2003).

Oil Spills

Oil spills, although unlikely, may occur. BOEM does not anticipate that a large oil spill would occur, however small, accidental spills do have the potential to occur. For the purpose of this analysis, BOEM assumed that over the two-year duration of the Proposed Action, up to four small diesel spills could occur with a combined volume of no greater than 50 bbl (see Section A-4.1). These small spills would likely be into containment (e.g., contained by drip pans, the gravel island, or by snow/ice), and cleaned up immediately. If a small diesel spill did reach marine waters, it would evaporate and disperse within hours to a few days due to weathering (see Section A-5).

Habitat degradation is a possible effect of oil spills. These spills would be unlikely, as well as spatially small and temporally limited due to rapid dispersion and evaporation. Accidental spills contain many compounds that are toxic to all or some life stages of fish. Acute toxicity to managed species may result in the immediate aftermath of a spill where life stages of fish are directly exposed to toxic fractions of spilled oil or fuel. Accidental spills that enter the water column could cause adverse impacts, such as reduced fitness or even death, on pelagic fish and larvae. Strong-swimming fish exposed to accidental spills in the upper water column may be capable of swimming away from the exposure site. Eggs, larvae, and juvenile stages of fish in the water column would have greater exposure to oil due to their inability or limited ability for motility. Arctic cod, an important keystone fish species in the Arctic, has been shown to have especially high sensitivity to oil pollution when exposed as eggs (Nahrgang et al., 2016). Arctic cod are known to spawn under nearshore ice during the winter (Love et al., 2016), making their eggs particularly susceptible to exposure to any oil that reaches the marine environment during this time. Oil from a small spill that is allowed to sink to the seafloor would have localized adverse effects on the fish and fish prey found there. Delayed exposure may occur on a chronic level in areas where residual spilled oil is protected from physical degradation and continually releases harmful polycyclic aromatic hydrocarbons (PAHs) into the environment (Jewett et al., 2002; Peterson et al., 2003).

Oil from a small spill that is allowed to sink to the seafloor would have localized adverse effects on the fish and fish prey found there. Delayed exposure may occur on a chronic level in areas where residual spilled oil is protected from physical degradation and continually releases harmful polycyclic aromatic hydrocarbons (PAHs) into the environment (Jewett et al., 2002; Peterson et al., 2003). Rapid response to oil spills is expected to occur and would mitigate the severity of the effect on EFH. Small spills are expected to have negligible adverse effects on EFH because the spill is not likely to enter marine waters. If a small spill is not contained or cleaned up, it is anticipated that the oil would evaporate/disperse quickly and effects would be localized and short-term.

Conclusions

Based on the analysis in preceding sections, exploration activities associated with the Proposed Action may adversely affect designated EFH for Arctic cod, saffron cod, and Pacific salmon. Noise impacts are expected to be temporary and to have no permanent impact on EFH. Small, accidental fuel spills could temporarily degrade surface waters of the pelagic habitat but would not cause population level effects to managed species, and therefore would be considered a minor adverse effect. Though unlikely, spilled oil making landfall may also have minor effects on nearshore habitats. Mitigation measures such as avoiding drilling in broken ice and open water seasons to make potential spills easier to contain and clean up, as well as adherence to applicable permit requirements should help decrease the extent of adverse impacts on EFH.

5.3. National Historic Preservation Act Consultation

Rules for implementing Section 106 of the National Historic Preservation Act are found in 36 C.F.R. 800. This CFR states that: “If the undertaking is a type of activity that does not have the potential to cause effects on historic properties, assuming such historic properties were present, the agency official has no further obligations under section 106 or this part” (36 CFR 800.3[a][1]). The undertaking considered here entails drilling four exploration wells, consisting of two extended reach mainbores and two sidetracks, from an existing drilling facility. No new disturbances of the seafloor or any onshore areas would occur. This action is a type of activity that does not have the potential to cause effects on historic properties.

5.4. Tribal Consultation

The Bureau of Ocean Energy Management (BOEM)–Alaska Region is determined to carry out the tenets and spirit of Executive Order 13175 requiring Federal agencies to consult, on a government-to-government basis, with federally-recognized Indian tribes (Alaska Native tribes and communities) when developing Federal policies with tribal implications.

The consultation purpose is to "have an accountable process to ensure meaningful and timely input by tribal officials in the development of regulatory policies that have tribal implications." The order requires the head of each agency to designate an official "with principal responsibility for the agency's implementation" of the order.

Secretary of the Interior Ken Salazar issued Order 3317 on December 1, 2011, to update, expand, and clarify the Department's policy on consultation with Indian tribes in compliance with E.O. 13175. In summary, Order 3317 states that USDOI officials must demonstrate a meaningful commitment to consultation "by identifying and involving Tribal representatives in a meaningful way early in the planning process," and that consultation aims to create effective collaboration emphasizing "trust, respect, and shared responsibility..."

BOEM determined that Eni’s proposed exploration activities have tribal implications for the several village tribes along the Beaufort Sea coast, and with one regional tribal entity. These tribes include the Native Village of Kaktovik, the Native Village of Nuiqsut, the Native Village of Utqiaġvik (Barrow), and the Inupiat Community of the Arctic Slope (ICAS).

BOEM consulted with the Native Village of Nuiqsut Council, via teleconference, on Tuesday, June 27, 2017.

The Native Village of Kaktovik, the Native Village of Utqiaġvik, and ICAS declined invitations to participate in Government-to-Government consultation.

5.5. ANCSA Consultation

On August 10, 2012, the Department of the Interior issued a Policy on Consultation with Alaska Native Claims Settlement Act (ANCSA) Corporations. In this policy, Secretary of the Interior Ken Salazar restated a provision of ANCSA requiring that "[t]he *Director of the Office of Management and Budget [and all Federal agencies] shall hereafter consult with Alaska Native corporations on the same basis as Indian tribes under Executive Order 13175*."

Additionally, the policy “*distinguishes the Federal relationship to ANCSA Corporations from the government-to-government relationship between the Federal Government and federally recognized Indian Tribes... and [states that] this Policy will not diminish in any way that relationship...*”

BOEM determined that oil and gas leasing activities in the Beaufort Sea have potential Alaska Native Claims Settlement Act (ANCSA) corporation implications for the several village corporations along the Beaufort Sea coast, and with one regional ANCSA corporation. These ANCSA corporations include Kaktovik Inupiat Corporation (Kaktovik), Kuukpik Corporation (Nuiqsut), Ukpeagvik Corporation (Utqiaġvik /Barrow), and Arctic Slope Regional Corporation (ASRC).

BOEM consulted with Kuukpik Corporation, at their offices in Anchorage, Friday, June 23, 2017. BOEM also consulted with ASRC, in BOEM's Alaska Region Offices, Thursday, June 29, 2017.

The Kaktovik Inupiat Corporation and Ukpeagvik Corporation declined offers for Government-to-ANCSA consultations.

5.6. Public Involvement

BOEM provided opportunities for public involvement regarding the 2017 Nikaitchuq North EP and the preparation of this Environmental Assessment. These opportunities included:

- Soliciting public comments on the 2017 Nikaitchuq North EP. When BOEM "deemed submitted" the EP, a 21-day public comment period was then initiated from June 12, 2017 to July 3, 2017. Comments were received through Regulations.gov at Docket # BOEM-2017-0014.
- Soliciting public comments on the preparation of this EA. When BOEM "deemed submitted" the EP, BOEM then notified the public that the agency was preparing an Environmental Assessment and requested public input. A 10-day public comment period was initiated from June 12, 2017 to June 22, 2017 (12:00 midnight, EDT). Comments were received through Regulations.gov at Docket # BOEM-2017-0025.

All comments were reviewed and considered in the preparation of this EA.

5.7. Preparers

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Heather Crowley	BOEM Oceanographer	Lower Trophic Organisms, Fish
Maureen DeZeeuw	BOEM Wildlife Biologist	Marine and Coastal Birds
Lorena Edenfield	BOEM Fisheries Biologist	Lower Trophic Organisms, Fish
Pamela Grefsrud	BOEM Biologist	Water Quality, Vegetation and Wetlands
Michael Haller	Tribal Liaison	Government-to-Government Coordination
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Virgilio Maisonet-Montanez	BOEM Meteorologist	Oceanography, Air Quality, Climate Change
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Appendix A

Analysis of Accidental Oil Spills

A-1. INTRODUCTION

Oil spills are an issue of great public concern in relation to the offshore oil and gas industry. With the exception of rare events like the Macondo Well blowout (hereafter called the Deepwater Horizon (DWH)), the discharges of oil in the sea have declined over the years, even though petroleum consumption is increasing (USDOT, 2017a; USDOT, 2017b). Possible causes for the decline in oil discharges include passage of the Oil Pollution Act of 1990 (OPA 90), technology improvements, and implementation of safety-management systems that put into practice risk-reduction interventions. The DWH has heightened the industry's, regulator's, and public's awareness of the potential impacts of very large oil spill events.

This Appendix describes the results of the oil-spill analysis and includes the supporting documentation for those results. The oil-spill analysis considers the potential accidental oil spill discharges and their likelihood of occurrence, and then outlines the framework for the impact analysis of the alternatives. On June 12, 2017, the Bureau of Ocean Energy Management (BOEM) deemed "submitted" a proposed exploration plan from Eni U.S. Operating Co. Inc. entitled "Nikaitchuq North Exploration Plan" (hereafter, the "EP") for exploration drilling activities in the Harrison Bay Block 6423 Unit (leases OCS-Y-1753, OCS-Y-1754, and OCS-Y-1757). The EP proposes drilling up to four exploration wells, consisting of two extended reach mainbores and two sidetracks (Proposed Action), to evaluate the oil and gas resource potential of three of the company's Outer Continental Shelf (OCS) leases in the U.S. Beaufort Sea. The Proposed Action was evaluated for both routine operations and accidental conditions. Oil spills are considered accidental events, and the Clean Water Act and the Oil Pollution Act include both regulatory and liability provisions that are designed to reduce damage to natural resources from oil spills. An accident is an unplanned event or sequence of events that results in an undesirable consequence. In this analysis, the undesirable consequence is an oil spill in the environment.

BOEM previously analyzed a range of oil spill sizes (from small (<1,000 bbl) to very large (≥150,000 bbl)) and the likely consequences to environmental, social, and economic resources in the 2003 Beaufort Sea Planning Area, Oil and Gas Lease Sales 186, 195, and 202, Final Environmental Impact Statement (hereafter "Beaufort Sea Multiple-Sale EIS") (USDOI, MMS, 2003). The oil spill analyses in this EA tier from the Beaufort Sea Multiple-Sale EIS (USDOI, MMS, 2003, Sections IV.A.4, IV.C, IV.I, and Appendix A) and the Proposed Oil and Gas Lease Sale 195 Beaufort Sea Planning Area Environmental Assessment (USDOI, MMS. 2004, Sections IV.A, IV.B.1, and Appendix C). These analyses have been summarized and augmented with relevant new information.

A-2. SUMMARY: POTENTIAL OIL SPILL SIZE CATEGORIES

BOEM analyzes three potential oil spill size categories for exploratory operations in the Proposed Action: (1) a small spill (<1,000 bbl) from exploration operations; (2) a large spill (≥1,000 bbl) from exploration operations; and (3) a very large spill (≥150,000 bbl) from a well-control incident. Historical oil spill and modeling data demonstrate that the frequency of a large spill or a very large oil spill occurring during exploration is low; therefore, the impacts from a large or very large spill are not reasonably foreseeable. For purposes of this oil spill analyses, no large or very large crude or diesel spills are estimated for exploration activities (See A-4 for details). Nonetheless, this EA tiers to BOEM's prior analyses of the impacts of large and very large oil spills in the Beaufort Sea Multiple-Sale EIS (Sections IV.A.4, IV.C, IV.I, and Appendix A).

A-2.1. Summary: Small Spills (<1,000 bbl) From Exploration Activities

Historical Beaufort Sea and Chukchi Sea OCS exploration spill data suggest that a small spill is likely to occur. BOEM estimates up to four small spills could occur as a result of the Proposed Action. Historical OCS exploration, Alaska North Slope (ANS), and Nikaitchuq Development spill data suggest the spill(s) would be relatively small (Robertson et al., 2013; Eni, 2017b, Table 2-1). For purposes of analysis, the combined spill volume from small spills over the life of the project is estimated to range from <1 bbl to ≤ 50 bbl. BOEM assumes the small spill oil type would be diesel based on spill data, which show that the majority of small spills from each respective area were refined oil spills (Robertson et. al., 2013; Eni, 2017b, Table 2-1). BOEM assumes that a small diesel spill could be a result of mechanical or human error.

If not cleaned up immediately, a small diesel spill is estimated to last less than 3 days on open water, less than 20 days during melt-out, and at least 20 days on landfast ice based on oil weathering model calculations discussed in Section A-4.1.1. Chapter 4.0 of this EA analyzes the impacts of such small spills on oil specific resources.

A-2.2. Summary: Large Spills (≥1,000 bbl) From Exploration Activities

Historical OCS spill data demonstrate that a large spill is unlikely to occur as a result of the Proposed Action. No oil would be produced. All wells would be permanently plugged and abandoned or suspended in accordance with regulatory requirements on completion of drilling. Since 1971, of the approximately 15,000 OCS exploration wells drilled, there has been one large or very large spill (Deepwater Horizon).

The total volume of diesel fuel tanks located on the drilling facility for Nikaitchuq North exploration activities is 777 bbl; therefore, even if all the diesel fuel tanks ruptured, the volume spilled would not be equal to that of a large spill.

This EA tiers to previous analyses of large spills in the 2003 Beaufort Sea Multiple-Sale FEIS (USDOI, MMS, 2003a, pp. IV-23-IV-209) and Proposed Oil and Gas Lease Sale 195 Beaufort Sea Planning Area Environmental Assessment (US DOI, MMS, 2004, pp.30-48).

A-2.3. Summary: Very Large Oil Spills (≥150,000 Bbl) From Exploration Activities

There is abundant and reliable scientific data on the infrequency of an exploration well-control incident occurring and releasing fluids. A very large spill from a well-control incident is unlikely in connection with the exploration activities set forth in the EP (Eni, 2017a), and therefore, this EA tiers to analysis of very large oil spills in the 2003 Beaufort Sea Multiple-Sale EIS and summarizes and incorporates by reference the 2012-2017 and 2017-2022 Five-Year Programmatic EISs (USDOI, BOEM, 2012; USDOI, BOEM, 2016a).

In the 2003 Beaufort Sea Multiple-Sale EIS, BOEM analyzed the potential impacts of a very large oil spill from a well-control incident escalating into a long duration flow (USDOI, MMS, 2003, pp. IV-228-IV-247). In that analysis, BOEM evaluated impacts from a launch area (LA10) that contains Eni's current leases and from a pipeline (PL10) that runs along the SID. The effects analysis in the 2003 Beaufort Sea Multiple-Sale EIS considers the impact without mitigation and then further considers spill response as mitigation. Eni's Oil Spill Response Plan (OSRP) and Oil Discharge Prevention and Contingency Plan (ODPCP) (Eni, 2017b) address the potential immediate release of crude oil to the environment by a loss of well control during drilling.

A-3. OIL-SPILL VOLUME AND TYPE ESTIMATES

A-3.1. Oil Spill Potential Discharge Volume

Table A-1 summarizes the spill sizes and types for small (<1,000 bbl) and very large (≥150,000 bbl) spills. BOEM did not estimate a large spill volume for this EA because the combined volume of all diesel fuel tanks at the drilling facility, 777 bbl, is less than that of a large spill (Eni, 2017a, 2017b, Table EP-2). Nevertheless, for the purposes of analysis, BOEM provides updated analyses of a hypothetical large spill. Within each of BOEM's spill-size categories, the estimated potential discharge volume is considered the representative volume for that size category. The estimated range for the combined spill volume from small spill(s) is <1 bbl to ≤50 bbl. The blowout worst-case discharge (WCD) of 519,445 bbl is the estimated volume of a very large oil spill (Eni, 2017a). All spill volumes assume no pollution prevention or oil spill response measures are implemented.

Table A-1. Potential Discharge Volumes for Small and Very Large Oil Spills

BOEM Spill-Size Categories	Type/Cause	Product	Size	Duration	Methods to Prevent Potential Discharge
Small <1,000 bbl	hose or line failure/rupture, tank overflow/rupture, equipment leaks, fuel transfer, or vehicle related	Diesel	<1bbl to ≤50 bbl[1]	Instantaneous	Examples include: overfill protection, secondary containment (capacity of at least 110%), alarms, drip pans, fuel transfer procedures, inspections of tanks and secondary containment, personnel training, visual monitoring/video surveillance, equipment sensors, secondary containment for diesel line, HSE (Health, Safety, Environment) Program, Oil Discharge Prevention and Contingency Plan (ODPCP), Oil Spill Response Plan (OSRP), and foul weather contingency plan
Very Large ≥150,000 bbl	Uncontrolled flow at SID caused by Loss of Well Control Escalating to Blowout	Crude Oil	519,445 bbl	40 days	Blowout prevention equipment and procedures for well control. Layer I includes proper well planning, risk identification, training, routine tests, and drills on the rig. Layer II includes early kick detection and timely implementation of kick-response procedures. Layer III involves the use of mechanical barriers, including, but not limited to, blowout preventers, casing, and cement. Testing and inspections are performed to ensure competency. Eni also has the capability to control the blowout with a capping stack and relief well.

Source: USDOI, BOEM, 2017 and Eni US 2017a, b
[1] Total Cumulative Spill Volume from small spill(s)

A-3.2. Worst-Case Discharge Calculation for the Oil Spill Response Plan

The BOEM and BSEE regulations set forth how the volume for a WCD calculation is determined for an Exploration Plan or oil-spill-response planning scenario (30 CFR Part 254.47(b), BOEM Notice to Lessees (NTL) 2015-001 and 30 CFR 550.213(g)). The BSEE requires the WCD to be based upon the daily volume possible from an uncontrolled blowout flowing for 30 days (30 CFR 254.47(b)). The BSEE is reviewing Eni's OSRP to ensure that it demonstrates access to sufficient equipment and personnel needed to respond to such a well blowout. The WCD volume and storage capacities are calculated to address BOEM and BSEE's need to determine the adequacy of the company's spill-response capabilities.

Other BOEM regulations (30 CFR 550.213(g)-Blowout scenario) require a scenario for a potential blowout that will have the highest volume and maximum duration for a given well. In its EP, Eni estimated the maximum time it would take to regain well control (by capping stack or relief well drilling) should a blowout occur would be 40 days (Eni, 2017a, Section G Oil Spill Information). The cumulative volume discharged at 40 days would be 519,445 bbl (Eni, 2017a, Section G Oil Spill Information). This oil spill volume was calculated without consideration for any well bridging (rock naturally sealing the well) or spill response measures. The BOEM Office of Resource Evaluation conducted an independent verification of the WCD model submitted by Eni.

A-3.3. Comparison of WCD to Very Large Oil Spill

BOEM reviewed the VLOS elements analyzed in the Beaufort Sea Multiple-Sale EIS (Section IV.I.1) to determine if the WCD estimates provided in the EP were within the scope of the VLOS scenario. In calculating the flow rate, length of flow, and volume, the 2003 Beaufort Sea Multiple-Sale EIS analysis did not consider the reduced volume that may have been achieved through the use of oil spill countermeasures.

BOEM determined that the very low-probability, very large oil spill scenario, and conclusions with respect to the effects analysis provided in the 2003 Beaufort Sea Multiple-Sale EIS remained valid and that the analysis was sufficient to inform the decision maker of the effects of a low-probability, very large oil spill in the vicinity of the Proposed Action. Table A-2 compares VLOS scenario elements to WCD information provided by Eni.

Table A- 2. Comparison of VLOS Scenario Elements to Eni EP WCD Information.

Description	Beaufort Sea Multiple-Sale EIS	Nikaitchuq North 02 (NN02)	2012-2017 and 2017-2022 Five-Year Programmatic EISs
Initial Flow Rate	15,000 barrels	25,957 barrels[1,2]	n/a
Length of Flow	15 days	40 days	60-300 days
Volume	225,000 barrels	519,445 barrels	1.7-3.9 million barrels
Oil Type	30 °API	40° API	Medium
Location	Open Water, Broken Ice, Landfast Ice	Landfast Ice	Varies

Source: Eni, 2017a; USDOI, MMS, 2003; USDOI, BOEM 2012, 2016a
Key: °API = American Petroleum Institute gravity (API)
[1]Provided as required by 30 CFR 550.213(g), 550.219(a)(2)(iv) and 254.47(b)
[2]Represents volume at the end of the first 24 hours of flow; the rate decreases after the first day.

A VLOS is a subset of large spills sometimes also called catastrophic. For the 2017-2022 Five-Year Program Final PEIS (USDOI, BOEM, 2016a), BOEM defined a reasonable range of potentially catastrophic OCS spill sizes by applying extreme value statistics to historical OCS spill data (Ji et al., 2014). Extreme value statistical methods and complementary methods (Bercha Group, 2014) were used to quantify the potential frequency of different size spills following loss of well control. In combining the estimated per well spill frequency (4.16×10^{-5} spills per well drilled), for spills greater than or equal to 519,445 bbl (VLOS volume), with the estimated total number of potential wells that penetrate the reservoir, 4 (2 mainbores and 2 sidetracks), no very large spills are estimated to occur over the life of the exploration project. The per well frequency of spills, caused by a loss of well control incident equal to or exceeding 519,445 bbl, is derived using the equation from the 2017-2022 Five-Year Programmatic EIS Program Final PEIS (USDOI, BOEM, 2016a).

A-4. HISTORICAL AND MODELED OIL SPILL INFORMATION

The historical oil spill and model data indicate it is unlikely a large or very large oil spill will result from a well-control incident during exploration drilling or other exploration operations based on:

- The low rate of OCS and ANS exploratory drilling well-control incidents that spilled fluids per well drilled (Bercha, 2014; Robertson et al., 2013; USDOI, BOEM 2016a,b). Since 1971, there has been just one OCS spill (large/very large) during the drilling of approximately 15,000 OCS exploration wells.
- No large or very large spills occurred while drilling 36 exploration wells to depth in the Arctic OCS. Exploration spills on the Arctic OCS and Alaska North Slope have all been small.

- The low number of proposed exploration wells (up to four) being drilled.
- There is no production of crude oil.
- All wells will be permanently plugged and abandoned or suspended when exploration ceases.
- Storage tanks will be routinely inspected and have secondary containment to prevent a spill from reaching the environment.
- The total volume of diesel tanks on the drilling facility will have a capacity <1,000 bbl, which is less than the size of a large spill.
- Offshore safety, well-bore integrity, pollution prevention and oil spill response regulations and methods, implemented by BOEM, BSEE and Industry, since the DWH event (USDOI, BOEM, 2012, Section 4.3.3.3.4; USDOI, BOEM, 2016b).

For further information on crude and diesel spills from exploration operations and well-control incidents see USDOI, BOEM (2015a, Appendix A, Sections A.1.2.2 through A.1.2.4; 2015b, Appendix A, Section A-4.3-1; 2012, Section 4.3.3.3.3; 2016a, Section 3.4; 2016b, Sections 2.3.3 and 2.4).

A-5. OIL-SPILL ANALYSIS FRAMEWORK

A-5.1. Small Oil Spills

This section provides the small oil spill analysis framework used to estimate spill frequency and size. Small spill estimates are based on a review of potential discharges, historical oil spill data, and the likelihood of oil spill occurrence. This estimate is based on:

- The fact that 99.3% of all OCS petroleum spills are <50 bbl and 95.8% are <1 bbl (Anderson, Mayes and LaBelle, 2012, Figure C-3).
- Historical Beaufort Sea and Chukchi Sea OCS exploration spill volumes have all been small (≤20 bbl). (USDOI, BOEM, 2015, Appendix A; Table A.1-2)
- 98.19% of all ANS spills are (≤200 bbl) and the median spill size for all spills is 3 bbl (Robertson et al., 2013).
- Eni’s tanks have secondary containment (at least 110% containment), overfill protection, and are routinely inspected.
- Eni’s fuel transfer procedures include holding pre-transfer conferences, using only trained personnel, use of drip pans, and the monitoring of meter readings and hose connections.
- The diesel line that runs from Oliktok Production Pad to SID is housed within an outer pipe to contain a potential leak, has spacers to prevent abrasion between the inner and outer pipes, and is monitored for leaks.
- Eni conducts monitoring of potential ice conditions such as ice movement, ice override, ice ridging, and open leads.
- Speed limits and the use of signs to reduce the chance of a spill from a vehicle accident.
- Video surveillance and equipment sensors used to detect spills when SID is unmanned.
- Implementation of a foul weather contingency plan and active HSE (Health, Safety, Environment) Program, Oil Discharge Prevention and Contingency Plan (ODPCP), and Oil Spill Response Plan (OSRP) when necessary.
- The design of facilities (able to account for temperature fluctuations).

Historical Beaufort Sea and Chukchi Sea OCS exploration spill data suggest that a small spill is likely to occur. Thirty-six exploration wells were drilled in the Arctic OCS from 1981-May 2017, and two top holes have been drilled through 2012. During that time period, 36 small spills have occurred spilling a total of 26.7 bbl (24 bbl recovered). Based on the total number of small spills that have occurred and exploration wells drilled , the small spill rate for the Proposed Action was estimated to be 1 small spill per well drilled. Accordingly, BOEM estimated up to 4 small spills could occur as a result of the Proposed Action, corresponding to the number of exploration wells that could be drilled (up to 4 wells).

Historical OCS exploration, ANS, and Eni spill data (Eni, 2017b; Table 2-1) suggest the small spill(s) would be relatively small. For purposes of analysis, a spill ranging from <1 bbl to ≤ 50 bbl was chosen as the representative volume for a small spill. This spill size was based on historical data, which indicated that 99.3% of all OCS spills are <50 bbl, and 95.8% are <1 bbl (Anderson, Mayes, and LaBelle, 2012, Figure C-3). The largest Arctic OCS exploration spill was less than 20 bbl. In addition, the average of ANS spills >10 bbl and ≤200 bbl is 44.5 barrels (inclusive of spills that occurred at Prudhoe Bay, Kuparuk, and Milne Point fields; Robertson et al., 2013, p. 62).

BOEM assumed the type of oil spilled from a small spill would be diesel based on historical data, which shows that the majority of small spills that occurred were refined oil spills (Robertson et al., 2013; Eni, 2017b, Table 2-1). The average amount of diesel spilled during Nikaitchuq development operations has been about 3 bbl from four diesel spills, with a total volume of approximately 13 bbl.

Beaufort Sea and Chukchi Sea OCS exploration spill data show that causes of small spills were primarily related to leaks, overfilling of tanks, fuel truck spills, fuel transfer spills, and line ruptures. Spills that occurred on the ANS during exploration were caused by mechanical failure or human error (Robertson et al., 2013). Diesel spills that have occurred at the Nikaitchuq development were either weather related, caused by human error, occurred during refueling, or caused by a diesel transfer line leak (Eni, 2017b; Table 2-1).

BOEM assumes that a small diesel spill could occur from any of the following scenarios: hose or line failure, tank overflow, tank rupture, equipment leaks, fuel transfer, or diesel line leak/rupture. BOEM also assumes that a small spill could occur during any time of year.

A-5.1.1. Modeling Simulations of Oil Weathering

To evaluate the fate of a small diesel spill that escapes containment or is not cleaned up, BOEM makes estimates regarding how much oil evaporates, how much oil is dispersed, and how much oil remains after a certain time periods.

In the unlikely scenario in which a 50 bbl diesel spill were to escape containment, reach the environment, and no cleanup response were to take place, BOEM estimates the diesel spill would last for less than 3 days on open water, less than 20 days during a melt-out spill, and for at least 20 days on landfast ice. BOEM derives the weathering estimates from the SINTEF Oil Weathering Model Version 3.0 (Reed et al., 2004). Table A-3 summarizes the estimates for the fate and behavior of a 50 bbl diesel spill.

Table A-3. Fate and Behavior of a 50 bbl Diesel Spill during Summer, Winter, or Melt-out.

Oil Status	Summer Spill[1]						Winter Landfast Ice Spill[2]					Melt-out Spill[3]				
Time After Spill (Hours)	**1**	**6**	**12**	**24**	**48**	**72**	-	-	-	-	-	-	-	-	-	-
Time After Spill in Days	-	-	-	-	-	-	**1**	**2**	**3**	**5**	**20**	**1**	**2**	**3**	**5**	**20**
Oil Remaining (%)	95.8	78.7	56.7	24.4	2.1	0	66	53.7	46.6	36.2	17.7	63.5	43.7	29.5	9.8	0
Oil Dispersed (%)	0.6	8.2	20.6	43.2	60.2	61.7	na	na	na	na	na	4.8	12.7	20.9	32.9	39.2
Oil Evaporated (%)	3.8	13.1	22.7	32.4	37.7	38.3	34	46.3	53.4	63.8	82.3	31.7	43.6	49.6	57.3	60.8

Notes: Calculated with the SINTEF oil-weathering model Version 4.0 of Reed et al. (2005) and assuming an Ultra Low Sulfur Diesel (SEA and SINTEF 2015).
[1] Summer or Open Water (July to September), Wind Speed 5.0 m/s, surface water temperature 4.0°C
[2] Winter (October to May) Wind Speed 6.0 m/s, surface temperature 0.0°C; only evaporation as spill is on surface of landfast ice.
[3] Meltout (June to July) spill is assumed to occur into 50% ice cover with surface water temperature of 2.0°C and wind speed of 5.0 m/s.
Summer Water Temperature is based on Dasher et al., 2016.
Wind speeds during summer, winter or melt-out are based on average wind speeds measured at Oliktok, Cottle Island and Milne Point from the years 1979-1999, 2002-2009, or 2001-2009, respectively.

A-5.1.2. Spill Prevention and Response for Small Oil Spills

Response equipment and trained personnel would be available on site to deploy recovery equipment for the control and removal of product spilled into the environment as described in the ODPCP (Eni, 2017b). See Section 2.5 Oil Spill Response and Exercise Requirements for further information. Eni has containment and recovery strategies for spills during all seasons. Winter strategies include containment using snow berms, containment of spills on ice using trenches and sumps, mechanical recovery techniques, and ice mining. Summer strategies include booming, skimming, and the use of hoses and pumps. Eni has fluid transfer procedures as part of its Health, Safety, and Environmental Program. During fluid transfers, communication among personnel and a constant line of sight would be maintained to prevent spills from occurring. Drip pans would also be used under all connections. The drilling facility has primary containment as well as lined and bermed barriers around rig equipment. The secondary containment around tanks serves as a barrier and decreases the chance that spills contact the environment. Inspections of tanks as well as containment would be routine. Further, wellheads are within well containment shelters, which can contain spills.

A-5.2. Large and Very Large Oil Spills

As stated previously, this EA tiers to previous analyses of large and very large accidental oil spills in the 2003 Beaufort Sea Multiple-Sale EIS. The chance of a large (≥1,000 bbl) spill during exploration activities is very low, but BOEM routinely analyzes their effects. The potential consequences of a large spill in the Beaufort Sea were analyzed in the 2003 Beaufort Sea Multiple-Sale EIS (USDOI, BOEM, 2003a, pp. IV-23 IV-209). In the 2003 Beaufort Sea Multiple-Sale EIS, based on OCS median spill sizes BOEM estimated a 1,500-bbl diesel, condensate or crude oil spill from a facility or a 4,600-bbl crude or condensate oil spill from a pipeline for purposes of analyzing a large spill volume (Anderson and LaBelle, 2000).

After the Exxon Valdez oil spill in 1989, BOEM, Alaska OCS Region analyzed very large spills in several OCS locations; seven of which were in the Beaufort Sea (USDOI, MMS, 1990a, 1990b, 1991, 1995a, b, 1996, 1998, 2002, 2003; USDOI, BLM and MMS, 1998, 2003; USDOI, BLM, 2005, USDOI, BOEMRE, 2011; USDOI, BOEM, 2012, 2015a, 2016a). The frequency of a very large spill (≥150,000 bbl) is also very low. The potential effects were most recently analyzed in the 2012-2017 and 2017-2017 Five-Year Programmatic FEISs for a total volume of 1.7 – 3.9 MMbbl lasting 60-300 days (USDOI, BOEM, 2012, Table 4.4.2-2; 2016a). In the unlikely event of a very large accidental oil spill, the potential for major impacts exist as was identified in the Beaufort Sea Multiple-Sale EIS (USDOI, MMS, 2003a, pp. IV-228-IV-IV-247).

The conditional probabilities estimated by the Oil-Spill Risk Analysis (OSRA) model (expressed as percent chance) of a spill ≥1,000 bbl contacting environmental resource areas (ERAs) or land segments within a given time frame from launch areas (LA10 or PL10), assuming a spill occurs, are discussed in the 2003 Beaufort Sea Multiple-Sale EIS. In the unlikely event of a large or very large accidental oil spill, there is potential for impacts as identified in those analyses (USDOI, MMS, 2003a, pp. IV-23 - IV-209 and IV-228 - IV-247).

A-5.2.1. Conditional Probabilities

The OSRA summer and winter conditional probability results (expressed as percent chance) for LA10 and PL10 are from the Beaufort Sea Multiple-Sale EIS (USDOI, MMS, 2003a, Appendix A, Table A.2-19 through A.2-30 and A.2-37 through A.2-48). The existing conditional probability information for LA10 and PL10 (USDOI, MMS, 2003a, Appendix A) was determined to be applicable for the proposed exploration wells, Nikaitchuq North (NN01) and Nikaitchuq North (NN02).

Probabilities in the following tables (Tables A-4 and A5), unless otherwise noted, are conditional probabilities estimated by the OSRA model (expressed as percent chance) of a spill ≥1,000 bbl contacting ERAs, LSs and Grouped Land Segments (GLSs) within the days and seasons as specified below. The chance of a large spill contacting, assuming a large spill occurs, is summarized specifically for the LA10 and PL10. The estimated conditional probabilities do not factor in pollution prevention, pre-booming or spill response, of any kind. A successful or partially successful spill response would reduce the chance of spill contact or make contact nonexistent for some resources.

Table A-4. Summer/Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at LA10 or PL10 Beaufort Sea Multiple-Sale 186, 195, 202 Will Contact a Certain Land Segment Within 3, 10, 30 and 360 Days Assuming a Spill Occurs.

Land Segment Number	Land Segment Area	Summer LA10 (Time in Days)				Summer PL10 (Time in Days)				Winter LA10 (Time in Days)				Winter PL10 (Time in Days)			
		3	10	30	360	3	10	30	360	3	10	30	360	3	10	30	360
24	Walakpa Bay, Walakpa River	--	--	--	1	--	--	--	--	--	--	--	1	--	--	--	--
25	Barrow, Elson Lagoon	--	--	1	2	--	--	--	1	--	--	--	2	--	--	--	2
26	Dease Inlet	--	--	--	2	--	--	--	1	--	--	--	1	--	--	--	1
27	Kugorak Bay	--	--	1	1	--	--	--	1	--	--	--	2	--	--	--	1
28	Cape Simpson	--	--	--	--	--	--	1	1	--	--	--	2	--	--	--	1
29	Ikpikpuk River, Smith Bay	--	--	--	1	--	--	--	--	--	--	--	1	--	--	--	1
30	Drew Point, McLeod Point	--	--	1	3	--	--	--	4	--	--	--	2	--	--	--	2
31	Lonely AFS Airport, Pitt Point, Pogik Bay	--	--	2	4	--	--	2	3	--	--	1	8	--	--	1	8
32	Cape Halkett	--	2	5	7	--	3	7	9	--	--	1	9	--	1	1	10
33	Atigaru Point, Kogru River	--	1	3	4	--	1	3	4	--	--	--	2	--	1	1	1
34	Fish Creek	--	1	4	5	--	1	4	5	--	--	--	2	--	--	--	2
35	Colville River	--	3	5	7	1	5	6	8	--	--	1	6	--	1	2	10
36	Oliktok Point	1	4	6	8	10	13	15	16	1	1	1	5	5	6	6	11
37	Milne Point, Simpson Lagoon	1	4	7	8	1	4	5	6	1	1	1	6	--	1	1	4
38	Kuparuk River	--	2	2	3	--	1	1	2	--	--	--	1	--	--	--	--
39	Point Brower, Prudhoe Bay	--	1	2	3	--	1	1	3	--	--	--	1	--	--	--	1
40	Foggy Island Bay, Kadleroshilik River	--	--	1	2	--	--	--	1	--	--	--	1	--	--	--	--
41	Bullen Point, Point Gordon, Reliance Point	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--
42	Point Hopson, and Sweeney, Staines River	--	--	1	1	--	--	1	1	--	--	--	--	--	--	--	--
43	Brownlow Point, Canning River	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--
44	Collinson Point, Konanevik Point	--	--	--	--	--	--	1	1	--	--	--	--	--	--	--	--
47	Kaktovik	--	--	--	1	--	--	--	1	--	--	--	1	--	--	--	--
53	Komakuk Beach, Fish Creek	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--
55	Herschel Island	--	--	--	1	--	--	--	--	--	--	--	1	--	--	--	1
59	Shingle Point	--	--	--	4	--	--	--	3	--	--	--	--	--	--	--	--
63	Outer Shallow Bay, Olivier Islands	--	--	--	1	--	--	--	1	--	--	--	--	--	--	--	--
64	Middle Channel, Gary Island	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--

Note: -- = less than 0.5%. For Environmental Resource Areas, see Maps A-2a through A-2d for Land Segments, see Maps A-3a and A-3b; and for Spill Areas LA10 and PL10, see Maps A-4a and A-4b
Source: Johnson, Marshall, and Lear (2002) or USDOI, MMS (2003, Appendix A).

Table A-5. Summer/Winter Conditional Probabilities (Expressed as Percent Chance) that an Oil Spill Starting at LA10 or PL10 Beaufort Sea Multiple-Sale 186, 195, 202 Will Contact a Certain Environmental Resource Area Within 3, 10, 30 and 360 Days Assuming a Spill Occurs.

ID	Environmental Resource Area	Summer LA10 (Time in Days)				Summer PL10 (Time in Days)				Winter LA10 (Time in Days)				Winter PL10 (Time in Days)			
		3	10	30	360	3	10	30	360	3	10	30	360	3	10	30	360
	Land	3	17	41	71	13	29	50	73	--	3	7	52	6	9	13	57
2	Point Barrow, Plover Islands	--	--	1	4	--	--	1	3	--	--	--	3	--	--	--	3
3	Thetis and Jones Islands	7	16	23	26	19	26	30	33	1	3	3	20	4	5	7	27
4	Cottle and Return Islands, West Dock	3	7	10	13	2	5	7	9	--	1	2	8	--	1	2	5
5	Midway Islands	1	3	4	5	--	1	3	3	--	--	--	2	--	--	--	1
6	Cross and No Name Islands	--	2	4	4	--	2	3	3	--	--	--	2	--	--	--	1
7	Endicott Causeway	--	1	1	2	--	--	1	1	--	--	--	1	--	--	--	--
8	McClure Islands	--	1	1	2	--	--	1	1	--	--	--	--	--	--	--	--
9	Stockton Islands	--	--	1	1	--	--	1	1	--	--	--	--	--	--	--	--
11	Maguire Islands	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--
12	Flaxman Island	--	--	1	1	--	--	1	1	--	--	--	--	--	--	--	--
13	Barrier Islands	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--
15	Jago and Tapkaurak Spits	--	--	--	1	--	--	--	1	--	--	--	1	--	--	--	1
18	Icy Reef	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--
24	Beaufort Spring Lead 6	--	--	--	--	--	--	--	--	--	--	1	3	--	--	--	2
25	Beaufort Spring Lead 7	--	--	--	--	--	--	--	--	--	--	1	3	--	--	1	3
26	Beaufort Spring Lead 8	--	--	--	--	--	--	--	--	--	--	2	5	--	--	2	7
27	Beaufort Spring Lead 9	--	--	--	1	--	--	--	1	--	--	2	6	--	--	2	7
28	Beaufort Spring Lead 10	--	--	--	2	--	--	--	2	--	4	8	14	--	4	6	12
29	Ice/Sea Segment 1	--	--	1	2	--	--	1	1	--	--	--	--	--	--	--	--
30	Ice/Sea Segment 2	--	1	4	7	--	1	4	6	--	--	--	1	--	--	--	2
31	Ice/Sea Segment 3	3	10	18	21	6	12	20	15	1	2	2	3	1	2	3	3
32	Ice/Sea Segment 4	24	29	35	37	16	20	26	36	6	7	7	7	4	5	5	5
33	Ice/Sea Segment 5	2	5	8	10	--	1	5	15	--	--	1	1	--	--	--	--
34	Ice/Sea Segment 6	--	--	2	2	--	--	1	3	--	--	--	--	--	--	--	--
35	Ice/Sea Segment 7	--	--	--	1	--	--	--	1	--	--	--	--	--	--	--	--
36	Ice/Sea Segment 8	--	--	--	1	--	--	--	1	--	--	--	--	--	--	--	--
37	Ice/Sea Segment 9	--	--	--	1	--	--	--	1	--	--	--	--	--	--	--	--
40	Wainwright Subsistence Area	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--
41	Barrow Subsistence Area 2	--	--	--	2	--	--	2	4	--	--	--	--	--	--	--	--
42	Nuiqsut Subsistence Area	--	--	--	1	--	3	6	14	--	--	--	--	--	--	--	--
43	Kaktovik Subsistence Area	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
48	Ice/Sea Segment 11	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	3--
49	Hanna's Shoal Polynya	--	--	--	1	--	--	--	1	--	--	--	3	--	--	--	3
50	Ice/Sea Segment 12	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	1
51	Ice/Sea Segment 13	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	1
52	Ice/Sea Segment 14	--	--	--	1	--	--	--	1	--	--	--	3	--	--	--	5
53	Ice/Sea Segment 15	--	1	6	11	--	2	7	11	--	1	6	15	--	1	7	17
54	Ice/Sea Segment 16a	3	16	33	38	3	19	35	40	3	15	27	42	3	17	27	43
55	Ice/Sea Segment 17	34	47	55	57	18	29	38	40	32	46	51	61	17	26	30	43
56	Ice/Sea Segment 18a	1	6	11	12	--	2	7	8	1	2	4	8	--	--	1	4
57	Ice/Sea Segment 19	--	--	2	3	--	--	1	2	--	--	--	2	--	--	--	1
58	Ice/Sea Segment 20a	--	--	1	8	--	--	1	6	--	--	--	2	--	--	--	11
59	Ice/Sea Segment 21	--	--	--	7	--	--	--	4	--	--	--	1	--	--	--	1
60	Ice/Sea Segment 22	--	--	--	7	--	--	--	4	--	--	--	2	--	--	--	2
61	Ice/Sea Segment 22	--	--	--	4	--	--	--	2	--	--	--	4	--	--	--	4
62	Ice/Sea Segment 24a	--	--	--	3	--	--	--	1	--	--	--	3	--	--	--	3
65	ERA 1	--	--	2	3	--	--	2	3	--	--	1	5	--	--	1	5
66	ERA 2	--	3	8	11	--	4	8	11	--	1	4	19	--	2	5	20
67	Ice/Sea Segment 16b	3	16	33	37	3	19	35	39	1	6	11	27	1	8	12	28
68	Harrison Bay	--	2	6	7	--	3	7	8	--	1	1	6	--	1	2	7
69	Harrison Bay/Colville Delta	2	8	16	19	6	14	21	24	--	1	2	15	1	3	4	23
70	ERA 3	27	43	53	55	48	58	64	65	9	15	17	36	16	20	22	45
71	Simpson Lagoon	4	12	17	20	20	27	31	32	1	2	3	17	5	6	6	23
72	Gwyder Bay	--	2	2	3	1	2	2	3	--	--	--	1	--	--	--	1
73	Prudhoe Bay	--	1	1	1	--	--	--	1	--	--	--	--	--	--	--	--
74	Cross Island ERA	2	6	10	11	--	4	7	8	--	1	1	5	--	--	--	2
75	Water over Boulder Patch 1	--	2	2	4	--	--	1	2	--	--	--	1	--	--	--	--

76	Water over Boulder Patch 2	--	1	2	4	--	--	1	1	--	--	--	1	--	--	--	--
77	Foggy Island Bay	--	--	1	2	--	--	1	1	--	--	--	1	--	--	--	--
79	ERA 4	--	2	4	5	--	1	3	4	--	--	--	2	--	--		1
80	Ice/Sea Segment 18b	1	6	11	12	--	2	7	8	--	1	1	5	--	--	1	2
82	ERA 5	--	--	--	1	--	--	--	1	--	--	--	--	--	--	--	--
83	Kaktovik ERA	--	--	--	1	--	--	--	1	--	--	--	1	--	--	--	1
84	Ice/Sea Segment 20b	--	--	1	6	--	--	1	4	--	--	--	1	--	--	--	--
85	ERA 6 (Cross Island)	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--

Note: -- = less than 0.5%. All rows with all values less than 0.5% are not shown. For Environmental Resource Areas, see Maps A-2a through A-2d; for Land Segments, see Maps A-3a and A-3b; and for Spill Areas LA10 and PL10, see Maps A-4a and A-4b.2 (All maps in USDOI, MMS, 2003).

Source: USDOI, MMS (2003).

A-5.2.2. Large Accidental Oil Spills

This section summarizes relevant analysis provided in the Beaufort Sea Multiple-Sale EIS (USDOI, MMS, 2003), and updates that analysis with new and site-specific information concerning potential impacts from a large oil spill. A large oil spill, as defined by BOEM, is an oil spill with a total volume that is greater than or equal to 1,000 bbl. The chance of one or more large spills occurring is low; however, BOEM comprehensively analyzed the potential consequences of a hypothetical large spill in the Beaufort Sea Multiple-Sale EIS (*Section IV.C. Analysis of Effects by Resource by Alternatives*), Sale 195 EA, Sale 202 EA, Camden Bay EA, (Section 5.7) and the 2012-2017 and 2017-2022 FPEISs (Sections 4.4 and 4.4.5, respectively) for likely consequences to all resources. Based on OCS median spill sizes, the BOEM estimated spills ranging from a 1,500-5,100-bbl diesel or crude oil spill from a facility or a 1,700- 4,600 -bbl crude oil spill from a pipeline for purposes of analyzing a large spill size (Anderson and LaBelle, 2000; Anderson, Mayes and LaBelle, 2012; ABS 2016).

The following paragraphs describe the effects of a large oil spill on the identified resources.

A-5.2.2.1. Air Quality

A large oil spill would cause an increase in the concentrations of volatile organic compounds (VOC) which could affect onshore air quality (USDOI, MMS, 2003, p. IV-245). Although effects would be localized and temporary, concentrations of criteria pollutants may exceed the federal and Alaska ambient air quality standards during the initial phases, particularly in the vicinity of the event. Major impacts at the spill-site may cause only minor impacts onshore, depending on how far from shore the spill occurs. The Proposed Action would be located 3 miles from shore and over 35 miles from closest community, Nuiqsut.

Hanna and Drivas (1993) modeled the emissions of various hydrocarbon compounds from a large spill. The results showed that these compounds evaporate rapidly within a few hours after the spill occurs. Large spills (≥1,000 bbl) would result in VOC increases over a larger area and a longer period of time. Most of the VOCs considered hazardous by USEPA are reduced by 99% within 12 hrs after a spill. Heavier compounds take longer to evaporate, and therefore air concentrations may not peak until 24 hr after the spill. VOC concentrations in the immediate vicinity of the spill could be high during the first day but concentrations of criteria pollutants would remain within the NAAQS. Over time, air quality would return to pre-spill conditions. Impacts from large spills could be moderate in the immediate vicinity of the spill for a short time after the spill but would be minor after about 12 hrs (2012-2017 5 Year PEIS p 4-224-4-226).

Air quality impacts from accidental oil spills in open water during the Proposed Action would be similar to those described above. However, a spill in the Arctic during broken ice or melting ice conditions could result in more concentrated emissions over a smaller area than would be the case under open-water conditions because the ice would act to reduce spreading of the oil compared to the spreading of a spill in open water (2012-2017 5 Year PEIS p 4-224-4-226). The sea-surface spreading of an oil spill on solid sea ice would be relatively slow compared to a spill in open water. The more volatile components of the oil would evaporate rather rapidly, but the heavier compounds would linger on the surface. The effects on air quality would result in more concentrated emissions over a smaller area than would be the case for a spill in open water (2012-2017 5 Year PEIS p 4-224-4-226).

Responding to an accidental oil spill there are three activities that could have an impact on air quality these activities include in-situ burning, mechanical recovery and dispersants.

In-situ burning is one potential technique for cleanup and disposal of spilled oil. In-situ burning as part of a cleanup of spilled crude oil or diesel fuel would increase emissions of NOx, SO2, and CO, but would decrease emissions of VOCs as compared to evaporation. Cleanup of a large oil spill would likely result in detectable impacts to air quality conditions when considering the emissions from the oil, either evaporative or from burning, combined with all the emissions from vessels, equipment, and personnel needed to remove the oils. Thus, the methods and consequences of the process and methods used to remove oil from a large spill may actually outweigh the air effects of the oil itself. From this perspective, a large oil spill, would be likely to have a minor effect both offshore and onshore, and although short-lived, could occur over a large area.

Mechanical recovery physically removes oil from the ocean through the use of devices such as containment booms and skimmers. Dispersants are chemical agents, such as surfactants, solvents, and other compounds, that break up the oil slick by decreasing interfacial tension between water and oil. Both mechanical recovery and dispersants are applied by marine vessels or by aircraft, whose emissions are the primary contributor to the local increase in emissions. Consequently, EPA suggests that using dispersants for oil-spill cleanup would cause a negligible impact on air quality (EPA, 2015).

Large spills are likely to have minor levels of effect on air quality. Air quality impacts immediately following a large spill would be short-term. The potential effects of oil spill response activities on air quality include a negligible impact from mechanical recovery operations and use of dispersants and a minor impact from in situ burning of large spills.

A-5.2.2.2. Water Quality

Water quality would be adversely affected by hydrocarbons from a large oil spill, resulting in hydrocarbon contamination of the water. Hydrocarbons could exceed the Alaska Water Quality Standards for the total aqueous hydrocarbons (TAqH) criterion of 15 µg/l (parts per billion) and for the total aromatic hydrocarbons (TAH) criterion of 10 µg/l (parts per billion) (ADEC, 18 AAC 70). A broad-scale increase of dissolved petroleum in the surface water and water column would cause toxicity conditions for organisms. Over the long-term, contamination of aquatic environments, particularly by polycyclic aromatic hydrocarbons (PAHs) in the sediments, would continue to occur. Sunlight (UV radiation) increases the toxicity of PAHs so summer sunlight in arctic Alaska could exacerbate the amount and degree of toxicity.

Under Arctic conditions (i.e., cold water and air temperatures), weathering processes would be much slower than in warmer climates (USDOI, MMS, 2008b). Seasonality and the specific spill location would cause variability in effects (e.g., summer versus winter in the Beaufort Sea). If a spill were to occur on ice, the volatile compounds from such a spill would be more likely to freeze into the ice within hours to days rather than dissolve or disperse into the water below the ice. A hydrocarbon plume in the water column underneath the ice could persist with concentrations that are above background levels for a distance that would be five times greater than that in the open sea (USDOI, MMS 2008b; USDOI, BOEM 2012, p.IV-190 – 192). The impact to water quality from a large oil spill could be moderate, depending upon numerous physical, chemical and biological processes that begin to transform the petroleum hydrocarbons once they enter the marine environment. These factors vary depending upon the location, magnitude, spatial extent and duration of exposure.

A-5.2.2.3. Vegetation and Wetlands

The potential effects on wetlands and vegetation would primarily be associated with impacts from spills of oil and other petroleum hydrocarbons and subsequent cleanup efforts. Heavy oiling of vegetation and wetlands would kill some plants through fouling, smothering, and poisoning from direct contact with the oil (USDOI, MMS, 2003, p. IV-137). Higher mortality and poorer recovery of vegetation generally result from spills of lighter petroleum products (such as diesel), heavy deposits of oil, spills during the growing season, contact with sensitive plant species, completely oiled plants, and deep penetration of oil and accumulation in substrates. Oil that reaches the root system would result in high levels of mortality (USDOI, BOEM 2012, p. IV-258-261).

Spill cleanup actions might damage wetlands through trampling of vegetation, incorporation of oil deeper into substrates, increased erosion, and inadvertent removal of plants or sediments, all of which could have long-term effects (NOAA, 1994, 2000; Hoff 1995; USDOI, BOEM, 2012, p. IV-258-261).

The NOAA Environmental Sensitivity Index (ESI) shoreline classification system classifies coastal habitats on a scale of 1 to 10, according to habitat sensitivity to spilled oil, oil-spill retention, and difficulty of cleanup (NOAA, 1994). Habitats with high ESI values are given a higher priority for protection. The ESI shoreline classification for the Beaufort Sea coasts includes habitats with high values, such as inundated lowland tundra or salt/brackish-water marshes, both ranked 10 (USDOI, MMS 2002d; USDOI, BOEM 2012, p. IV-258-261). Stranded oil on sheltered intertidal areas, especially along upper shorelines, likely would persist for many years.

Adverse impacts to vegetation and wetlands from a large spill are dependent upon a variety of factors including, spill volume, duration of exposure to oiling and re-oiling, extent of oil coverage on exposed vegetation and roots, and degree of substrate oiling. The impact to vegetation and wetlands from a large spill could be moderate to major depending upon these factors and the location, spatial extent and duration of the large spill.

A-5.2.2.4. Lower Trophic Organisms

The effects of a large oil spill on phytoplankton vary widely, depending on the concentration and type of oil or compounds used in the experiments and on the species being tested. Nevertheless, general patterns do exist, and both laboratory and field studies have shown that hydrocarbons typically inhibit phytoplankton growth at higher concentrations (USDOI, MMS, 2003: p. IV-30). In cases where studies have been conducted following large oil spills, there was found to be a lack of long-term effect on phytoplankton populations. This is thought to be due to the relatively rapid turnaround rate of phytoplankton generations and the influx of phytoplankton from unaffected areas that replace the population levels. Effects on phytoplankton populations would be highest in the summer during periods of bloom concentrations that are most likely to occur in early July and late August. The effects of petroleum based hydrocarbons on invertebrates have been observed by both field based observations and laboratory testing. Effects are highly varied and depend upon species tested and levels of exposure. When considering zooplankton, it is known that exposure to sunlight increases toxicity of petroleum by the enhanced creation of polcyclic aromatic hydrocarbons from raw crude. A study by Duesterloh and Shirley (2004) noted increased toxicity in copepods with exposure to these products, with copepods being considered as important components of zooplanktonic masses. In general, the effect of the oil associated with a large oil spill would depend on the amount of sunlight, wind speed and duration, air and water temperature, and the composition of the oil. However, based on the assumptions associated with weathering of Prudhoe Bay crude oil, within 10 days of a spill occurring during the summer season, 26% of the oil would have evaporated, 58% would remain on the surface, and 16% would be dispersed through the water column. Dispersed and dissolved oil in the water column has the greatest potential of adversely affecting zooplankton and benthic or pelagic invertebrates.

Much of the impact magnitude depends on the location of the spill, the direction of bottom currents, and the amount of oil released. Impact magnitude would typically increase with the size of the spill. Large spills would temporarily reduce habitat quality over large areas of pelagic habitat, however, the oil would be broken down by natural processes, and pelagic habitat would recover. Large spills would affect a wide area of benthic habitat and potentially persist in the sediment for an extended period. Oil from most surface spills is likely to reach the sediment only at biologically negligible concentrations. Spills that persist long enough to reach shore could contaminate shoreline benthic communities. Sublethal impacts that would occur on exposed benthic organisms would include reduced feeding, reduced reproduction and growth, physical tissue damage, and altered behavior. Benthic habitat would recover without mitigation because of natural breakdown of the oil, sediment movement by currents, and reworking by benthic fauna.

Spill response activities could include mechanical recovery methods and in-situ burning of spilled materials. Increased vessel traffic, with corresponding increases in vessel discharges and noise, would also be associated with spill cleanup operations. Planktonic organisms, such as zooplankton (including fish and invertebrate larvae) and phytoplankton, may be affected by mechanical recovery of spilled material, as they are located in the water column and are generally unable to move away from oil without a current, which would carry the spilled material with it. Physical damage from containment and collection procedures may occur. These effects of mechanical recovery would be short-term and localized to the spill area. Benthic organisms would not likely be affected by mechanical recovery activities occurring at the surface. The effects of mechanical recovery on lower trophic organisms would be minor.

In-situ burning of spilled oil is used to remove oil from the surface and would impact lower trophic organisms in the immediate area due to increased water temperature and residue from the burn sinking to the bottom. Death of planktonic organisms is expected in the area of the burn. At the seafloor, residue from a burn can sink and smother benthic organisms. These effects are expected to be short-term and localized to the immediate burn area, and would be considered minor.

Spill impacts and cleanup operations will be influenced by time of year. An oil spill occurring into ice may persist for a longer period of time than during ice-free conditions (Buist, et al., 2008; Payne, McNabb, and Clayton, 1991). Should oil be trapped and persist in the environment, the effects on lower trophics would be expected to be greater than for summer response efforts. Natural processes would aid the degradation of the oil and gas released during a large spill, but at a slower rate than in warmer summer waters. Under calm conditions and cold temperatures in restricted waters, vertical mixing and dissolution would be reduced (Buist et al., 2008). A large spill occurring on or under ice would be trapped and persist until the ice melted, allowing the spill to disperse (Drozdowski et al., 2011), and trapped oil can be transported by currents to areas more distant from the site of the accidental spill. Volatile components of the spill would be more likely to freeze into the ice rather than evaporate. Response efforts would be hindered and aided by the presence of ice. Ice will contain a spill (reduce spreading), concentrate it, and may act as a barrier to shoreline oiling. However, ice may also make a spill difficult to detect, locate, and access. Oil trapped under the ice may persist longer in the environment than oil spilled in open water, and have a greater impact on lower trophic organisms. Effects are unlikely to be population-level, though, as planktonic communities can quickly recover, and benthic community impact would be limited spatially by the settling of oil. Effects of a large oil spill on these organisms would likely be minor to moderate due to the levels of oil released to the environment, with these effects being highly dependent upon the physical forcing mechanisms that move and break down the oil within the environment.

A-5.2.2.5. Fish

Effects of a large oil or diesel spill on arctic fishes, including Pacific salmon, would depend on the season of the spill, the location of the spill; the life stage of the fishes (adult, juvenile, larval, or egg) affected; and the duration of the exposure. A large oil spill would cause acute and chronic toxicity effects to individual fish and local fish populations that could take multiple generations to recover to their former status.

Large spills would degrade fish habitat and potentially reduce the habitat value and ecosystem function in the areas affected. Impacts from spills would be greatest if a large spill occurred during a reproductive period or contacted a location important for spawning or growth such as intertidal and nearshore subtidal habitats. A large oil spill that contacted estuarine and riverine waters and EFH could affect the year's salmon smolts and eggs. If the oil contacted nearshore Beaufort Sea fish spawning and feeding habitat, fish such as capelin and arctic cod would be affected. Depending on the location, timing and duration of a large oil spill, EFH and regional fish populations would be affected. Impacts would generally increase with the size of the spill. The oil would be transported from the area as well as broken down by natural processes. Wave and wind action, weathering, and biological degradation by microbes would dissipate oil in the surface water, and EFH would be reestablished after some period of time. It is anticipated that pelagic eggs and larval stages of fish, whose movements are largely controlled by water currents, would be killed if they came into contact with surface oil spills (Patin, 1999; Peterson et al., 2003). Conversely, evidence indicates that the majority of adult pelagic fish can likely detect and avoid heavily oiled waters in the open sea, thereby avoiding acute effects (Patin, 1999). Because pelagic species of fishes in the Beaufort Sea and Chukchi Sea Planning Areas are widely distributed, even a large oil spill is not likely to cause population-level impacts on most fish populations.

Toxic fractions of oil in the parts-per-billion range can cause sublethal impacts on developing fishes. Depending on the timing and severity of an oil spill, adult anadromous fish migrating from marine waters to fresh water to spawn and juveniles migrating seaward from freshwater could be harmed by high concentrations of hydrocarbons. Most adult managed species in the Beaufort and Chukchi Seas are highly mobile and would likely avoid oil spills by temporarily moving to other areas. However, small obligate benthic species and egg and larval life stages of managed species as well as planktonic organisms that serve as their prey may be unable to avoid hydrocarbon spills. In addition, oil reaching the intertidal zone can persist in the sediments and cause sublethal impacts on fish eggs and larvae for multiple years (Peterson et al., 2003).

Spill response activities could include mechanical recovery methods and in-situ burning of spilled materials. Increased vessel traffic, and corresponding increases in vessel discharges and noise, would also be associated with spill cleanup operations. If clean-up operations include sections of the beach, or intertidal zones, access to spawning or overwintering habitat for some species may be restricted.

Pelagic fishes may be affected by mechanical recovery of spilled material, but are expected to avoid an oiled area and to move away from vessels and booms or skimmers. However, these avoidance impacts would be short-term and localized to the spill area. Benthic fishes and shellfish would not likely be affected by mechanical recovery activities occurring at the surface. The effects of mechanical recovery on fish resources would be negligible.

In-situ burning of spilled oil is used to remove oil from the surface and would impact fish in the immediate area due to increased water temperature and residue from the burn sinking to the bottom. Death of pelagic fishes that did not move away from the spill is possible in the immediate burn area. As with lower trophic organisms, residue from a burn can sink and smother benthic fish. These effects are expected to be short-term and localized to the immediate burn area, and would be considered minor.

Spill impacts and cleanup operations will be influenced by time of year. An oil spill occurring into ice may persist for a longer period of time than during ice-free conditions (Buist et al., 2008; Payne, McNabb, and Clayton, 1991). Under calm conditions and cold temperatures in restricted waters, vertical mixing and dissolution would be reduced (Buist et al., 2008). A large spill occurring on or under ice would be trapped and persist until the ice melted, allowing the spill to disperse (Drozdowski et al., 2011), and trapped oil can be transported by currents to areas more distant from the site of the accidental spill. Volatile components of the spill would be more likely to freeze into the ice rather than evaporate. Response efforts could be both hindered and aided by the presence of ice. Ice will contain a spill (reduce spreading), concentrate it, and may act as a barrier to shoreline oiling. However, ice also will make a spill difficult to detect, locate, and access. Natural processes would aid the degradation of the oil and gas released during a large spill, but at a slower rate than in warmer waters. Increased vessel traffic would add noise to the environment, and would increase the chance of small discharges from response vessels. Effects to fish would be extremely short-term and would have negligible impact overall. Effects are unlikely to be population-level, though, as fish can avoid areas of spilled oil.

Overall, the severity of effects of accidental hydrocarbon spills on fish resources would depend on the size of the spill, its location, environmental factors, and the uniqueness of the affected area. Large spills that reach coastal areas could have persistent impacts and could require remediation. Most adult managed species could avoid hydrocarbon spills in open water areas, but small obligate benthic species, eggs, larvae, and some managed species and their prey could experience lethal and sublethal effects from contact with hydrocarbons. Overall, impacts to fish would range negligible to minor for large spills (≥1,000 bbl).

A-5.2.2.6. Birds

Although it is considered unlikely that a large spill will occur, BOEM had previously analyzed the impacts of large spills and in this section updates and summarizes that analysis. Many species of birds could be affected by a large oil spill associated with the Proposed Action. The magnitude and extent of impacts would be a function of a variety of factors, including the time of year of the spill, the volume and product type of the spill, the habitats exposed to the spill, the species exposed to the spill or that utilize the exposed habitats, and environmental conditions (e.g., wind, waves, sea ice which can affect oil spills and oil spill response in many ways such as trapping oil, impacting extent of oiling, rate of oil migration and weathering, and response strategies and timeline (Arctic Council, EPPR, 2015).

An unlikely large spill (assumed for purposes of analysis to be either 1,500 or 4,600 bbl), depending on the season and location, would be more difficult to contain and may expose relatively large numbers of birds. Exposure of eggs and young and adult birds to oil may result in a variety of lethal and sublethal effects. Oil may foul habitats, reducing habitat quality and contaminating vegetation and lower trophic and fish food sources. Ingestion of contaminated foods may lead to a variety of lethal and sublethal toxic and physiological effects. Oil spill response activities may disturb birds in nearby habitats that are unaffected by an oil spill.

Certain species of birds can be more susceptible to contact with spilled oil than others, based on their life histories. For example, molting and staging sea ducks aggregate in dense flocks in late summer through autumn in coastal lagoons. Other waterfowl and shorebirds may be especially susceptible to spills that reach the beach intertidal zone, deltas, or inshore wetland habitats where these species frequently forage, raise young, stage and stopover in flocks on migration. Large spills that reach coastal barrier islands and mainland coastal wetland areas in spring have the potential to expose hundreds or possibly thousands of migrating shorebirds, as well as contaminate nesting and foraging habitats and oil nests and eggs of common eider, gulls, and others.

A modeling effort by USFWS and MMS for large spills that could potentially originate at the original Liberty Project approximately 95 km (58 mi) east of the Proposed Action estimated mortality levels of king and common eiders, scoters, and glaucous gull in the hundreds and long-tailed ducks typically between one thousand and low thousands during the peak exposure period (i.e., July and August) (Stehn and Platte, 2000).While current OSRA modeling design and certain project-specific environmental parameters differ somewhat from Stehn and Platte (2000), local bird distributions and broad-scale modeling parameters remain similar, and roughly similar mortality levels ultimately would be expected from a hypothetical large spill associated with the Proposed Action. In some cases, modelled mortality levels may have a lower level or more temporary impact than predicted previously for Liberty. For example, previous analyses in the Beaufort Sea Multiple-Sale EIS (USDOI, MMS, 2003: 106) and subsequent LS 202 EA (USDOI, MMS, 2006: 46) considered that mortality levels could result in a significant long-term adverse effect on the local (ACP) long-tailed duck population due to its declining status. The species is generally more heavily distributed closer to the Liberty project area than the Proposed Action, however, and now the local population is believed to be stable (Bowman et al., 2015). The fraction of its total ACP population killed would likely be small enough, given a stable population, that it would be expected to recover in the relative short-term following a one-time event such as a localized oil spill (Stehn and Platte, 2000) that caused mortality in the low thousands.

Most birds at risk of exposure are only present in the near the Proposed Action for three to five months out of the year. During winter, given low bird numbers and restriction of oil movement in their habitats, it is unlikely that more than a handful of birds, primarily landbirds that may occur in the area year-round, would be at risk of exposure. A winter spill retained under the ice, however, could contaminate ice leads that develop during spring break-up, exposing eiders and other waterbirds that use these features while migrating.

The exposure of birds could range from acute (lethal) to chronic (birds are exposed to smaller amounts of oil over a longer period of time). Common routes of exposure to oil include covering skin or feathers, inhalation of vapors, and ingesting oil or contaminated prey. Chronic exposure can lead to reproductive effects and reduced food sources and fitness. Along with the tendency to aggregate in flocks and the difficulties involved in cleaning up spills in remote areas and the wide variety of possible ice conditions, the potential for large numbers of birds to be affected by oil spills is in part due to toxicity of oils to individual birds and their prey. Additionally, lightly oiled birds could bring oil contamination to a nest, impacting reproductive success, while heavily oiled birds would be unable to return to the nest, resulting in abandonment and starvation of the young. Prey items and other food resources used by birds may also be reduced in quantity (e.g., fish or invertebrate prey may experience mortality as a result of a spill, or there may be effects to primary producers that carry up through the food web).

Spill response activities may disturb and displace birds from their preferred foraging, nesting, brood rearing, molting, staging, or resting habitats. The duration of cleanup activities may not only displace birds currently present but also preclude arriving birds from using the area. Depending on the use of those habitats (e.g., nesting, molting, staging), displaced birds could incur reduced reproductive success or survival. Food resources and nests can also be damaged or crushed by mechanical spill response. Response activities associated with a large spill may involve hundreds of workers and numerous boats, aircraft, and onshore vehicles, operating in the affected area for a year or more. Response activities can have positive effects as well, potentially indirectly hazing additional birds from landing in oiled areas, and shortening the period of habitat recovery. The resultant combination of impacts to birds from large spills and large spill response can be complex and vary widely according to species.

Threatened and Endangered Species

Spectacled eider. As diving sea ducks that use marine waters throughout the open water season, ESA-listed spectacled eiders are among the birds most individually susceptible to the effects of oil spills and spill response efforts associated with the Proposed Action. Compared to other sea ducks in the Central Beaufort Sea vicinity, however, their vulnerability to exposure tends to be lower because they are relatively widely distributed and do not tend to occur in large flocks while in these waters (Stehn and Platte, 2000).

Previous analyses in the Beaufort Sea Multiple-Sale EIS (USDOI, MMS, 2003: IV-91), updated in the Lease Sale 195 EA (USDOI, MMS, 2004: 31), found that mortality of spectacled eiders from a large oil spill was expected to be fewer than 100 individuals, although any substantial losses (25+ individuals) would represent a considerable effect and recovery from substantial mortality would not occur while the population exhibited a declining trend. The Lease Sale 202 EA, reached the same conclusion, but added that while an oil spill, under certain conditions, would result in a potentially significant effect to spectacled eiders, the coincidence of all the occurrence, presence, timing, environmental and response factors that would have to occur simultaneously to result in such an impact to spectacled eiders is improbable, and large impacts to spectacled eiders were not reasonably certain to occur (USDOI, MMS, 2006: 34). Current analysis (Bowman et al., 2015) shows that the ACP breeding population of spectacled eider has been stable since surveys began in the early 1990s. It is still anticipated that between 25-100 spectacled eider may suffer mortality from a large oil spill associated with the Proposed Action, and the impacts are likely to be widespread, given the migratory nature of the species and potential additional indirect impacts to nests, etc. caused by the spill and spill response efforts. Because the population is now considered stable, impacts from an improbable spill event may be long-lasting or short-term, but would be expected to be less than severe.

Steller's Eider. The abundance of Steller's eider is so low and distribution so scattered in the Alaskan Beaufort Sea that it is unlikely that the population would be exposed to a large oil spill associated with the Proposed Action. Previous analyses in the Beaufort Sea Multiple-Sale EIS (USDOI, MMS, 2003: IV-98), updated in the Lease Sale 195 EA (USDOI, MMS, 2004: 32) concluded that only a minor proportion of the small Alaskan breeding population of Steller's eider is likely to be vulnerable to an oil spill. The Lease Sale 202 EA reached the same conclusion, but added that while an oil spill under certain conditions would result in a potentially significant effect to Steller's eiders, the coincidence of all the factors that would have to occur simultaneously to result in such an impact to Steller's eiders is improbable, and that considerable impacts to Steller's eiders were not anticipated (USDOI, MMS, 2006: 34). This latter finding is updated to include this basis of coincidental improbability for the Proposed Action and conclude that there would be little impact from a large spill to listed Steller's eider.

Conclusion. Accidental large oil spills could affect both birds and their habitats. The magnitude and ecological importance of any effects would depend upon the size of the spill, the species and life stages that are exposed, and the size of the local bird population. A winter spill under ice could increase cleanup difficulties and potentially result in greater impacts than a spill in ice-free conditions. Large spills, especially those that enter coastal lagoons and delta areas, may result in lethal and sublethal effects, including reduced reproductive success, for birds using those habitats for nesting, molting and staging. Impacts to marine and coastal bird populations from a large oil spill would potentially be widespread, given the migratory nature of birds. For some vulnerable populations, effects could be long-lasting. Impacts to threatened and endangered eider species would be expected to be negligible for Steller's eider and moderate for spectacled eider. Conversely, a larger spill could occur in an OCS area in winter when few birds are present and have only a minor impact, in part via habitat effects, on bird species. The effects to birds that result from large spills and large spill response combined can be complex and vary widely according to species. Overall, impacts on birds from a large accidental spill is anticipated to range from negligible to moderate.

A-5.2.2.7. Marine Mammals

Bowhead Whales. In the unlikely event of a large oil spill, the probability of oil contacting whales is likely to be considerably less than the probability of oil contacting bowhead habitat. If a spill occurred and contacted bowhead habitat during the westward fall migration, it is likely that some whales would be contacted by oil (USDOI, MMS, 2003: p. IV-79). The number of whales contacting a large spill would depend on the timing, and duration of the spill and the whales' ability or inclination to avoid contact. The extent of the effects would depend on how many whales contacted oil, the duration of contact, and the age/degree of weathering of the spilled oil (USDOI, BOEM, 2012, 2016; NMFS, 2013: p. 234-237). The Beaufort Sea Lease Sale 195 EA (USDOI, MMS, 2004: p. 40) concluded that whales exposed to a large spill likely would experience temporary, nonlethal effects; however, the number likely would be small. This impact would depend on the timing and duration of the spill, as bowhead whales are migratory in this portion of the Beaufort Sea.

Feeding bowhead whales are also sometimes observed aggregating in large numbers during the summer open-water season, when they could also be vulnerable to a spill (USDOI, BOEM, 2012). If a large amount of fresh oil contacted a substantial portion of such an aggregation, effects potentially could be greater than typically would be assumed. However, based on available information about the effects of oil on large cetaceans, there was no evidence that any impact on this population from an oil spill would be likely to result in a considerable effect. The population is robust, and the population is, as evidenced by its continued increase despite a documented lethal removal in the subsistence hunt, resilient to relatively small removals. Based on published information, the amount of mortality, if any, due to an unlikely large oil spill, is not likely to be large. The analysis for the Lease Sale 202 EA (USDOI, MMS, 2006a: p. 35) in the central Beaufort Sea also concluded that no significant impacts to the bowhead whale were expected, including the effects of an oil spill.

Humpback Whales. Previous analysis in the Beaufort Sea Multiple-Sale EIS (USDOI, MMS, 2003) and subsequent EAs (USDOI, MMS, 2004, 2006) did not consider the humpback whale to be present in the central Beaufort Sea. However, in 2007, two humpback whales were observed in the Beaufort Sea (Hashagen et al. 2009), approximately 273 km (170 mi) west of the Proposed Action. While these were extralimital observations of humpback whales in the summer, the number of whales contacting spilled oil from the Proposed Action, if any, would be very small and depend on the size, timing, and duration of the spill and the whales' ability or inclination to avoid contact. The extent of the effects would depend on the small number of whales contacted by oil, the duration of contact, and the age/degree of weathering of the spilled oil (USDOI, BOEM, 2012, 2016).

Beluga Whales. Previous analyses in the Beaufort Sea Multiple-Sale EIS (USDOI, MMS, 2003: p. IV-121) and subsequent EAs (USDOI, MMS, 2004: p. 41, 2006: p. 35) concluded that a large spill could affect fewer than 10 beluga whales, with the population recovering within about 1 year. Beluga whales would be most vulnerable to oil contact during the spring migration (April-June) off Point Barrow, approximately 350 km (217 mi) from the Proposed Action. Contamination of the ice-lead system from an oil slick during spring migration could directly expose several whales to some oil-spill contact. However, such contact is expected to be brief or intermittent and probably would not result in any deaths of healthy whales or have long-lasting sublethal effects after short exposure. The probability of oil-spill occurrence and contact with the lead system during the spring period is very low (less than 0.5%). The likely physical reaction between oil, ice, water temperature, and wind off Point Barrow appreciably would reduce the chance of an oil slick persisting in the lead system. Therefore, belugas of the western Beaufort population may have some contact with an oil spill that would temporarily contaminate the spring lead system off Point Barrow; however, few, if any, beluga whales are likely to be seriously affected, even in a severe situation, with no long-term effect on the population. In the context of new information that had become available since publication of the Beaufort Sea Multiple-Sale EIS, subsequent NEPA conclusions remained consistent; thus, the updated potential level of effect on beluga whales was expected to be about the same as stated in Beaufort Sea Multiple-Sale EIS.

Ringed Seals. Previous analyses in the Beaufort Sea Multiple-Sale EIS (USDOI, MMS, 2003: p. IV-120) and subsequent EAs (USDOI, MMS, 2004: p. 41, 2006: p. 35) concluded that a large spill could affect perhaps 100-200 ringed seals, with the population recovering within about 1 year. In the context of new information that has become available since publication of the Beaufort Multiple Sale FEIS (i.e., NMFS, 2013), those NEPA conclusions remained consistent; thus the updated potential level of effect on pinnipeds was expected to be about the same as stated in the Beaufort Multiple Sale FEIS.

Bearded Seals. Previous analyses in the Beaufort Sea Multiple-Sale EIS (USDOI, MMS, 2003: p. IV-120) and subsequent EAs (USDOI, MMS, 2004: p. 41, 2006: p. 35) concluded that a large spill could affect 30-50 bearded seals, with the population recovering within about 1 year. In the context of new information that had become available since publication of the Beaufort Multiple Sale FEIS (i.e., NMFS, 2013), those NEPA conclusions remained consistent; thus the updated potential level of effect on pinnipeds was expected to be about the same as stated in the Beaufort Sea Multiple-Sale EIS.

Spotted Seals. Previous analyses in the Beaufort Sea Multiple-Sale EIS (USDOI, MMS, 2003: p. IV-120) and two subsequent EAs (USDOI, MMS, 2004: p. 41, 2006: p. 35) concluded that a large spill could affect 10-20 spotted seals, with the population recovering within about 1 year. A spotted seal haulout on Oarlock Island in the Colville River Delta is located several miles south of Spy Island. At any given time only a few 10's of spotted seals may be found at the island, indicating it is not a major haulout area for the species. Considering the proximity of the haulout and the low number of seals using it, a large spill should not significantly increase the number of spotted potentially affected by a large spill. In the context of new information that had become available since publication of the Beaufort Sea Multiple-Sale EIS (i.e., NMFS, 2013), those NEPA conclusions remained consistent; thus the updated potential level of effect on pinnipeds was expected to be about the same as stated in the Beaufort Sea Multiple-Sale EIS .

Polar Bears. Recent analyses of the impacts of large oil spills on polar bears in the central Beaufort Sea concluded that polar bears occur in this area at extremely low densities, minimizing the potential for oiling or killing large numbers of polar bears (USFWS, 2012: p. 104; 81 FR 52303). The extent of the effects of oil would depend on the number of polar bears impacted by the oil, the duration of contact, and the age/degree of weathering of the spilled oil (USDOI, BOEM, 2012, 2016; USFWS, 2012: p. 104). If a large spill occurred in the central Beaufort Sea, polar bears would be most susceptible to the impacts during the open-water and broken-ice periods (summer and fall) when polar bears can be concentrated in the nearshore environment (i.e., on barrier islands and in areas where beach-cast marine mammal carcasses occur, such as Cross or Barter Island) (USFWS, 2012: p. 104). Known polar bear aggregations tend to be seasonal during the fall, and this further minimizes the potential of a spill to impact the polar bear population (*81 FR 52304*, August 5, 2016). In addition, consuming oiled prey could also impact polar bears (*81 FR 52304*, August 5, 2016).

In the event that a large marine oil spill occurs or persists into the fall in areas where large numbers of polar bears congregate, the oil could contact and possibly kill tens of polar bears (USFWS, 2012: p. 104). This corresponds with previous analyses. An analysis in the Beaufort Sea Multiple-Sale EIS (USDOI, MMS, 2003: p. IV-120) in the Beaufort Sea concluded an estimated 5-30 bears could be susceptible to oiling and thus injury or death. This estimate was based on the number of polar bears observed by bowhead whale aerial surveys conducted on Cross and Barter Islands, areas where subsistence fall bowhead whale harvests occur. In addition, subsequent EAs (USDOI, MMS, 2004: p. 41, 2006: p. 35) concluded the likely loss of polar bears would be no more than 6-10 bears, assuming a bear density of 1 bear per 25 km2 divided into 143-252 km2, the calculated area of a large spill. In this analysis, the polar bear population was expected to recover individuals killed by the spill within 1 year and there would be no effect on the population. In the most recent USFWS analysis for oil and gas activities in the central Beaufort Sea, they concluded that in the event of a large spill, the likelihood that oil would contaminate areas occupied by large numbers of bears was low (*81 FR 52303*, August 5, 2016). While individual bears could be negatively affected by a spill, the potential for a population-level effect would be low, but could potentially be higher if the spill contacted an area where large numbers of polar bears were gathered (*81 FR 52303*, August 5, 2016).

Pacific Walrus. Pacific walruses do not normally range into the Beaufort Sea, although individuals and small groups have occasionally been reported (Garlich-Miller et al., 2011: p. 66). Oil and gas industry monitoring data have reported only 35 walrus sightings between 1995 and 2016 in the central Beaufort Sea (*81 FR 52288*). Because of the small numbers of walruses encountered by past and present oil and gas activity in the Beaufort Sea, impacts to the Pacific walrus population appear to have been minimal (Garlich-Miller et al., 2011: p. 66).

The extent of the effects of a large spill would depend on the small number of walruses impacted by the oil, the duration of contact, and the age/degree of weathering of the spilled oil (USDOI, BOEM, 2012, 2016; *81 FR 52296*, August 5, 2016). Oil contamination of walruses probably would not result in the direct mortality of healthy individuals. However, contamination could seriously stress diseased or injured animals and stress young calves. A large spill resulting from the Proposed Action is unlikely to contact individual Pacific walruses because they occur only occasionally in the central Beaufort Sea. If an individual walrus contacted or ingested crude oil it could experience acute and chronic physiological impacts, up to and including mortality. However, the adverse impact to a single or few individual walrus would have negligible effects on the Pacific walrus population.

A-5.2.2.8. Sociocultural Systems and Subsistence Activities

Subsistence activities and harvest patterns hold cultural significance and represent a way of life for the Iñupiat. Communities of the North Slope have historically expressed concerns about what would happen if an accidental oil spill occurred in the Arctic. They are primarily concerned with impacts on subsistence resources and harvest practices, especially the bowhead whale, and oil spill cleanup actions. An oil spill could have physical, psychological, social, economic, spiritual, and cultural impacts on communities in the NSB.

The BOEM views large and very large oil spills as having the potential to cause long-term, widespread, and severe, and thus major adverse impacts that would disrupt or nearly eliminate subsistence harvests for one or more seasons.

Effects on the sociocultural systems of the communities of Utiaġvik, Nuiqsut, and Kaktovik could result from changes in population, employment, and the effects of a large spill and oil spill response and clean-up activities to subsistence harvest patterns. Community activities and traditional practices for harvesting, processing, and sharing subsistence resources could be severely disrupted if there are concerns over the tainting of bowhead whales from an oil spill.

The Arctic environment is particularly vulnerable to the effects of large oil spills, which are expected to persist longer in the environment because of the colder temperatures. An oil spill of more than 1,000 bbl could, depending on the time and location of the spill event, affect subsistence harvests of fish, migratory waterfowl, and marine mammals.

As the result of a large spill, the bowhead whale hunt could be disrupted. Bowhead whales could be directly oiled or oil could contact the area used for migration. Oiled whales or whales trying to avoid oil in the water may be skittish, either because of the spill itself or because of the hazing of marine mammals, which is a standard spill-response technique to encourage them to leave the area affected by a spill. Under these conditions, whaling could become more difficult than usual.

Marine mammals and fish typically comprise 60% of a coastal Alaska Native community's diet. Oiled marine mammals are likely to be considered tainted by subsistence hunters and may be avoided, similar to what occurred after the Exxon Valdez oil spill. This could also apply to individual caribou that seasonally spend time along the shore or on barrier islands seeking relief from insects and heat during July and August. Loss or tainting of marine mammals occurring off the north coast of Alaska could affect subsistence communities all along the migration routes of the marine mammals, including whaling communities in the Northwest Arctic Borough and on islands in the Bering Sea.

Fishes most likely to be affected by large spills include many that are important to subsistence fishers. They include migratory fishes such as Arctic cisco; those with strong ties to streams where they were spawned such as the Dolly Varden; and those tied to nearshore environments, such as broad whitefish. Large oil spills could also impact migrating anadromous fish in the river deltas. The impacts of large oil spills on sociocultural systems and subsistence activities and harvest practices would range from minor to major, depending on the size, location, and timing of the spill. As shown by the results of the Exxon Valdez spill, subsistence harvesters in unaffected areas are likely to share resources with impacted villages through established sharing networks. Local ties are strengthened through mutual exchange but can be weakened when there is less food to distribute.

Cleaning up a large spill is likely to have adverse consequences. Cleanup activities and increased human presence could displace subsistence hunters and fishers from their usual harvesting locations. There are relatively few vessels on the northern and northwestern coasts of Alaska to participate in cleanup of a large spill. Some local villagers would be employed in the cleanup, but it is likely that many additional workers would be necessary, potentially placing stress on village facilities. An influx of outsiders is likely to result in some cultural conflict, stressing the local sociocultural systems. As is evident from the Exxon Valdez oil spill event, such cleanup efforts can be disruptive socially, psychologically, and economically for an extended period of time. While the magnitude of impacts declines rapidly in the first year or two after a large spill, long-term and widespread effects continue to be evident (Picou et al., 2009).

Conclusion. Potential adverse impacts to fish and wildlife and subsistence harvest activities and harvest patterns due to a large oil spill are of greatest concern to residents of the NSB. Potential impacts on sociocultural systems from large oil spills could vary from minor to major, depending on the size, location, and timing of a large spill. A large spill could severely disrupt subsistence bowhead whaling activities and harvest practices. Adverse impacts to seal, waterfowl, and caribou hunting could be minor to major. Animals could be oiled or spooked by hazing. Any major disruptions to marine mammal harvests could have major impacts to sociocultural systems. Important subsistence fisheries could be adversely affected. A large spill could have moderate to major impacts on subsistence fishing for Nuiqsut and moderate effects to fishing for residents of Kaktovik. A large spill would most likely have little to no impacts to subsistence fishing for residents of Utiaġvik. Impacts to subsistence activities could be major if intertidal zones, lagoons, and estuaries were oiled. Overall, a large spill could have minor to major adverse effects to sociocultural systems and subsistence activities.

A-5.2.2.9. Economy and Population

The NSB is a mixed cash-subsistence economy. This section discusses economic impacts from potential large oil spills in terms of traditional measures of population, employment, income, and revenues. This discussion of employment, income, and revenues for oil-spill response is based on the most relevant historical spill in Alaskan waters, the Exxon Valdez Oil Spill (EVOS) of 1989. That spill was 240,000 bbl. It generated substantial employment of up to 10,000 workers doing cleanup work in remote locations. Smaller numbers of cleanup workers returned in the warmer months of each year following 1989 until 1992. During the EVOS, numerous local residents quit their jobs in the fishing industry to work on the cleanup, often at significantly higher wages. This generated additional adverse effects in the form of sudden and significant inflation in the local economy (Cohen, 1993). Similar adverse effects on the NSB as a result of a large spill would be mitigated due to the likelihood that cleanup activities, including administrative personnel and spill-cleanup workers, would likely be located in existing enclave-support facilities. This physical separation of workers from communities of permanent residents of the NSB would make it less likely that incoming non-resident cleanup workers would settle in the NSB, minimizing population impacts.

In the event of large oil spills, the number of workers employed for cleanup would depend on several factors. These include the procedures called for in the Oil Spill Response Plan (OSRP), how well prepared with equipment and training the entities responsible for cleanup are, how efficiently the cleanup is executed, and how well coordination of the cleanup is executed.

A large oil spill between 1,000 and 5,100 barrels could generate several hundred direct and indirect jobs and thousands of dollars in personal income associated with oil-spill response and cleanup in the short term. As context, a spill size of 5,100 is approximately 2.1% of the EVOS spill size; taking 2.1% of the 10,000 workers who cleaned up the EVOS would translate to approximately 210 workers. A large spill is expected to have little adverse effects on employment and wages in other sectors of the State or NSB economies. The relatively small number of jobs and associated labor income associated with the cleanup efforts would likely have little to no effect on the State economy. The effects on the NSB economy would depend on the extent to which Borough residents are employed in the cleanup efforts, but are likely to be negligible to minor due to the temporary nature of the jobs.

Potential positive revenue impacts would include property tax revenues accruing to NSB from any additional onshore infrastructure built to house the influx of workers and to support cleanup efforts. However, extra vessels staged offshore would likely be the primary source of additional infrastructure used to support the response and cleanup efforts. Thus, a large spill is expected to have little to no impact on NSB revenues, resulting in a negligible effect on the NSB economy.

The associated State and NSB population effects are likely to be negligible due to the temporary nature of the jobs, physical separation of worker housing, and low likelihood of workers permanently relocating to the NSB or the rest of Alaska.

Conclusion. Overall, effects of a large spill to the Alaskan economy would be negligible for employment and wages, revenue, and population. For the NSB economy, a large spill is anticipated to have negligible to minor beneficial effects to employment and wages. For revenue and population, there would be negligible impacts to the NSB economy as a result of a large spill.

A-5.2.2.10. Community Health

A large spill during exploration activities could adversely impact community health depending on the type and amount of oil spilled, location, and season. In the event of a large oil spill, subsistence resources and harvest patterns would most likely be affected due to contact with crude oil or refined products and could result in long lasting and widespread to severe impacts to community health for Nuiqsut. These impacts to community health would primarily be realized through major disruptions to subsistence practices and loss of harvest opportunities. Moderate to major impacts to community health would include compromised nutrition and general decreases in community and cultural well-being due to a lack of traditional foods and inability to engage in traditional practices such as sharing food with elders.

A large oil spill could affect NSB communities due to toxic contamination or perceived contamination of air, water, soils, and subsistence harvest resources such as fish or marine mammals. In turn, perceived and/or actual contamination could increase community stressors such as avoidance of subsistence harvests and decreased sharing and consumption of traditional foods. Moreover, impacts of a large oil spill to subsistence harvest of bowhead whales could be major for Nuiqsut and moderate to major for Kaktovik and Utiaġvik. Potential impacts to bowhead whaling from a large spill of crude or refined oil could translate to severe impacts to community health in the NSB, especially for Nuiqsut where major impacts to whaling could occur in the event of a large spill.

Spill response and cleanup workers from both inside and outside communities could experience potential health hazards from toxic oil byproducts, dispersants, detergents, and degreasers. Drowning, cold exposure, and falls pose hazards to oil spill response workers. Changes in air quality could occur as a result of spills of crude or refined oil. Adverse health consequences of a large oil spill to community members could be experienced from exposure to vapors, particulate matter from controlled burns of spilled oil, VOC, PAHs, and heavy metals. However, impacts on air quality due to a large spill are likely to be minor; air quality impacts immediately following a large spill would most likely be short-term, and BOEM does not expect adverse impacts to community health to occur from air pollutants released during a large oil spill.

Impacts to community members could occur when they work on spill response and cleanup alongside outside workers who may be unfamiliar with Iñupiaq culture, and who may bring illnesses and social conflicts to villages. Large oil spills can have long lasting and widespread adverse but reversible physical and mental impacts for community members living in the affected area (Eykelbosh, 2014). Researchers working on health issues in Alaskan communities impacted by the *Exxon Valdez* oil spill found community members showed changes in indicators of post-traumatic stress, including greater degrees of stress in the forms of recurrent, unprovoked, negative thoughts about the spill and avoidance behaviors such as suppression of thoughts and behaviors related to the spill (Picou et al., 1992). Researchers found these intrusive stresses slightly declined over time but remained elevated compared to the control community 18 months after the spill; avoidance behaviors remained constant over time, indicating persistent, long-term psychological harm to individuals (Eykelbosh, 2014, p. 19). The trauma associated with oil spills, whether due to income loss, disruption of subsistence activities and important cultural practices, or the stress of long-term uncertainty, can lead to depression, generalized anxiety disorder, and post-traumatic stress (Eykelbosh, 2014, p. 34).

Spill response and cleanup activities could include mechanical recovery methods, use of dispersants, and in-situ burning of spilled oil. Increased aircraft and vessel traffic, and corresponding increases in vessel discharges and noise, would also be associated with spill response and cleanup operations. Depending on the size of the spill and whether or not it contacted onshore resources, response and cleanup time and extent of cleanup activities could be short-term and localized or long lasting and widespread.

If spill response and clean-up operations included sections of shorelines and barrier islands, access to areas used for subsistence fishing, waterfowl hunting, caribou hunting, and butchering whales could be disrupted by spill response and cleanup activities or restricted by regulators due to conservation and species recovery issues. Disruptions to subsistence harvest practices due to spill response and cleanup could be long lasting and widespread for Nuiqsut. Loss of subsistence opportunities from response and cleanup could cause moderate impacts to community health.

Offshore mechanical recovery methods are not expected to impact community health because these are not expected to affect subsistence harvest patterns, social organization, or cultural values. The use of chemical dispersants and in-situ burning would most likely result in perceptions of environmental contamination and tainting of subsistence resources that could last for one or more seasons. Perceptions of contamination and actual contamination of marine resources from cleanup activities could result in avoidance of subsistence harvest of marine resources. Avoidance of subsistence harvests due to the use of chemical dispersants and in-situ burning could cause long lasting and widespread adverse impacts to community health and well-being.

Effects to community organization and capacity to provide healthcare services can occur due to local employment in spill response and cleanup activities. A sudden increase in employment in spill response and cleanup work could have long lasting and widespread effects, including displacement of Alaska Native residents from their normal subsistence harvests, processing, and distribution activities. Increased employment of local residents could place stresses on community infrastructures such as hospitals and health clinics by drawing away local workers from community service jobs or increased medical visits from outside cleanup workers. These changes could increase healthcare demands, injury rates, and social conflicts between local residents and outsiders. The deterioration of social relationships, anxiety, stress, and depression may result from long-term and widespread spill response and cleanup operations, making routine stress-coping strategies ineffective at the local level and contributing to compromised community health (Palinkas et al., 1993; USDOI, BOEM, 2015).

Conclusion. For a large oil spill, impacts to community health for Nuiqsut could be major. Impacts to community health for Kaktovik and Utqiaġvik from a large oil spill are expected to be moderate to major, depending on the size and location of a spill and whether or not impacts disrupt subsistence harvest activities for one or more seasons, alter local healthcare services, disrupt traditional sharing networks, and/or threaten cultural values and identities. Overall, large spills could have moderate to major adverse impacts to community health in the NSB, particularly if a large spill caused moderate to major impacts to sociocultural systems and subsistence activities and harvest patterns, which would most likely occur if a large spill made subsistence resources unavailable or contaminated.

Impacts to community health from spill response and cleanup activities are expected to be minor to moderate depending on method of oil recovery and removal, extent and location of the spill, and extent of disruption to subsistence harvest patterns, social organization, local institutions, and community healthcare services. Minor to moderate effects from spill response and cleanup are not expected to change the overall impact conclusions for a large spill.

A-5.2.2.11. Environmental Justice

Subsistence continues to be the central organizing element of Iñupiaq society, and it is primarily through damage to subsistence resources and disruptions to subsistence activities and harvest patterns that environmental justice concerns can be assessed for Iñupiaq communities located on the North Slope. Large spills have potential to affect subsistence harvest patterns in the central Beaufort Sea and coastal areas. Any major disruptions to sociocultural systems and subsistence activities and/or community health from large spills and/or spill response and cleanup activities could cause disproportionately high and adverse impacts to EJ communities in the NSB.

Conclusion. If major impacts from a large spill occur to Cross Island whaling, BOEM expects disproportionately high and adverse impacts for Nuiqsut. Large oils spills could have some major effects on the sociocultural system in Nuiqsut. If these major effects to social organization, cultural values, and local institutions occur, BOEM anticipates disproportionately high and adverse impacts to the Nuiqsut.

In the event of a large spill, moderate to major impacts are expected to occur for whaling for Kaktovik and Utqiaġvik crews. BOEM expects severe and thus major impacts on sociocultural systems lasting more than one year for Kaktovik and Utqiaġvik if their bowhead whaling areas are contacted by oil from a large spill. If these major impacts occur to sociocultural systems, BOEM anticipates that a large spill could have disproportionately high and adverse impacts in Kaktovik and Utqiaġvik.

BOEM anticipates major impacts to community health to occur as a result of a large oil spill for Nuiqsut and moderate to major effects to community health for Kaktovik and Utqiaġvik. If major impacts occur to community health, BOEM anticipates that a large spill could have disproportionately high and adverse effects on EJ communities.

A-5.2.2.12. Archaeological Resources

Overall, impacts on archaeological and historical resources from unexpected large or very large oil spills would range from negligible to major, depending on the location, timing, and magnitude of the event as well as the effectiveness of containment and cleanup activities. There are no reported shipwrecks in the vicinity of SID or the proposed exploratory wells in the OCS. There are no reported shipwrecks in the vicinity of SID or the proposed exploratory wells in the OCS however, there is the possibility that unreported historic shipwrecks may exist on the seabed in the vicinity. There is one reported airplane wreck located approximately six miles from Oliktok Point.

Archaeological and historical resources could be impacted by a spill if material contaminated with oil reaches the seafloor and directly impacts a shipwreck site or airplane wreck by disrupting the local environment, resulting in degradation of the resource and loss of information. In the event that a spill reaches coastal areas, it could affect shallow water shipwrecks, airplane wrecks, and coastal historic and pre-contact archaeological sites. Overall, impacts on archaeological and historical resources from expected accidental spills and an unexpected large or very large oil spill would range from negligible to major.

An oil spill of any size could result in impacts to archaeological and historic resources from response activities. These impacts could range from negligible to major. Cleanup crews might be needed in a number of locations. The greatest threat to archaeological and historic resources during an oil spill would result from the larger number of response crews being employed. Following the Exxon Valdez Oil Spill, most impacts to archaeological and historic resources that occurred during spill response were the result of vandalism or physical damage from spill response activities (Reger et. al., 2000). Furthermore, timely monitoring of affected sites might not be possible, given the number of resources to be considered and personnel limitations (Reger et al., 2000).

The level of impact to archaeological resources would depend not only on the magnitude of the spill and direct impacts to a resource, but the time of the year. If the spill were to occur when the ground was frozen or covered by snow, these factors would lessen potential impacts to archaeological sites. Thus, the effect on historic properties could range from negligible through major.

A-5.2.3. Very Large Accidental Oil Spills

A very large oil spill (VLOS), as defined by BOEM, is an oil spill with a total volume that is greater than or equal to 150,000 bbl. The chance of a very large spill (≥150,000 bbl) occurring is very low; however, BOEM comprehensively analyzed the potential effects of such a spill in the Beaufort Sea Multiple-Sale EIS (*Section IV.I Low-Probability, Very Large Oil Spill*). The spill scenario in USDOI, MMS (2003) was based on a 15,000-bbl flow-rate for 15 days totaling 225,000 bbl reaching water or air. In the unlikely event of a very large accidental oil spill, the potential for major impacts exist, as identified in USDOI, MMS (2003). Subsequent analyses, after the Deep Water Horizon and the required calculation of Worst Case Discharges, considered volumes ranging from 1.7-3.9 million bbl (USDOI, BOEM, 2012, 2016a). The following paragraphs describe the effects of a very large oil spill of roughly 520,000 bbl on each resource.

A-5.2.3.1. Air Quality

A VLOS in Arctic Alaska could emit regulated pollutants into the atmosphere. This may impact air quality during some phases of the event. A very large oil spill could cause an increase in the concentrations of gaseous hydrocarbons (volatile organic compounds) which could affect onshore air quality (USDOI, MMS, 2003, p. IV-245). The greatest impacts on air quality conditions would occur during the initial release of gas and oil and during spill response and clean up, particularly if the event occurs during the winter. Impacts could continue for days during the initial event and could continue for months during spill response and clean up. The cleanup of a very large oil spill would require the operation of equipment, such as boats and vehicles. Emissions from their operation would include nitrogen oxides, carbon monoxide, and sulfur dioxide. If in situ burning is used during the response to a VLOS, carcinogenic dioxins and furans could be formed. These chemicals can bioaccumulate in the food chain. Studies performed during the DWH event indicated that levels of these chemicals were about the same as levels from residential wood stoves and forest fires, so that bioaccumulation is not expected to be a problem. Although dioxins were created during DWH burns, reports found that workers, onshore residents, and residents consuming fish had incremental lifetime cancer risks well below USEPA’s target risk level. As most of the oil would have been burned, evaporated, or weathered over time, air quality would return to pre-oil spill conditions. While impacts on air quality are expected to be localized and temporary, adverse effects that may occur from the exposure of humans and wildlife to air pollutants could have long-term consequences (BOEMRE, 2011a). Therefore, while the impacts may be large, overall, the emissions from a VLOS would be temporary and, over time, air quality in Arctic Alaska would return to pre-event conditions (BOEMRE, 2011j).

Therefore, while a major impact would likely occur during the initial blowout and spill response phases, and the emissions from the VLOS would be temporary and distributed over time, air quality in the Arctic would eventually return to pre-oil-spill conditions. Due to dispersion, impacts on air quality would be limited to the immediate area of the spill and are expected to be temporary. Concentrations of criteria pollutants would likely not exceed air quality standards in any onshore areas. The impacts of a VLOS on air quality would be minor.

A-5.2.3.2. Water Quality

A very large crude oil spill would cause elevated hydrocarbon concentrations on the ocean water surface, in the water column and in coastal riverine waters covering a very large area. These concentrations would exceed state and Federal water and sediment quality standards and present toxic conditions to aquatic organisms (USDOI, MMS, 2003, p. IV-230). Oil would be removed from the environment during clean-up activities; however, the amount of oil removed would be affected by several factors including weather and sea conditions during the clean-up. Additional effects on water quality could occur from response and cleanup vessels, in situ burning of oil, dispersant use, discharges and seafloor disturbance from relief well drilling, and activities on shorelines associated with cleanup, booming, beach cleaning, and monitoring (USDOI, BOEM 2012). As oil was removed during the clean-up process, there would be less volume available to become dispersed or entrained in the environment. In summary, depending on the extent and magnitude of a VLOS, and ensuing cleanup activities, moderate to major impacts to water quality would result.

A-5.2.3.3. Vegetation and Wetlands

Coastal wetlands and coastal salt marshes would comprise the vegetation habitats most likely to be affected by a very large oil spill (USDOI, MMS, 2003, p. IV-239). The level of impacts is related to the amount of oil weathering, whether substrates are lightly or heavily oiled, duration of exposure, season, plant species, percentage of plant surface oiled, substrate type, soil moisture level, and oil penetration into the soil and root systems. Natural degradation and the persistence of oil on beaches are influenced by the amount of oil present, sand grain size, degree of penetration into the subsurface, exposure to weathering action of waves, and sand movement onto and off shore. Oil contamination could persist for 10 years or more, during which time the oil in the sediments could be slowly released back into the environment as a result of erosion or exposure of oiled sediments and soils (USDOI, BOEM 2012). Marshy wetland habitats could be partially rehabilitated by using fertilizers to aid in biological weathering-breakdown of the oil, but recovery would be slow due to cool temperatures in summer and the short growing season. Complete recovery of oiled coastal wetlands could take several decades, resulting in moderate to major impacts on vegetation and wetlands.

A-5.2.3.4. Lower Trophic Levels

A very large oil spill could result in lethal or sublethal concentrations of hydrocarbons, which could accumulate in soft sediments, reducing habitat function. Impacts would be similar to those described for small and large oil spills, but the magnitude would be greater. The magnitude of the impact depends primarily on the location of the spill, the volume released, and the speed at which the spill was capped. The soft sediment habitat would recover without mitigation because of natural breakdown of the oil, sediment movement by currents, and reworking by benthic fauna. However, the cold temperatures of the Arctic may allow hydrocarbons to persist in the sediments longer than in temperate areas. A spill would adversely affect some lower trophic-level organisms by exposing them to petroleum-based compounds at, or above, acute or chronic toxicity levels. The nearshore area supports mobile benthic and epibenthic invertebrates (amphipods, mysids, copepods, euphasiids, clams, snails, crab, and shrimp), which are fed on by vertebrate consumers during the summer. If contacted by surface oil, these invertebrates are likely to die or be affected at a sub-lethal level.

Oil that becomes incorporated into shoreline bottom sediments by wave action is expected to remain entrained in the sediment for several years. In areas where bottom sediments are heavily oiled, some lethal and sub-lethal effects could occur each summer, when seasonal benthic invertebrates return to those areas. Other lower trophic-level organisms likely to be contacted by oil in the water column are plankton. Because of similarities in habitat use and distribution, the percentage of other marine-invertebrate larva contacted by floating or dispersed oil is likely to be similar to that expected for plankton. Some lower trophic-level organisms on the shorelines would be adversely affected by use of shore based oil containment booms and other response tactics.

A VLOS could potentially reduce habitat quality over potentially large areas. The effects from oil spills would depend on the size, timing, duration, and location of the spill and on various environmental factors. Pelagic habitat in nearshore areas would likely have the greatest potential for long-term contamination. Unique pelagic habitat and associated biota such as sea ice could also be affected by oil spills. In the Arctic planning areas, oil could become trapped under sea ice for an extended period, where it would remain relatively unweathered and capable of being transported large distances. Oil under ice or frozen in ice could therefore degrade pelagic habitat for an extended period of time with the extent of the impacts increasing with the size of the oiled area; the largest area affected would occur with a VLOS. Sea ice habitat could be degraded or lost if contact with oil spills results in lethal or sublethal effects on biota growing beneath the ice. Oil spill response activities could also affect pelagic habitat and biota. Over time, hydrocarbons in the water column would be diluted and broken down by natural processes and pelagic habitat would recover. Overall, a VLOS could result in minor to moderate impacts to pelagic habitat and sea ice habitat.

A-5.2.3.5. Fish

Impacts to fish from a VLOS would be similar to those described for small and large oil spills, but the magnitude would be greater. The magnitude of the impact depends primarily on the location of the spill, the volume released, and the speed at which the spill was capped. Effects to fishes would be more likely to occur from an oil spill moving into nearshore waters in summer, where fishes concentrate to feed and migrate (USDOI, MMS, 2003, p. IV-232). There may be sub-lethal or lethal effects on some marine and migratory fish. The number affected would depend on the size of the area affected, the concentration of petroleum present, the time and duration of exposure, and the stage of fish development involved (eggs, larva, and juveniles are most sensitive). While a very large oil spill would be expected to affect about 300 km of nearshore waters, particularly in shallow-water lagoons associated with barrier islands, and coastline, it would likely have mostly sub-lethal effects (e.g. changes in growth, feeding, fecundity, and temporary displacement) on marine and migratory fish. Juvenile fish (e.g. arctic cod), which are common in the nearshore area during summer, or nearshore spawners (e.g. capelin) are among the most likely candidates to be adversely affected.

A VLOS could have population-level consequences if vital habitat areas were affected or if it occurred in spawning areas or juvenile feeding grounds when fish populations are highly concentrated. In such cases, VLOS could cause substantial reductions in population levels for one or more years.

In addition to effects on individuals and species, impacts to fish can result in ecosystem level effects if the population impacts are significant. For example, fish can occupy a number of trophic levels ranging from herbivore to top-level carnivore. Therefore, fish are critical to energy flow within nearshore and marine food webs. They are also seasonally important food sources to transient carnivores. Consequently, impacts to fish can propagate throughout the food web, affecting birds and marine mammals. In addition, many Alaskan fishes, particularly salmonids, migrate between and within marine, estuarine, and freshwater habitats. In doing so, they transfer nutrients and carbon over a broad area and connect offshore and coastal ecosystems (Naiman et al., 2002). Significant impacts to fish populations could reduce this transfer, resulting in local changes in productivity. In addition, Arctic cod are keystone species in the Arctic, and significant impact to this species could have broad ecosystem effects.

Overall, a VLOS would affect a wider area, with the magnitude of the impacts depending on the location, timing, and volume of spills, distribution and ecology of affected fish species, and other environmental factors. Most adult fish are highly mobile and would likely avoid lethal hydrocarbon exposures, although they may be subjected to sublethal concentrations. Smaller species and egg and larval life stages are more likely to suffer lethal or sublethal exposures from oil contact because of their relative lack of mobility. Under most circumstances, a VLOS would affect only a small proportion of a given fish population; therefore, overall population levels may not be affected. Oil contacting shoreline areas used for spawning or providing habitat for early life stages of fish could result in largescale lethal and long-term sublethal effects on fish. In Alaskan waters, where oil may be slow to break down, coastal oiling could measurably depress some fish populations for several years. Overall, the impacts to fish from a VLOS could range from minor to moderate.

A-5.2.3.6. Birds

A very large oil spill (VLOS) could result in bird mortality exceeding ten thousand individuals, particularly if swimming flocks of molting waterfowl, or brood-rearing waterfowl or shorebirds contact stranded oil in a substantial proportion of affected habitat (USDOI, MMS, 2003). In lagoon habitats, long-tailed duck densities suggest that when large concentrations of molting individuals are present, tens of thousands could be contacted by spilled oil. Hundreds or low thousands of mortalities could also be experienced by post-breeding common eiders concentrated near barrier islands and in lagoons. A VLOS would be expected to contact many other species present in substantial numbers during the open water season, including king eider, scoters, northern pintail, Pacific loon, and glaucous gull. These levels of mortalities alone can have widespread impacts on even stable populations.

Additional mortality would be expected from decreased fitness or productivity from indirect effects including decreased availability of food or physiological effects caused by the ingestion of oil A VLOS would cause long-term adverse effects (i.e., 2 years or more in duration) to coastal and estuarine migratory bird habitats. Long-term loss of breeding and forage habitat would occur where shore side camps and storage areas displace tundra. Contamination of food resources or nesting substrates could lead to reduced fitness and productivity.

A summer VLOS would cause additional waterbird, including spectacled and Steller's eider, mortality, if females with young contact stranded oil in coastal habitats, or flocks of adult eiders or females with young feeding in lagoons and offshore waters are contacted by a spill (USDOI, MMS, 2003). Any mortality, decreased fitness or productivity from indirect effects, such as decreased availability of food sources or physiological effects caused by the ingestion of oil, would be additive to the loss of oiled individuals. Mortality of a few spectacled and Steller's eiders also would represent a substantial loss to the small regional populations.

The nest disturbance of ESA-listed eiders caused by these activities is not expected to result in large increases in nest abandonment, loss of eggs through predation or exposure, or overall decrease in productivity. The primary reason for this level of effect is the low density of ESA-listed eiders nesting and the low frequency of nesting which occurs near the coast (USDOI, MMS, 2003). If not lethally impacted by contact, however, many eiders could be otherwise adversely affected by prey contamination, and those impacts would be spread across several years, i.e., long-lasting. Taken together, impacts to spectacled eiders in the hundreds, or about 3% of the estimated 14,800 ACP breeding population, that persist over several generations could be considered long-lasting and severe, and the loss of as few as a hundred spectacled eiders would be expected to have major impacts to the local Central Beaufort Sea breeding population for similar reasons.

The magnitude and duration of spill response impacts would be larger for a VLOS than for a large spill. The duration of cleanup activities may preclude birds from successfully using the area for an entire season or more, which could disrupt survivorship or productivity. VLOS are expected to involve hundreds of workers and numerous boats, aircraft, and onshore vehicles operating over an extensive area for more than 1 year. The presence of such a workforce is likely to act as a general hazing factor, displacing eiders from the immediate area of activity, which potentially would have both negative and positive effects, in that they may keep some birds from additional contamination impacts.

The Steller's eider ACP population is small and distribution is limited. It is possible, however, that low numbers of Steller's eiders could be contacted by oil should a VLOS occur, and given their low numbers and declining status, any loss of breeding adults could have a long-term and moderate impact. Oil Spill response activities are unlikely to have any additive effect on this species, because mechanical response is unlikely to disturb nesting birds or nesting areas, and response activities are unlikely to alter the already low probability of whether or not a Steller's eider is oiled.

Conclusion. The Central Beaufort Sea coast provides important nesting, molting, and stopover habitat for many species of coastal and marine birds. An unexpected VLOS has the potential to affect large numbers of birds that are in the region for a short season to breed and are sensitive to additional stress. Spill response can be complicated by ice conditions and the cleanup process itself could displace birds from important habitats. Impacts to marine and coastal birds from a VLOS associated with the proposed project and from spill response and cleanup activities are expected to cause widespread impacts to multiple migratory populations, and in many cases impacts to these populations and their habitats will last for more than one year, i.e., have long-lasting impacts. Overall, impacts from a VLOS would be expected to be moderate to major.

A-5.2.3.7. Marine Mammals

The probability of a very large oil spill contacting bowhead whales is likely to be considerably less than the probability of oil contacting bowhead whale habitat (USDOI, MMS, 2003). It is unlikely that a spill would cause an impediment to the fall migration. However, direct contact with spilled oil resulting from a very large oil spill would have the greatest potential to affect bowhead whales migrating through their fall migration corridor, particularly if toxic fumes from fresh oil are inhaled where bowheads aggregate. The migrating whales could come in contact with oil, but such contact likely would be brief. If bowheads feed in an area when spilled oil is present, some oil could be ingested. Most individuals exposed to spilled oil are expected to experience temporary, nonlethal effects from oiling of the skin, inhaling hydrocarbon vapors, ingesting contaminated prey, fouling of their baleen, a reduction in food sources, and a displacement from feeding areas. Exposure of bowhead whales to spilled oil could result in lethal effects to some individuals.

The effect of a very large oil spill on other marine mammals is expected to be fairly long-term (1-2 generations, about 15 years) on pinnipeds and short-term (about 1 year) on beluga whales (USDOI, MMS, 2003). Assuming that all young ringed and bearded seals exposed to the oil died because of absorption (through the skin), inhalation, and/or ingestion of toxic hydrocarbons in the oil, this loss could take these marine mammal populations more than one to two generations to recover (up to about 15 years). Although some beluga whales might encounter spilled oil during the spring migration and summer few, if any, are likely to be adversely affected (loss of fewer than 20 whales with population recovery in 1 year).

Polar bears exposed to a very large oil spill through direct contact or by ingesting oiled prey would probably not survive (Neff, 1990; St. Aubin, 1990). The density of polar bears in the central Beaufort

Sea is low, if a spill reaches the environment there is a correspondingly low likelihood that polar bears would be exposed. In addition, it is likely that polar bears would be intentionally deterred to keep them away from the area, further reducing the likelihood of bears contacting the oil. Impacts associated with a very large oil spill would depend upon the time of year, weather conditions, cleanup efforts and the efficiency of hazing bears away from the spill. Exposure would likely be limited to a small number of polar bears, possibly resulting in the death of some bears that come into contact with oil. Large aggregations of bears periodically gather on shore during August through October near Point Barrow, Cross Island and Barter Island. If a very large oil spill occurred during this time as many as 60-100 polar bears may be at risk of exposure.

The central Beaufort Sea is extralimital to Pacific walruses and only individuals and small groups have occasionally been reported (Garlich-Miller et al., 2011: p. 66). Because of the small numbers of walruses using the Beaufort Sea during summer, they should remain unaffected by a very large oil spill from the Proposed Action. Due to the scarcity of walruses in the Beaufort Sea, no more than 10 walruses should be affected by a very large oil spill from the Proposed Action, and only during summer when walruses would be present in the Chukchi and Beaufort Seas, coinciding with the only time when a very large oil spill could potentially disperse over a broad area of the ocean. In addition, walruses may continue to be exposed to hydrocarbons through their prey, which may lead to reduced fitness and possibly population-level effects over time.

Impacts to marine mammals associated with a very large oil spill would depend upon the time of year, weather conditions, and cleanup efforts. Impacts to whales would most likely be brief, but could have lethal effects for some individuals. The effect of a very large oil spill on other marine mammals is expected to be fairly long-term (1-2 generations, about 15 years) on pinnipeds and short-term (about 1 year) on beluga whales. Exposure to polar bears would likely be limited to a small number, possibly resulting in the death of some bears that come into contact with oil. For these reasons, impacts form a VLOS on marine mammals would be minor to major.

A-5.2.3.8. Terrestrial Mammals

A very large oil spill, in the vicinity of the Proposed Action, has the ability to contact terrestrial habitat and potentially impact terrestrial mammals. A VLOS that occurred during the open-water season or during winter and melted out of the ice during spring, could affect caribou of the Central Arctic, Teshekpuk Lake, Western Arctic, and/or Porcupine herds in coastal areas between Demarcation Bay and Point Barrow, particularly during periods of insect-harassment. Even in the most severe situation, a relatively small proportion of any caribou herd (up to a few thousand) would be directly exposed to the spilled oil, and die from ingesting, absorbing, or inhaling hydrocarbons. Such losses among caribou should be replaced within about 1 year. Likewise, the numbers of muskoxen, grizzly bears, and arctic foxes affected likely would be fewer than 10 individuals of each species, based on their scattered distribution, low population numbers for grizzly bears and muskoxen, and high fecundity of Arctic foxes.

Impacts to terrestrial mammals associated with a very large oil spill would depend upon the time of year, weather conditions, and cleanup efforts. They would be temporary and distributed over time, where terrestrial mammals would eventually return to pre-oil-spill levels. The impacts of a VLOS on terrestrial mammals would be minor to major.

A-5.2.3.9. Sociocultural Systems and Subsistence Activities

If oil from an offshore VLOS directly contacted migrating or resident marine mammals, seals, fish, caribou, and/or migratory waterfowl, contaminated traditional harvest areas, and persisted in subsistence harvest areas, sociocultural systems and subsistence activities would be severely curtailed and interrupted, particularly seal and whale hunting. This could create severe reductions in access to traditional nearshore and offshore harvest areas lasting one or more seasons. Social organization, cultural values, and formal institutions would most likely be disrupted for one or more seasons. Overall, BOEM anticipates impacts to sociocultural systems from a VLOS to be severe and thus major for Nuiqsut.

BOEM also anticipates long lasting and widespread impacts from a VLOS on sociocultural systems for Kaktovik and Utqiaġvik. Impacts from VLOS spill response and cleanup activities to sociocultural systems could be moderate to major for Nuiqsut, Kaktovik, and Utqiaġvik depending on how long cleanup would take and to what extent residents of these communities participated in response and cleanup work. If VLOS cleanup activities persisted longer than one season on the North Slope and resources and labor were substantially drawn from all three communities, effects to sociocultural systems could become severe and thus major for Nuiqsut, Kaktovik, and Utqiaġvik. Overall, BOEM anticipates moderate to major effects to the sociocultural system and subsistence activities from a VLOS for Kaktovik and Utqiaġvik.

Long-term recovery from a VLOS could severely disrupt sociocultural systems and subsistence activities and harvest patterns for more than one year, resulting in major impacts in Nuiqsut. Impacts of long-term recovery to sociocultural systems and subsistence activities for Kaktovik and Utqiaġvik are anticipated to be long lasting and widespread but less than severe and thus moderate.

A-5.2.3.10. Economy and Population

If a VLOS occurred, it would likely generate several thousand direct, indirect, and induced jobs and millions of dollars in personal income associated with oil-spill response and cleanup. It is likely that employment during winter cleanup and response would be less than employment for summer cleanup and response operations; however, the overall short-run employment created for response and cleanup would likely be substantial for any season of occurrence. Fewer job losses (i.e., adverse employment/labor income effects) are expected in the NSB or other parts of Alaska because of a VLOS given that there are few other industries in the area that would likely be directly or indirectly impacted. Thus, the net employment/labor income effects are expected to be positive at both the State and NSB level.

The incremental impact of annual jobs and labor income associated with cleanup and response would represent less than one percent of the total Alaska employment and labor income, and would likely result in little to no effect on employment in other sectors of the State economy resulting in a negligible effect.

The effects of employment and labor income on the NSB economy would ultimately depend on the extent to which Borough residents are employed in the cleanup efforts. Given the relatively small size of the existing labor force in the NSB relative to the number of response and cleanup workers that could be employed, the incremental impacts to the NSB economy would likely be major, although the employment and its beneficial economic effects would be short-term in nature.

A VLOS is expected to have negligible effects on State employment and associated labor income. Response and cleanup workers would likely come from the NSB, other parts of Alaska, and the lower 48 States. A VLOS is likely to have little to no impact on the population base of the State of Alaska or the NSB due to the temporary nature of the response and cleanup jobs, physical separation of worker housing, and low likelihood of workers permanently relocating to the NSB.

Positive revenue impacts on the State and NSB from a potential VLOS would include property tax revenues from any new onshore infrastructure put in place to support cleanup efforts. A VLOS would result in a Natural Resource Damage Assessment (NRDA). The National Ocean and Atmospheric Administration (NOAA) conducts NRDAs through a process that includes determination of the injuries from a spill, quantification of those injuries, and then restoration planning (USDOC, NOAA, 2017). The result of the NRDA process could have substantial revenue impacts as the population of interest is compensated for a range of natural resource service values damaged by the hypothetical VLOS and come at a high cost to the responsible parties.

There would be adverse impacts to State revenues if TAPS throughput were reduced because of the oil spill, either through a temporary moratorium on oil and gas activities or space-use conflicts with producing fields. Space-use conflicts may occur because clean up resources would be competing with existing onshore oil and gas operations. Potential space/use conflicts or a moratorium could delay permitting for other future exploration and production activities that could reduce economic activity in general, including employment, personal income, and revenues. Loss of access from congested shipping routes and crowded ports could have a short-term adverse effect on Alaska economic output as delivery of goods and services could be reduced. A VLOS could displace future economic activity that currently is relatively minor or could potentially exist in the Arctic (e.g., a VLOS could limit future jobs and revenues that may be generated by increased marine shipping activities in the region).

The effects of a VLOS on State and NSB revenues could be substantial. The most notable beneficial effects would result from compensation because of the NRDA process and property tax revenues from any new onshore infrastructure put in place to support cleanup efforts. The magnitude of potential long-term adverse effects is more uncertain; effects would ultimately depend on the degree to which the VLOS affects future economic activities in the State and NSB. The potential effects of a VLOS on the State and NSB economies are likely to be major.

VLOS is expected to have negligible effects on State employment and labor income, and major effects on revenues. The beneficial impacts on NSB employment, labor income and revenues are likely to be major. A VLOS is likely to have little to no impact on the population base of the State of Alaska or the NSB. Overall, a VLOS is expected to have a major impact on the State and NSB economy.

A-5.2.3.11. Community Health

If offshore oil from a VLOS directly contacted migrating or resident marine mammals, seals, fish, caribou, and/or migratory waterfowl; contaminated traditional harvest areas; and persisted in subsistence harvest areas, sociocultural systems would be severely interrupted. This would most likely lead to moderate to major impacts to community health from food insecurity, poor nutritional status, increased metabolic disorders, and low cultural well-being. Social organization, cultural values, and health and social services would most likely be disrupted for one or more seasons. Impacts to community health from a VLOS are anticipated to be severe and thus major for Nuiqsut.

Impacts from VLOS response and cleanup activities to community health could be moderate to major for Nuiqsut, Kaktovik, and Utqiaġvik depending on how long cleanup would take and to what extend residents of these communities participated in response and cleanup work. If VLOS cleanup activities persisted longer than one season on the North Slope and resources and labor were substantially drawn from all three communities, effects to community health could increase to severe and thus major for Nuiqsut, Kaktovik, and Utqiaġvik. Some of these impacts would most likely be beneficial to community health through increased employment and income. Overall, BOEM anticipates moderate to major effects from a VLOS on community health for Kaktovik and Utqiaġvik.

Long-term recovery from a VLOS could severely disrupt community health for more than one year, resulting in major impacts in Nuiqsut. Impacts of long-term recovery to community health for Kaktovik and Utqiaġvik are anticipated to be long lasting and widespread but less than severe and thus moderate.

A-5.2.3.12. Environmental Justice

A VLOS could threaten some important subsistence harvest areas on which EJ communities rely. Of particular importance are the offshore bowhead whaling area used by crews from Nuiqsut in

September and the coastal lands used by Nuiqsut and Kaktovik for subsistence caribou hunting during July through August.

If offshore oil from a VLOS directly contacted migrating or resident marine mammals, seals, fish, caribou, and/or migratory waterfowl; contaminated traditional harvest areas; and persisted in subsistence harvest areas, subsistence harvest patterns would be severely interrupted, particularly seal and bowhead whale hunting. This could create severe reductions in access to traditional nearshore and offshore harvest areas lasting one or more seasons. Social organization, cultural values, and formal institutions would most likely be disrupted for one or more seasons.

Impacts to sociocultural systems and community health from a VLOS are anticipated to be major for Nuiqsut. If these impacts occurred as anticipated as a result of a VLOS, BOEM expects disproportionately high and adverse environmental, social, and health impacts to occur for Nuiqsut.

Some impacts from VLOS spill response and cleanup activities to sociocultural systems and community health could be major for Nuiqsut, Kaktovik, and Utqiaġvik depending on how long cleanup would take and to what extent residents of these communities participated in response and cleanup work. If VLOS cleanup activities persisted longer than one season on the North Slope, effects to sociocultural systems and community health would most likely be major for these EJ communities. Therefore, BOEM would expect disproportionately high and adverse environmental, social, and health impacts for these EJ communities from VLOS response and cleanup.

Long-term recovery from a VLOS could cause major disruptions to community health for more than one year in Nuiqsut. Accordingly, BOEM would expect disproportionately high and adverse environmental, social, and health impacts for Nuiqsut due to long-term recovery from a VLOS.

A-5.2.3.13. Archaeological Resources

Overall, impacts on archaeological and historical resources from unexpected large or very large oil spills would range from negligible to major, depending on the location, timing, and magnitude of the event as well as the effectiveness of containment and cleanup activities. There are no reported shipwrecks in the vicinity of SID or the proposed exploratory wells in the OCS. There are no reported shipwrecks in the vicinity of SID or the proposed exploratory wells in the OCS however, there is the possibility that unreported historic shipwrecks may exist on the seabed in the vicinity. There is one reported airplane wreck located approximately six miles from Oliktok Point.

Archaeological and historical resources could be impacted by a spill if material contaminated with oil reaches the seafloor and directly impacts a shipwreck site or airplane wreck by disrupting the local environment, resulting in degradation of the resource and loss of information. In the event that a spill reaches coastal areas, it could affect shallow water shipwrecks, airplane wrecks, and coastal historic and pre-contact archaeological sites. Overall, impacts on archaeological and historical resources from expected accidental spills and an unexpected large or very large oil spill would range from negligible to major.

An oil spill of any size could result in impacts to archaeological and historic resources from response activities. These impacts could range from negligible to major. Cleanup crews might be needed in a number of locations. The greatest threat to archaeological and historic resources during an oil spill would result from the larger number of response crews being employed. Following the Exxon Valdez Oil Spill, most impacts to archaeological and historic resources that occurred during spill response were the result of vandalism or physical damage from spill response activities (Bittner, 1996; Reger et. al., 2000). Furthermore, timely monitoring of affected sites might not be possible, given the number of resources to be considered and personnel limitations (Reger et al., 2000).

The level of impact to archaeological resources would depend not only on the magnitude of the spill and direct impacts to a resource, but the time of the year. If the spill were to occur when the ground was frozen or covered by snow, these factors would lessen potential impacts to archaeological sites. Thus, the effect on historic properties could range from negligible through major.

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Appendix B

Cumulative Effects Scenario

Appendix B. Cumulative Effects

B-1. INTRODUCTION

The Council on Environmental Quality (CEQ) Regulations defines cumulative effects at 40 CFR 1508.7:

Sec. 1508.7 Cumulative impact.

> "Cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

This appendix identifies the past, present, and reasonably foreseeable future actions that could be relevant to the resource-specific cumulative impacts analyses provided in Chapter 4 of this EA. When developing this appendix, BOEM considered actions identified in past NEPA documents along with updated information about ongoing and potential future actions. Past NEPA documents considered included:

- Final Programmatic Environmental Impact Statement — Outer Continental Shelf Oil and Gas Leasing Program: 2012-2017. Final Programmatic Environmental Impact Statement. OCS/EIS/EA BOEM 2012-003 (USDOI, BOEM, 2012).
- Final Environmental Impact Statement — Beaufort Sea Planning Area Oil and Gas Lease Sales 186, 195, and 202 (Volume I, Section V) (OCS EIS/EA MMS 2003-001) (USDOI, MMS, 2003) (hereafter "Beaufort Sea Multiple-Sale EIS").
- Environmental Assessment — Proposed Oil & Gas Lease Sale 195, Beaufort Sea Planning Area (Section IV.E.) and Finding of No Significant Impacts (OCS EIS/EA MMS 2004-028) (USDOI, MMS, 2004) (hereafter "Sale 195 EA").

B-2. IMPACT SOURCES

BOEM identified the potential effects resulting from the Proposed Action and Alternatives on the marine, coastal, and human environments, which are interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment. BOEM also identified other past, present, and reasonably foreseeable future actions and their effects on those environments.

General categories describing the past, present and reasonably foreseeable future actions that could potentially impact the marine, coastal and human environments are listed in Table B-1. A detailed list of specific activities is provided in Table B-2.

Table B-1.Categories of past, present and reasonably foreseeable future actions.

Category	Area	Type of Action
Marine Vessel Traffic	US Beaufort Sea (nearshore)	Industry vessels, Community barge and supply vessels; Research vessels; Small marine subsistence vessels
Aircraft Traffic	US Beaufort Sea (OCS and onshore at Oliktok Point)	Industry Crew Transfers; Commercial and private flights, National and International Cargo Flights; Research flights
Subsistence Activities	Nuiqsut and select offshore areas	Subsistence fishing, gathering, and whaling
Scientific Research Activities	US Beaufort Sea (nearshore and offshore)	Studies and Surveys: Oceanographic; Biological; Geophysical; Socioeconomic
Oil and Gas Activities	US Beaufort Sea (state and Federal Waters; Onshore Alaska Central North Slope)	Geological and Geophysical Surveys; Infrastructure Development; Construction and Maintenance; Energy Development and Production

Table B-2. List of past, present and reasonably foreseeable future actions.

Category	Activity	Area or Location	Past, Present, RFFA*
Subsistence	Whale Harvest	Central Beaufort Sea, (Nuiqsut to Cross Island)	Past, Present, RFFA
Scientific	Pacific Arctic Group (PAG)	Beaufort Sea, Chukchi Sea, Bering Strait	Present, RFFA
Scientific	Bowhead Whale Studies	Beaufort Sea	Past, Present, RFFA
Scientific	Long Term Arctic Census	Beaufort Sea (International)	Past, Present, RFFA
Oil and Gas*	Seismic Survey	BPXA, North Prudhoe Bay	Past
Oil and Gas	Seismic Survey	SAExploration, Beaufort Sea	Past
Oil and Gas	Seismic Survey	Ion Geophysical, Beaufort Sea	Past
Oil and Gas	Exploration Drilling	Camden Bay-Sivulliq prospect (Shell)	Past
Oil and Gas	Exploration Drilling	Smith Bay (Caelus Energy)	Past
Oil and Gas	Exploration Drilling	Qugruk Unit	Past
Oil and Gas	Production	Colville – Alpine CD-1, CD-2,CD-3,CD-4	Present
Oil and Gas	Production	Colville - Alpine CD-5	Present, RFFA
Oil and Gas	Production	Greater Moose's Tooth - GMT2	RFFA
Oil and Gas	Production	Kuparuk – Meltwater, Palm, Tarn, Kuparuk, Shark Tooth, West Sak	Past, Present, RFFA
Oil and Gas	Production	Liberty Unit	RFFA
Oil and Gas	Production	Caleus Energy, Smith Bay	RFFA
Oil and Gas	Production	Milne Point	Past, RFFA
Oil and Gas	Production	Northstar	Past, Present, RFFA
Oil and Gas	Production	Nikaitchuq Unit	Past, Present, RFFA
Oil and Gas	Production	Oooguruk Unit – Pioneer and Nuna	Present, RFFA
Oil and Gas	Production	Pikka Unit - Nanusuk	RFFA
Oil and Gas	Gravel Mining /Fill / Extraction	North Slope	Past, Present, RFFA
Oil and Gas	USACE Wetland Fill	North Slope	Past, Present, RFFA

*Reasonably foreseeable future oil and gas activities - activities where sufficient planning and/or initiation of appropriate permitting processes have begun that they are considered likely to proceed.

B-2.1. Marine Vessel Traffic

Marine vessel traffic in the area may consist of subsistence hunting vessels, oil and gas activities, research or military activity. Weather and ice have typically limited marine vessel traffic to July through September. Future marine traffic patterns may change due to the influence of a longer ice-free period and overall decreased ice cover, potentially increasing the number of vessels traversing the central North Slope.

Vessel traffic, in the project area, is expected to be limited, primarily to those vessels associated with the proposed activities, fishing and hunting, and possibly Coast Guard activities. During ice-free months (June-October), barges are used for supplying the local communities, Alaskan Native villages, and the North Slope oil-industry complex at Prudhoe Bay with larger items that cannot be flown in on commercial air carriers. Usually, one large fuel barge and one supply barge visit the villages per year and one barge per year traverses through the Arctic Ocean to the Canadian Beaufort Sea.

B-2.2. Aircraft Traffic

Past air traffic activities in the area of the proposed project have been limited to movement of people and supply materials between industry operations, native villages, and military outposts. Air traffic has increased in recent years, primarily from increases in academic and commercial ventures, and increases in military operations. Arctic aircraft traffic includes fixed-wing and helicopter flights for research programs and marine mammal monitoring operations; cargo flights for supplies to villages and for commercial ventures including oil and gas related activities (such as crew changes and supply flights); flights for regional and inter-village transport of passengers; air ambulance and search and rescue emergency flights; general aviation for the purpose of sport hunting and fishing or flightseeing activities; and multi-governmental military flights. Overall, air traffic is expected to continue at present levels for the reasonably foreseeable future.

B-2.3. Subsistence Activities

Subsistence hunting and other community activities by residents of Nuiqsut are expected to continue during the Proposed Action. Residents primarily use boats nearshore and at staging areas along the coast to practice subsistence activities during June through October. Additional information regarding these activities is provided in Sections 3.10 and 4.8.

B-2.4. Scientific Research Activities

A sizable scientific research effort by governmental, non-governmental, and academic organizations operating from marine vessels and aircraft occurs annually in the Beaufort Sea. Programs conducted by these organizations are expected to continue through the period of the Proposed Action. Scientific activities occurring in the region include research pertaining to climate, physical oceanography, marine chemistry, biological oceanography, and marine biology.

Marine environmental baseline studies involve deployment of oceanographic equipment for collecting water and sediment samples, and use of nets and trawls for fish sampling and collection of phytoplankton, zooplankton, benthic invertebrates, and pelagic invertebrates. Also continuing will be observations of marine and coastal birds and marine mammals using standardized survey transect methods and passive acoustic monitoring. Equipment such as buoys, drifters tracked by satellite, and acoustic wave and current meters will continue to be deployed for various studies Ocean cruises to sample a multitude of biological systems are ongoing and data continue to be disseminated and coordinated by the Pacific Arctic Group (PAG), whose mission is to enhance scientific collaboration and partnerships.

B-3. OIL AND GAS RELATED ACTIVITIES

Onshore oil development has been the main agent of industrial change on the North Slope and throughout the Arctic OCS in the twentieth and twenty-first centuries. Oil and gas exploration activities have occurred on the North Slope since the early 1900s, with oil and gas exploration and production beginning in earnest with the Prudhoe Bay discovery in the late 1960s. Oil production has occurred for over 40 years in the region, and presently spans from Alpine in the west to Point Thomson in the east. By 2014, over 17.15 billion barrels of oil had been produced from the region.

Associated industrial development has included the creation of industry-supported community airfields at Deadhorse and Kuparuk, and an interconnected industrial infrastructure that includes roadways, pipelines, production and processing facilities, gravel mines, and docks. In 1977, the Trans-Alaska Pipeline System (TAPS) began to transport North Slope crude oil to a year-round marine terminal in Valdez, Alaska. Today, it continues to transport the North Slope's entire onshore and offshore oil production, and it is projected to do so for many years into the future.

B-3.1. Nikaitchuq Development

The Nikaitchuq Unit has supported ongoing construction, exploration and production activities under the current operator since 2006. Past and current drilling activities have occurred at an existing man-made gravel island, the Spy Island Drillsite (SID) just south of the Spy Island barrier island. Past activities have also included the construction of a ten-acre onshore production and processing facility at Oliktok Point (OPP). This onshore facility required a USACE 404 wetland fill permit. Additional facilities include a subsea pipeline bundle from SID to the production pad. Hydrocarbon products from the current facilities are transported from Oliktok Point through aboveground transmission pipelines that ultimately tie to the Trans Alaska Pipeline System (TAPS). The subsea pipeline from SID to OPP was constructed in 2009, and the pipeline between OPP and the Kuparuk Pipeline was constructed in 2010. The current Nikaitchuq production is approximately 25,000 bbls/day from 70 wellbores. From 2011 through 2015, Eni has drilled a total of 23wells in State of Alaska leases from OPP; 11 production wells, 8 injection wells, 3 water source wells, and 1 disposal well. From late 2011 through 2015, Eni has drilled a total of 32 wells on State of Alaska leases from the SID; 18 production wells, 13 injection wells, and one disposal well. Construction of SID was completed in 2010, with first oil in January 2011. Between 2010 and 2015, Eni drilled a total of 32 wells into State of Alaska leases from SID: 18 production wells, 13 injection wells, and a single disposal well.

If the current exploration activities are not approved, Eni proposes to expedite drilling additional production wells and sidetracks into State of Alaska leases as part of their Nikaitchuq Development Project. Drilling would continue year-round on state leases, beginning in January 2018 and continuing through March 2019. No improvements to the SID facilities or the drill rig would be required. BOEM assumes these additional production wells into state leases will be developed in the future regardless of its decision on the current EP. Based on the results of the exploratory drilling in the Proposed Action, it is possible that Eni would initiate development and production activities on Nikaitchuq North OCS (Federal) leases. Development of these leases may, or may not, require construction of additional infrastructure. A development and production plan (DPP) submitted for these activities would be subject to NEPA review.

Operational support needs would continue, although projected vessel and vehicle trips would vary based on production and active drilling needs, as opposed to support needs for exploratory drilling. For example, more barge and hovercraft trips would be required for active drilling support during 2018-2019. Other support needs would be very similar to, or identical with, the Proposed Action. These include personnel levels, waste disposal, maintenance dredging at SID, and ice road construction. Expected differences in the linear feet of pipe required, and in the drilling fluids used for production vs. exploration are also provided in detail (Appendix O, Table 2.4, Eni EP).

B-3.2. Pikka Unit and Nanushuk Development

The Pikka Unit was approved in 2015 to accommodate Repsol and Armstrong Energy's exploration leases. Wells, referred to as Horseshoe-1 and 1A, were drilled on State land during the 2016-2017 winter season in a section of the Pikka Unit known as the Nanushuk Prospect. In 2017, Repsol and Armstrong Energy reported they had discovered the largest U.S. onshore oil discovery in 30 years between the Colville River Unit, the Oooguruk Unit and the Placer Unit in the central North Slope. The Horseshoe wells are located approximately 12 miles south of Nuiqsut, indicating the successful extension of the Nanushuk Prospect by 20 miles (32 kilometers).

The Pikka Unit (including the Nanushuk Development) and the Horseshoe discovery apparently contain at least 1.2 billion barrels of recoverable light oil combined. First production for the Pikka Unit from the Nanushuk Development could occur as early as 2021, with a potential rate approaching 120,000 barrels of oil per day. Armstrong Energy, proposing to develop Nanushuk, will target oil deposits in the Alpine C and Nanushuk reservoirs. The project is southeast of the East Channel of the Colville River, located approximately 52 miles west of Deadhorse and about 6.5 miles from Nuiqsut (at the southernmost location of the Nanushuk Project). The project will include construction of the Nanushuk Pad comprised of Drill Site 1 and a Central Processing Facility, Drill Site 2, Drill Site 3, an operations center pad, infield pipelines, the export/import Nanushuk Pipeline, infield roads, and an access road.

B-3.3. Alpine Satellite Development

The Colville River Unit (commonly referred to as Alpine) is located in the Colville River Delta on Alaska's western North Slope, 34 miles west of the Kuparuk River Field (Kuparuk) and eight miles north of the Inupiat village of Nuiqsut. After processing, the sales-quality crude oil from Alpine moves to market through an elevated 34-mile, 14-inch pipeline connecting Alpine to the Trans-Alaska Pipeline System via the Kuparuk Pipeline System. Construction of the newest Alpine field satellite development drill site (CD-5) began in 2014. This new drill site is located on Alaska Native village corporation lands and required on-site processing facilities, associated gravel roads, bridges, and pipelines from the Central Alpine processing facility to Nuiqsut. This is the first commercial oil production from within the National Petroleum Reserve in Alaska (NPR-A). First production flowed from CD-5 to Alpine CPF in October 2015 and is estimated to peak at a rate of 16,000 barrels per day. Continued drilling at CD-5 for an eventual total of up to 33 wells is anticipated. The Alpine field also supports production at the Greater Mooses Unit (GMT).

B-3.4. Liberty Development

The Liberty Unit came under the Operatorship of Hilcorp Alaska, LLC (Hilcorp) in November 2014; then Hilcorp submitted the Liberty Development and Production Plan (DPP) to BOEM in December 2014. The Liberty DPP was deemed submitted by BOEM in September 2015, which initiated the EIS process (currently underway).

The Liberty Prospect was discovered in OCS waters in the late 1980's by Shell Oil Company which drilled four wells from Tern and Goose Islands. Later, BP Exploration Alaska drilled an additional exploration well in the area. These exploration wells determined that the prospect had about 80 – 150 billion barrels of producible oil. Hilcorp has proposed to develop these oil reserves using an artificial gravel island located in Foggy Island Bay in the Beaufort Sea, with a peak production rate of 60,000 barrels per day.

The development of the Liberty Prospect would include the 9.3 ac Liberty Development and Production Island, including drilling and processing facilities; a 5.6-mile long pipeline, running from the offshore island to an onshore tie-in point with the Badami Pipeline; and, small accessory onshore gravel pads. This project is scheduled to commence and continue for approximately 25 years, including construction, operations and decommissioning.

B-4. CLIMATE CHANGE AND OCEAN ACIDIFICATION

Climate change is an ongoing consideration in evaluating cumulative effects on environmental resources of the Arctic region (NOAA, 2015). It has been implicated in changing weather patterns, changes in the classification and seasonality of ice cover, ocean surface temperature regimes, and the timing and duration of phytoplankton blooms in the Beaufort Sea. These changes have been attributed to rising CO_2 levels in the atmosphere and corresponding increases in the CO_2 levels of the waters of the world's oceans. These changes have also led to the phenomena of ocean acidification, often called a sister problem to climate change, because they are both attributed to human activities that are leading to increased CO_2 levels in the atmosphere (IPCC, 2014).

The capacity of the Arctic Ocean to uptake CO_2 is expected to increase in response to climate change (Bates and Mathis, 2009). Further, ocean acidification in high latitude seas is happening at a more advanced rate than in other areas. This is due to the loss of sea ice that increases the surface area of the Arctic seas. This exposure of cooler surface water lowers the solubility of calcium carbonate, which results in lower saturation levels of calcium carbonate within the water, and in turn leads to lower available levels of the minerals needed by shell-producing organisms, such as pteropods, foraminifers, sea urchins, and molluscs (Fabry et al., 2009; Mathis, 2011). Measurable changes in climate have been occurring over the last 180 years in Alaska (Smith et al., 2005; Wendler and Shulski, 2009; Abram et al., 2016) and are projected to occur into the future (Markon, Trainor, and Chapman, 2012).

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Appendix C

Lease Stipulations

C-1. LEASE STIPULATIONS

Leasing Activities Information

MMS

U.S. Department of the Interior
Minerals Management Service
Alaska OCS Region

Lease Stipulations

Oil and Gas Lease Sale 195

Beaufort Sea

March 30, 2005

Stipulation No. 1. Protection of Biological Resources

Stipulation No. 2. Orientation Program

Stipulation No. 3. Transportation of Hydrocarbons

Stipulation No. 4. Industry Site-Specific Bowhead Whale Monitoring Program

Stipulation No. 5. Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence harvesting Activities

Stipulation No. 6. Pre-Booming Requirements for Fuel Transfers

Stipulation No. 7. Lighting of Lease Structures to Minimize Effects to Spectacled and Steller's Eider

Stipulation No. 1 - Protection of Biological Resources

If biological populations or habitats that may require additional protection are identified in the leased area by the Regional Supervisor, Field Operations (RS/FO), the RS/FO may require the lessee to conduct biological surveys to determine the extent and composition of such biological populations or habitats. The RS/FO shall give written notification to the lessee of the RS/FO's decision to require such surveys.

Based on any surveys that the RS/FO may require of the lessee or on other information available to the RS/FO on special biological resources, the RS/FO may require the lessee to:

1. relocate the site of operations;
2. establish to the satisfaction of the RS/FO, on the basis of a site-specific survey, either that such operations will not have a significant adverse effect upon the resource identified or that a special biological resource does not exist;
3. operate only during those periods of time, as established by the RS/FO, that do not adversely affect the biological resources; and/or
4. modify operations to ensure that significant biological populations or habitats deserving protection are not adversely affected.

If any area of biological significance should be discovered during the conduct of any operations on the lease, the lessee shall immediately report such findings to the RS/FO and make every reasonable effort to preserve and protect the biological resource from damage until the RS/FO has given the lessee direction with respect to its protection.

The lessee/operator shall submit all data obtained in the course of biological surveys to the RS/FO with the locational information for drilling or other activity. The lessee may take no action that might affect the biological populations or habitats surveyed until the RS/FO provides written directions to the lessee with regard to permissible actions.

Stipulation No. 2 – Orientation Program

The lessee shall include in any exploration or development and production plans submitted under 30 CFR 250.203 and 250.204 a proposed orientation program for all personnel involved in exploration or development and production activities (including personnel of the lessee's agents, contractors, and subcontractors) for review and approval by the RS/FO. The program shall be designed in sufficient detail to inform individuals working on the project of specific types of environmental, social, and cultural concerns that relate to the sale and adjacent areas. The program shall address the importance of not disturbing archaeological and biological resources and habitats, including endangered species, fisheries, bird colonies, and marine mammals and provide guidance on how to avoid disturbance. This guidance will include the production and distribution of information cards on endangered and/or threatened species in the sale area. The program shall be designed to increase the sensitivity and understanding of personnel to community values, customs, and lifestyles in areas in which such personnel will be operating. The orientation program shall also include information concerning avoidance of conflicts with subsistence, commercial fishing activities, and pertinent mitigation.

The program must be attended at least once a year by all personnel involved in onsite exploration or development and production activities (including personnel of the lessee's agents, contractors, and subcontractors) and all supervisory and managerial personnel involved in lease activities of the lessee and its agents, contractors, and subcontractors.

The lessee shall maintain a record of all personnel who attend the program onsite for so long as the site is active, not to exceed 5 years. This record shall include the name and date(s) of attendance of each attendee.

Stipulation No. 3 – Transportation of Hydrocarbons

Pipelines will be required: (a) if pipeline rights-of-way can be determined and obtained; (b) if laying such pipelines is technologically feasible and environmentally preferable; and (c) if, in the opinion of the lessor, pipelines can be laid without net social loss, taking into account any incremental costs of pipelines over alternative methods of transportation and any incremental benefits in the form of increased environmental protection or reduced multiple-use conflicts. The lessor specifically reserves the right to require that any pipeline used for transporting production to shore be placed in certain designated management areas. In selecting the means of transportation, consideration will be given to recommendations of any advisory groups and Federal, state, and local governments and industry.

Following the development of sufficient pipeline capacity, no crude oil production will be transported by surface vessel from offshore production sites, except in the case of an emergency. Determinations as to emergency conditions and appropriate responses to these conditions will be made by the RS/FO.

Stipulation No. 4 – Industry Site-Specific Bowhead Whale-Monitoring Program.

Lessees proposing to conduct exploratory drilling operations, including seismic surveys, during the bowhead whale migration will be required to conduct a site-specific monitoring program approved by the RS/FO; unless, based on the size, timing, duration and scope of the proposed operations, the RS/FO, in consultation with the North Slope Borough (NSB) and the Alaska Eskimo Whaling

Commission (AEWC), determine that a monitoring program is not necessary. The RS/FO will provide the NSB, AEWC, and the State of Alaska a minimum of 30 but no longer than 60 calendar days to review and comment on a proposed monitoring program prior to approval. The monitoring program must be approved each year before exploratory drilling operations can be commenced.

The monitoring program will be designed to assess when bowhead whales are present in the vicinity of lease operations and the extent of behavioral effects on bowhead whales due to these operations. In designing the program, lessees must consider the potential scope and extent of effects that the type of operation could have on bowhead whales. Experiences relayed by subsistence hunters indicate that, depending on the type of operations, some whales demonstrate avoidance behavior at distances of up to 35 miles. The program must also provide for the following:

1. Recording and reporting information on sighting of other marine mammals and the extent of behavioral effects due to operations;
2. Inviting an AEWC or NSB representative to participate in the monitoring program as an observer;
3. Coordinating the monitoring logistics beforehand with the MMS Bowhead Whale Aerial Survey Project (BWASP);
4. Submitting daily monitoring results to the MMS BWASP;
5. Submitting a draft report on the results of the monitoring program to the RS/FO within 60 days following the completion of the operation (the RS/FO will distribute this draft report to the AEWC, the NSB, the State of Alaska, and the National Oceanic and Atmospheric Administration-Fisheries [NOAA]); and
6. Submitting a final report on the results of the monitoring program to the RS/FO (the final report will include a discussion of the results of the peer review of the draft report and the RS/FO will distribute this report to the AEWC, the NSB, the State of Alaska, and the NOAA Fisheries).

Lessees will be required to fund an independent peer review of a proposed monitoring plan and the draft report on the results of the monitoring program. This peer review will consist of independent reviewers who have knowledge and experience in statistics, monitoring marine mammal behavior, the type and extent of the proposed operations, and an awareness of traditional knowledge. The peer reviewers will be selected by the RS/FO from experts recommended by the NSB, the AEWC, industry, NOAA Fisheries, and MMS. The results of these peer reviews will be provided to the RS/FO for consideration in final approval of the monitoring program and the final report, with copies to the NSB, AEWC, and the State of Alaska.

In the event the lessee is seeking a Letter of Authorization (LOA) or Incidental Harassment Authorization (IHA) for incidental take from the NOAA Fisheries, the monitoring program and review process required under the LOA or IHA may satisfy the requirements of this stipulation. Lessees must advise the RS/FO when it is seeking an LOA or IHA in lieu of meeting the requirements of this stipulation and provide the RS/FO with copies of all pertinent submittals and resulting correspondence. The RS/FO will coordinate with the NOAA Fisheries and advise the lessee if the LOA or IHA will meet these requirements.

This stipulation applies to the following blocks for the time periods listed and will remain in effect until termination or modification by the Department of the Interior, after consultation with the NOAA Fisheries and the NSB.

<u>Spring Migration Area: April 1 through June 15</u>

OPD: NR 05-01, Dease Inlet. Blocks included:

6102-6111	6302-6321	6508-6523	6717-6723
6152-6167	6354-6371	6560-6573	
6202-6220	6404-6423	6610-6623	
6252-6270	6455-6473	6659-6673	

OPD: NR 05-02, Harrison Bay North. Blocks included:

6401-6404	6501-6506	6601-6609	6701-6716
6451-6454	6551-6556	6651-6659	

<u>Central Fall Migration Area: September 1 through October 31</u>

OPD: NR 05-01, Dease Inlet. Blocks included:

6102-6111	6354-6371	6610-6623	6856-6873
6152-6167	6404-6423	6659-6673	6908-6923
6202-6220	6455-6473	6706-6723	6960-6973
6252-6270	6508-6523	6756-6773	7011-7023
6302-6321	6560-6573	6806-6823	7062-7073
			7112-7123

OPD: NR 05-02, Harrison Bay North. Blocks included:

6401-6404	6601-6609	6801-6818	7001-7023
6451-6454	6651-6659	6851-6868	7051-7073
6501-6506	6701-6716	6901-6923	7101-7123
6551-6556	6751-6766	6951-6973	

OPD: NR 05-03, Teshekpuk. Blocks included:

6015-6124	6067-6072

OPD: NR 05-04, Harrison Bay. Blocks included:

6001-6023	6157-6173	6309-6324	6461-6471
6052-6073	6208-6223	6360-6374	6513-6519
6106-6123	6258-6274	6410-6424	6565-6566

OPD: NR 06-01, Beechey Point North. Blocks included:

6901-6911	6951-6962	7001-7012	7051-7062
			7101-7113

OPD: NR 06-03, Beechey Point. Blocks included:

6002-6014	6202-6220	6401-6424	6618-6624
6052-6064	6251-6274	6456-6474	6671-6674
6102-6114	6301-6324	6509-6524	6722-6724
6152-6169	6351-6374	6568-6574	6773

OPD: NR 06- Flaxman Island. Blocks included:

6301-6303	6421-6459	6601-6609	6751-6759
6351-6359	6501-6509	6651-6659	6802-6809
6401-6409	6551-6559	6701-6709	6856-6859

Eastern Fall Migration: August 1 through October 31

OPD: NR 06-04, Flaxman Island. Blocks included:

6360-6364	6560-6574	6760-6774	6961-6974
6410-6424	6610-6624	6810-6824	7013-7022
6460-6474	6660-6674	6860-6874	7066-7070
6510-6524	6710-6724	6910-6924	7118-7119

OPD: NR 07-03, Barter Island. Blocks included:

6401-6405	6601-6605	6801-6803	7012-7013
6451-6455	6651-6655	6851-6853	7062-7067
6501-6505	6701-6705	6901-6903	7113-7117
6551-6555	6751-6753	6962-6963	

OPD: NR 07-05, Demarcation Point. Blocks included:

6016-6022	6118-6125	6221-6226	6324-6326
6067-6072	6169-6175	6273-6276	

OPD: NR 07-06, Mackenzie Canyon. Blocks included:

6201	6251	6301	6351

Stipulation No. 5 – Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence-Harvesting Activities.

Exploration and development and production operations shall be conducted in a manner that prevents unreasonable conflicts between the oil and gas industry and subsistence activities (including, but not limited to, bowhead whale subsistence hunting).

Prior to submitting an exploration plan or development and production plan (including associated oil-spill contingency plans) to MMS for activities proposed during the bowhead whale migration period, the lessee shall consult with the directly affected subsistence communities, Barrow, Kaktovik, or Nuiqsut, the North Slope Borough (NSB), and the Alaska Eskimo Whaling Commission (AEWC) to discuss potential conflicts with the siting, timing, and methods of proposed operations and safeguards or mitigating measures which could be implemented by the operator to prevent unreasonable conflicts. Through this consultation, the lessee shall make every reasonable effort, including such mechanisms as a conflict avoidance agreement, to assure that exploration, development, and production activities are compatible with whaling and other subsistence hunting activities and will not result in unreasonable interference with the subsistence harvests.

A discussion of resolutions reached during this consultation process and plans for continued consultation shall be included in the exploration plan or the development and production plan. In particular, the lessee shall show in the plan how its activities, in combination with other activities in the area, will be scheduled and located to prevent unreasonable conflicts with subsistence activities. Lessees shall also include a discussion of multiple or simultaneous operations, such as ice management and seismic activities, that can be expected to occur during operations in order to more accurately assess the potential for any cumulative effects. Communities, individuals and other entities who were involved in the consultation shall be identified in the plan. The RS/FO shall send a copy of the exploration plan or development and production plan (including associated oil-spill contingency plans) to the directly affected communities and the AEWC at the time they are submitted to the MMS to allow concurrent review and comment as part of the plan approval process.

In the event no agreement is reached between the parties, the lessee, the AEWC, the NSB, the National Oceanic and Atmospheric Administration – Fisheries (NOAA), or any of the subsistence communities that could be affected directly by the proposed activity may request that the RS/FO assemble a group consisting of representatives from the subsistence communities, AEWS, NSB, NOAA Fisheries, and the lessee(s) to specifically address the conflict and attempt to resolve the issues before making a final determination on the adequacy of the measures taken to prevent unreasonable conflicts with subsistence harvests. Upon request, the RS/FO will assemble this group if the RS/FO determines such a meeting is warranted and relevant before making a final determination on the adequacy of the measures taken to prevent unreasonable conflicts with subsistence harvests.

The lessee shall notify the RS/FO of all concerns expressed by subsistence hunters during operations and of steps taken to address such concerns. Lease-related use will be restricted when the RS/FO determines it is necessary to prevent unreasonable conflicts with local subsistence hunting activities.

In enforcing this stipulation, the RS/FO will work with other agencies and the public to assure that potential conflicts are identified and efforts are taken to avoid these conflicts.

Subsistence whaling activities occur generally during the following periods:

> **August to October:** Kaktovik whalers use the area circumscribed from Anderson Point in Camden Bay to a point 30 kilometers north of Barter Island to Humphrey Point east of Barter Island. Nuiqsut whalers use an area extending from a line northward of the Nechelik Channel of the Colville River to Flaxman Island, seaward of the Barrier Islands.
>
> **September to October:** Barrow hunters use the area circumscribed by a western boundary extending approximately 15 kilometers west of Barrow, a northern boundary 50 kilometers north of Barrow, then southeastward to a point about 50 kilometers off Cooper Island, with an eastern boundary on the east side of Dease Inlet. Occasional use may extend eastward as far as Cape Halkett.

Stipulation No. 6 – Pre-Booming Requirements for Fuel Transfers.

Fuel transfers (excluding gasoline transfers) of 100 barrels or more occurring 3 weeks prior to or during the bowhead whale migration will require pre-booming of the fuel barge(s). The fuel barge must be surrounded by an oil-spill-containment boom during the entire transfer operation to help reduce any adverse effects from a fuel spill. This stipulation is applicable to the blocks and migration times listed in the stipulation on Industry Site-Specific Bowhead Whale-Monitoring. The lessee's oil-spill-contingency plans must include procedures for the pre-transfer booming of the fuel barge(s).

Stipulation No. 7 – Lighting of Lease Structures to Minimize Effects to Spectacled and Steller's Eider.

In accordance with the Biological Opinion for the Beaufort Sea Lease Sale 186 Issued by the U.S. Fish and Wildlife Service (FWS) on October 22, 2002, and FWS's subsequent amendment of the Incidental Take Statement on September 21, 2004, lessees must adhere to lighting requirements for all exploration or delineation structures so as to minimize the likelihood that migrating spectacled or Steller's eiders will strike these structures.

Lessees are required to implement lighting requirements aimed at minimizing the radiation of light outward from exploration/delineation structures to minimize the likelihood that spectacled or Steller's eiders will strike those structures. These requirements establish a coordinated process for a performance based objective rather than pre-determined prescriptive requirements. The performance based objective is to minimize the radiation of light outward from exploration/delineation structures. Measures to be considered include but need not be limited to the following:

- Shading and /or light fixture placement to direct light inward and downward to living and work structures while minimizing light radiating upward and outward;
- Types of lights;
- Adjustment of the number and intensity of lights as needed during specific activities;

- Dark paint colors for selected surfaces;
- Low reflecting finishes or coverings for selected surfaces; and
- Facility or equipment configuration.

Lessees are encouraged to consider other technical, operational and management approaches to reduce outward light radiation that could be applied to their specific facility and operation.

If further information on bird avoidance measures becomes available that suggests modification to this lighting protocol is warranted under the Endangered Species Act to implement the reasonable and prudent measures of the Biological Opinion, MMS will issue further requirements, based on guidance from the FWS. Lessees will be required to adhere to such modification of this protocol. The MMS will promptly notify lessees of any changes to lighting required under this stipulation.

These requirements apply to all new and existing Outer Continental Shelf oil and gas leases issued between the 156^{o} W longitude and 146^{o} W longitude for activities conducted between May 1 and October 31. The MMS encourages operators to consider such measures in areas to the east of 146^{o} W longitude because occasional sightings of eiders that are now listed have been made there and because such measures could reduce the potential for collisions of other, non-ESA listed migratory birds that are protected under the Migratory Bird Treaty Act.

Nothing in this protocol is intended to reduce personnel safety or prevent compliance with other regulatory requirements (E.g. U.S. Coast Guard or Department of Occupational Safety and Health) for marking or lighting of equipment and work areas.

Lessees are required to report spectacled and/or Steller's eiders injured or killed through collisions with lease structures to the Fairbanks Fish and Wildlife Field Office, Endangered Species Branch, Fairbanks, Alaska at (907) 456-0499. We recommend that you call that office for instruction on the handling and disposal of the injured or dead bird.

Lessees must provide MMS with a written statement of measures that will be or that have been taken to meet the objective of this stipulation. Lessees must also include a plan for recording and reporting bird strikes that occur during approved activities to the MMS. This information must be included with an Exploration Plan when the EP is submitted for regulatory review and approval pursuant to 30 CFR 250.203. Lessees are encouraged to discuss their proposed measures in a pre-submittal meeting with the MMS and FWS.