Marsh Creek East 3-D Seismic Survey Environmental Assessment

DOI-BLM-AK-R000-2021-0001EA

Kaktovik Iñupiat Corporation

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Chapter 1 Introduction

1.1 Summary of Proposed Action

Kaktovik Iñupiat Corporation (KIC or applicant) has requested authorization from the Bureau of Land Management (BLM), in the form of a seismic permit, to conduct a three-dimensional (3-D) geophysical winter seismic survey and associated activities on the eastside of the Arctic National Wildlife Refuge (Refuge) Coastal Plain (Coastal Plain) (Appendix A Legal Description, Map 1) for the winter season of 2020-2021. Air-supported cleanup and inspections would take place the following summer. The proposed Project Area encompasses approximately 352,416 acres, including 92,000 acres of KIC owned lands with Arctic Slope Regional Corporation (ASRC) subsurface ownership and approximately 260,416 acres of surrounding federally managed lands subject to the BLM's Coastal Plain Oil and Gas Leasing Program (Coastal Plain Leasing Program).

1.2 Purpose and Need

The BLM's purpose and need for the proposed action is to respond to KIC's application to conduct geophysical activities within the Coastal Plain by providing reasonable access to and use of federally managed lands within the proposed Project Area in a manner that would allow for geophysical exploration of oil and gas resources and related activities while protecting surface resources, other uses of the Coastal Plain, and maintaining other statutory purposes of the Refuge. The objective of the proposed action is to allow the applicant to conduct the requested activity subject to reasonable and appropriate terms and conditions, including, but not limited to, the applicant's proposed project and BLM's Required Operating Procedures (ROPs) (USDOI BLM 2020). Where lease stipulations are referred to herein, it is because the referenced stipulation applies as a ROP for this non-lease-based project.

The applicant's purpose and need of the proposed project is to acquire high-quality, high-resolution seismic data that could inform potential lease sale bidders and future operators. The proposed project would use recently updated seismic recording technology to locate potential oil and gas reservoirs.

1.3 Related Statutes, Regulations, Policies, and Programs

1.3.1 Federal Laws and Regulations

Congress identified the Coastal Plain in Section 1002 of the Alaska National Interest Lands Conservation Act of 1980 (ANILCA) for its oil and natural gas potential. In 2017 Congress passed the Tax Cuts and Jobs Act (Tax Act), Public Law 115-97 (Dec. 22, 2017) (PL 115-97), Section 20001 which lifted a prohibition on oil and gas development imposed by Section 1003 of ANILCA as it pertained to the Coastal Plain and requires the Secretary of the Interior, acting through the BLM, to establish and administer a competitive oil and gas program for the leasing, development, production, and transportation of oil and gas in and from the Coastal Plain. Particularly relevant to the proposed action analyzed in this Environmental Assessment (EA), Section 20001(c)(2) requires BLM to issue any rights-of-way or easements across the Coastal Plain for the exploration, development, production, or transportation necessary to carry out Section 20001. In this regard, a

BLM seismic permit, as sought by the applicant, acts as a right-of-way that authorizes geophysical exploration activities to be conducted across an area.

Throughout this EA, the term "Coastal Plain" (capitalized) refers to the area defined in and referenced throughout Section 20001 of PL 115-97, on which an oil and gas program must be established and administered. When "coastal plain" is used in lower case, it refers to the physiographic province of the Beaufort Sea coastal plain, which includes lands within and outside the Coastal Plain. A description of Acronyms used throughout this EA can be found in Appendix B, references cited in this EA are in Appendix C, and the list of preparers is in Appendix D.

Section 20001(b)(3) of PL 115-97 requires BLM to manage the oil and gas program on the Coastal Plain in a manner similar to the administration of the National Petroleum Reserve in Alaska (NPR-A) oil and gas leasing program. BLM's management of the NPR-A, including the oil and gas program, is guided by an Integrated Activity Plan (IAP) and Environmental Impact Statement (EIS) (collectively "IAP/EIS"). Similar to the NPR-A IAP/EIS, the September 2019 Coastal Plain Oil and Gas Leasing Program EIS (Coastal Plain Leasing EIS) and associated Record of Decision (ROD) (August 2020), was completed to fulfill the BLM's responsibility to establish and administer the Coastal Plain oil and gas program. As they pertain to exploration activities, such as the proposed action, findings in the Coastal Plain Leasing EIS (USDOI BLM 2019) and decisions reflected in the associated 2020 ROD (USDOI BLM 2020) were based upon an open and collaborative public process, as well as experience with multiple exploration projects completed in the NPR-A.

As part of the Coastal Plain Leasing EIS scoping process, the BLM considered public comments provided during scoping meetings held in Anchorage, Arctic Village, Fairbanks, Kaktovik, Utqiavik, and Venetie, Alaska, and in Washington, DC, during May and June 2018, when developing the alternatives for analysis in the Coastal Plain Leasing EIS. It also considered input from cooperating agencies, tribes, and Alaska Native Claims Settlement Act (ANCSA) corporations. Issues such as fish and wildlife, including the Porcupine caribou herd (PCH), special status species, including polar bear (*Ursus maritimus*), analysis of oil and gas activities including seismic and other types of exploration activities, and subsistence use and traditional ways of life, were identified during scoping and addressed in the Coastal Plain Leasing EIS (USDOI BLM 2019).

Section 20001(b)(2)(B) of PL 115-97 amended Section 303(2)(B) of ANILCA, to add a fifth purpose of the Refuge. As amended, Section 303(2)(B) of ANILCA now provides the following purposes (emphasis added in italic):

i. to conserve fish and wildlife populations and habitats in their natural diversity including, but not limited to, the Porcupine caribou herd (including participation in coordinated ecological studies and management of this herd and the Western Arctic Caribou Herd), polar bears, grizzly bears, muskox, Dall's sheep, wolves, wolverines, snow geese, peregrine falcons and other migratory birds and Arctic char and grayling;
ii. to fulfill the international treaty obligations of the United States with respect to fish and wildlife and their habitats;

iii. to provide, in a manner consistent with the purposes set forth in subparagraphs (i) and (ii), the opportunity for continued subsistence uses by local residents;
iv. to ensure, to the maximum extent practicable and in a manner consistent with the purposes set forth in paragraph (i), water quality and necessary water quantity within the Refuge; *and*
v. *to provide for an oil and gas program on the Coastal Plain.*

The proposed action must be consistent with Section 20001 of PL 115-97, BLM regulations at 43 Code of Federal Regulations (CFR) Part 3150 – *Onshore Oil and Gas Geophysical Exploration*, Subpart 3152 – *Exploration in Alaska*, and other applicable Federal laws and Executive Orders (EOs) that apply to activities occurring on federal lands including, but not limited, to: ANILCA, the Endangered Species Act, Federal Land Policy and Management Act (FLPMA), Marine Mammal Protection Act, National Historic Preservation Act, EO 11988 – *Floodplain Management*, and EO 11990 – *Protection of Wetlands*.

1.3.2 Required Permits, Licenses, Authorizations, and Approvals

In addition to a seismic permit issued by BLM under 43 CFR Part 3150, Subpart 3152, a number of other Federal, State, and local permits and approvals must be obtained before the applicant can access the proposed exploration area and conduct seismic exploration and related activities. Primary regulatory authorization requirements for the proposed project are listed in Appendix E.

1.3.3 Related Environmental Analyses

This EA analyzes the environmental impacts of KIC's proposed activities in accordance with the National Environmental Policy Act of 1969, as amended (NEPA) and regulations implementing NEPA promulgated by the Council of Environmental Quality (40 CFR Parts 1500-1508; 85 FR 43357, July 16, 2020) and Department of the Interior (43 CFR Part 46; 73 FR 61314, Oct. 15, 2008).

In processing applications for exploration activities in NPR-A, BLM commonly develops EAs that are tiered to, and/or incorporate by reference, the IAP/EIS. This EA takes a similar approach in that it incorporates by reference the Coastal Plain Leasing EIS (USDOI BLM 2019), as well as the Arctic National Wildlife Refuge Revised Comprehensive Conservation Plan (CCP) (USDOI FWS 2015a and 2015b), in accordance with 40 CFR 1501.11 and 1501.12 and 43 CFR 46.120, 46.135, and 46.140.

1.4 Decision to be Made

The BLM will determine under what terms and conditions to issue a permit to KIC under 43 CFR Subpart 3152 to conduct 3-D seismic and associated activities on the Coastal Plain. The BLM will also determine which mitigation measures, referred to in this EA as Required Operating Procedures (ROPs), are necessary to prevent undue and unnecessary degradation and to protect natural resources and other uses and values in the Project Area.

The US Fish and Wildlife Service (FWS) continues managing all federal lands in the Coastal Plain as part of the Refuge, including both leased and unleased areas; however, the BLM manages all aspects of the oil and gas program, including issuing and administering oil and gas leases and issuing permits for all oil and gas activities (including seismic exploration) occurring on federal lands. Although the FWS is a cooperating agency on this proposed action, the BLM will make the final decision in accordance with PL 115-97, which assigns the BLM the sole responsibility for implementing the oil and gas program.

1.5 Scoping and Issues

Public notification of the application and development of this EA was initiated on October 23, 2020, on the BLM NEPA ePlanning website (https://eplanning.blm.gov/epl-front-office/eplanning/nepa/nepa_register.do). BLM accepted public scoping comments for 14 days, closing the comment period on November 6, 2020. The BLM received approximately 101,300 scoping comment submissions. The majority of comments, 101,148, were "form" emails with the same or very similar wording. There were 210 unique comment letters as well as approximately 917 form letters that contained unique comments.

The BLM conducted government to government and Section 106 consultation with tribes from both Arctic Village and Venetie on November 17 and 19, 2020.

Resources of concern identified through public scoping, internal BLM and FWS scoping, and through government to government consultations are shown in Table 1. BLM specialists evaluated each resource and made determinations of potentially impacted, minimally impacted, or not present. Determinations are tiered to the 2019 Coastal Plain Leasing EIS (USDOI BLM 2019), the 2020 ROD (USDOI BLM 2020), and laws and regulations, as noted.

A **potentially impacted** determination in Table 1 means the proposed action could result in impacts to a resource that are beyond what could be considered minimal or negligible. Resources identified as potentially impacted are further analyzed in this EA. All potentially impacted resources have issue statements identified in Table 2 which are evaluated in this document.

A **minimally impacted** determination in Table 1 means the proposed action would not affect a resource to a degree that would require further analysis because the expected impacts would be minimal, negligible, or are already addressed by standard protections such as Required Operating Procedures from the Coastal Plain Leasing Record of Decision (USDOI BLM 2020) or other legal protections. Minimally impacted resources are not analyzed further in this EA.

A **not present** determination in Table 1 means that a resource is not expected to be affected by the proposed project because it is not physically located where the project is occurring, or it is not in the Project Area during a time when the project is being implemented. Resources that are not present in the Project Area are not discussed further in this EA.

Resource reports found in Appendix F provide greater detail of resources in the Project Area.

Table 1. Resources Evaluated

Resources Considered	Determination	Location of Tiered Information (Coastal Plain Leasing EIS)	Basis of Determination
ACEC's	Not Present		None
Air Quality	Minimally Impacted	Coastal Plain Leasing EIS §3.2.2	Air resources would not be affected to a degree requiring further analysis because either the expected impacts from the proposed action would be minimal or standard protections (e.g ROPs from the Coastal Plain Leasing ROD and other legal protections) would reduce and manage impacts. ROP 5 from the Coastal Plain Leasing ROD requires the use of ultra-low sulfur diesel to reduce air quality impacts. The larger vehicles (tuckers and vibroseis vehicles) would also be equipped with EPA certified Tier 4 engines and associated emissions controls. Refer to Appendix F for further discussion. Protections provided by the Coastal Plain Leasing ROD ROPs 5 and 6a.
Cultural (Prehistoric, Historic, and Ethnographic) and Paleontological Resources	Potentially Impacted	Coastal Plain Leasing EIS §3.4.2	Protection provided by the Antiquities Act (1906), NHPA (1966), ARPA (1979), PRPA (2009), AIRFA (1978); EO 13007; and Coastal Plain Leasing ROD ROPs 10, 11, 13, 14, and 15. Refer to Section 3.2.3 for a detailed analysis of cultural resources.
Environmental Justice	Potentially Impacted	Coastal Plain Leasing EIS §3.4.10	Protection provided by ANILCA and EO 12898. Refer to Section 3.2 for a detailed analysis of sociocultural resources.
Fisheries	Potentially Impacted	Coastal Plain Leasing EIS §3.3.2	Protections provided by the Coastal Plain Leasing ROD ROPs 2, 3, 8, 9, 11, 13, 14; project specific ROPs; and ADF&G Fish Habitat Permits for stream crossings. Essential Fish Habitat (EFH) assessment (Appendix G) finding is *not likely to adversely affect.* Refer to Section 3.8 for a detailed analysis of fish resources.
Floodplains/ Wetlands and Riparian Zones	Minimally Impacted	Coastal Plain Leasing EIS §3.3.1	Protections provided by the Coastal Plain Leasing ROD ROPs 2, 3, 9, and 11.
Invasive, Non-native species	Minimally Impacted	Coastal Plain Leasing EIS §3.3.1	The protections provided by the Coastal Plain Leasing ROD ROP 43 would aid in minimizing the introduction or spread of non-native, invasive species within the Coastal Plain.
Marine Protected Areas	Minimally Impacted	Coastal Plain Leasing EIS §3.4.7	Protections provided by the Coastal Plain Leasing ROD ROPs 1-5 6a, 8, 11, 25, 34, 40 and 43 and Lease stipulation 9.

Resources Considered	Determination	Location of Tiered Information (Coastal Plain Leasing EIS)	Basis of Determination
Recreation	Potentially Impacted	Coastal Plain Leasing EIS §3.4.6	Protections provided by Coastal Plain Leasing ROPs 1-5, 6a, 8, 11, 25, 34, 38, 40, 42 and 43, and Lease Stipulation 9. Refer to Section 3.3.1.1 for a detailed analysis of recreational resources.
Soils/Permafrost	Potentially Impacted	Coastal Plain Leasing EIS §3.2.8	Protections provided by the Coastal Plain Leasing ROD ROP 11 seek to minimize impacts from seismic exploration. Refer to Section 3.5 for a detailed analysis of soils.
Subsistence	Potentially Impacted	Coastal Plain Leasing EIS §3.4.3	Protection provided by ANILCA, applicable Coastal Plain Leasing ROD ROPs and ADFG Fish Habitat Permits. Refer to Sections 3.2.1 and 3.2.1.1 for a detailed analysis of subsistence resources.
Threatened Species Steller's eider	Minimally Impacted	Coastal Plain Leasing EIS § 3.3.3	Steller's eiders are listed as Threatened under the Endangered Species Act and the FWS concurred with the BLM ESA section 7 determination of *not likely to adversely affect.* Steller's eiders are considered to occur only as rare visitors in the Coastal Plain (USFWS 2015a) and would only occur during the summer operations period. Protections provided by 2020 Coastal Plain ROD ROPs 1, 2, 3, 8, 9, 11, 13, 14, 15, 25, 40b, 42b, Lease Stipulation 9 and Lease Notice 1.
Threatened Species Spectacled eider	Minimally Impacted	Coastal Plain Leasing EIS §3.3.3	Spectacled eiders are listed as Threatened under the Endangered Species Act and the FWS concurred with the BLM ESA section 7 determination of *not likely to adversely affect*. The spectacled eider is an uncommon breeder in the Coastal Plain (USFWS 2015a) and would only occur during the summer operations period. Protections provided by Coastal Plain Leasing ROD ROPs 1, 2, 3, 8, 9, 11, 13, 14, 15, 25, 40b, 42b, Lease Stipulation 9 and Lease Notice 1.
Threatened Species Polar Bear	Potentially Impacted	Coastal Plain Leasing EIS §3.3.5	Impacts to polar bear would be minimized with Coastal Plain Leasing ROD ROPs, measures in the proposed action and requirements from the FWS Marine Mammal Protection Act (MMPA) Incidental Harassment Authorization (IHA). Refer to Section 3.7.1 and 3.7.1.1 for a detailed analysis of polar bear.
Threatened Species	Potentially Impacted	Coastal Plain Leasing EIS §3.3.5	Protections provided by the Coastal Plain Leasing ROD ROPs 10, 34, and 40 and numerous measures in the proposed action. Refer to Section 3.7.2 and 3.7.2.1 for a detailed analysis of ringed seal.

Resources Considered	Determination	Location of Tiered Information (Coastal Plain Leasing EIS)	Basis of Determination
Non threatened or endangered birds	Minimally Impacted	Coastal Plain Leasing EIS §3.3.3	Snowy owls, gyrfalcons, raven, and ptarmigan may inhabit the area during the winter operations period. Most birds that regularly occur in the Project Area would be present during summertime operations (Appendix F). Protections provided by the Coastal Plain Leasing ROD ROPs 1, 2, 3, 8, 9, 11, 13, 14, 15, 25, 34 c&f, 40b, 42b and Lease Stipulation 9.
Non threatened or endangered mammals	Potentially Impacted	Coastal Plain Leasing EIS §3.3.4	Protections provided by the Coastal Plain Leasing ROD Stipulations and ROP's. Refer to Section 3.6 for a detailed analysis of wildlife.
Vegetation	Potentially Impacted	Coastal Plain Leasing EIS §3.3.1	Refer to Section 3.4 for a detailed analysis of vegetation.
Visual Resource Management	Potentially Impacted	Coastal Plain Leasing EIS §3.4.8	Protections provided the Coastal Plain Leasing ROD ROPs 1-3, 8, 11, 40 and 43. Refer to Section 3.3.2.1 for a detailed analysis of visual resources.
Water Resources	Potentially Impacted	Coastal Plain Leasing EIS §3.2.10	Protections provided the Coastal Plain Leasing ROD ROPs 8, 9, 11, and 13. Refer to Section 3.8 for a detailed analysis of water resources.
Waste (Hazardous/ Solid)	Minimally Impacted	Coastal Plain Leasing EIS §3.2.11	Protections provided by ADEC regulations 18 AAC 60 (solid waste management) and 18 AAC 75 (oil and other hazardous substances pollution control), the applicants Waste Management Plan and Spill Prevention Countermeasures and Control (SPCC) Plan, and ROPs 1, 2, and 3.
Wild & Scenic Rivers	Potentially Impacted	Coastal Plain Leasing EIS §3.4.7	Protections provided by the Coastal Plain Leasing ROD ROPs 1-5, 6a, 8, 11, 25, 34, 40 and 43 and Lease stipulation 9. Refer to Sections 3.3.4 and 3.3.4.1 for a detailed analysis of wild and scenic rivers.
Wilderness Characteristics	Potentially Impacted	Coastal Plain Leasing EIS §3.4.7	Protections provided by the Coastal Plain Leasing ROD ROPs 1, 11, and lease stipulation 9. Refer to Sections 3.3.3 and 3.3.3.1 for a detailed analysis of wilderness characteristics.

Table 2. Issues/Concerns Identified for Evaluating Impacts

Issue/Concern Identified for Evaluating Impacts	Evaluation Section
How would seismic activity affect the abundance, availability, and access to subsistence resources?	Subsistence
How would seismic activities affect sociocultural systems and land uses of minority and/or low-income populations in affected communities, and would any effects identified be disproportionate and negative?	Sociocultural Systems and Environmental Justice
How would seismic activities (including overland travel) affect tangible cultural resources (i.e., historic and prehistoric	Cultural/Paleontological

Issue/Concern Identified for Evaluating Impacts	Evaluation Section
artifacts, features, buildings, and structures) and paleontological resources located both on and below the ground surface?	
How would seismic activities (including overland travel) affect *Iizhik Gwats'an Gwandaii Goodlit* (*the Sacred Place Where Life Begins*)?	Cultural/Paleontological
How would summer helicopter work impact recreational users?	Recreation
How would seismic activity affect the scenic quality of the area?	Visual Resources
How would seismic activity affect lands with Wilderness Characteristics within the Project Area?	Wilderness
How would seismic activity affect the status of river classification and values for rivers recommended to Congress for inclusion in the Wild and Scenic River System?	Wild & Scenic Rivers
How would the use of vehicles during seismic exploration activities impact vegetation, including the use of snow trails?	Vegetation
What would be the potential impacts to tundra vegetation resulting from the development and use of snow airstrips in this area?	Vegetation
How would overland vehicle travel impact vegetation, permafrost, and surface water hydrology and runoff?	Vegetation/Soils/Water Resources
What would be the effects of seismic activity on soils and permafrost of the Coastal Plain?	Soils
How would disturbance from seismic exploration including vehicles, noise, human activity, and related summer activities, affect caribou, especially young of the year and pregnant cows?	Wildlife - Caribou
What would be the effects of disturbance from seismic activity and travel on grizzly bears, muskoxen, wolves, foxes, and wolverines?	Wildlife – Other Terrestrial Species
What would be the impacts of seismic activities, including snow compaction, on small mammals that rely on subnivean foraging and travel corridors?	Wildlife – Other Terrestrial Species
What would be the potential impacts to polar bears and their habitat, including designated critical habitat, from the proposed action?	T&E Polar Bear
What would be the potential impacts to ringed seal from the proposed action?	T&E Ringed Seal
How would vibroseis sound waves impact overwintering fish?	Fish
How would snow and water use impact fish, fish habitat, and natural hydrologic patterns?	Fish/Water Resources
What would be the potential impacts of seismic vehicles crossing streams, rivers, and lakes?	Fish/Water Resources
How would seismic activity affect water quality?	Fish/Water Resources

Chapter 2 Proposed Action and Alternatives

2.1 Introduction

Kaktovik Iñupiat Corporation (KIC) has requested authorization to conduct 3-D winter seismic exploration surveys on the eastern Coastal Plain within the Refuge (Appendix A Legal Description). The proposed seismic exploration would be conducted during the winter 2020-2021 by a third-party acquisition company, SAExploration Inc. (SAE). Seismic exploration generates acoustic waves that are picked up by sensors as the waves bounce off subsurface formations. From this information, images can be created that show subsurface topography and formations including structural traps that may host potential hydrocarbons.

Approval of the proposed action would allow KIC and its operator, SAE, to conduct 3-D seismic surveys beginning when frost and snow cover are at sufficient depths to protect tundra (as identified in the 2020 Coastal Plain Leasing Record of Decision) and would continue through the winter season until tundra travel has been closed. Analysis of this project includes access to the seismic Project Area from Deadhorse, advance surveys, storage of fuel, and the use of 1 mobile crew camp, capable of housing up to 180 people. The proposed Project Area includes private and federally managed lands within the Coastal Plain. The Project Area encompasses 352,416 acres (92,000 acres of KIC lands with ASRC subsurface and 260,416 acres of federally managed lands). The geographic region of the seismic exploration would extend from Kajutakrok Creek on the west to Poktok Bay on the east and approximately 25 miles inland. The Project Area also includes offshore waters managed by the FWS and BLM.

2.2 Alternative A - Description of Proposed Action

The proposed project is described below. Equipment and techniques described for the proposed project would be similar to those used for winter seismic exploration on the North Slope in previous winter seasons.

2.2.1 Access and Advance Surveys

Mobilization to the Project Area would begin in January 2021, but after Forward Looking Infrared Radar (FLIR) surveys had been conducted to detect polar bear den sites. KIC estimates there would be sufficient snow cover for mobilization and all permits for tundra travel from the State of Alaska would have been received by January 1, 2021. KIC would work with the operator to deploy 3 thermistors on private land around Kaktovik to determine snow depth and appropriate soil temperatures prior to start of operations.

Equipment would be mobilized from existing facilities in Deadhorse, Alaska. The camp trailers and seismic equipment would be transported by an overland access route from Deadhorse to Kaktovik (Figure 1).

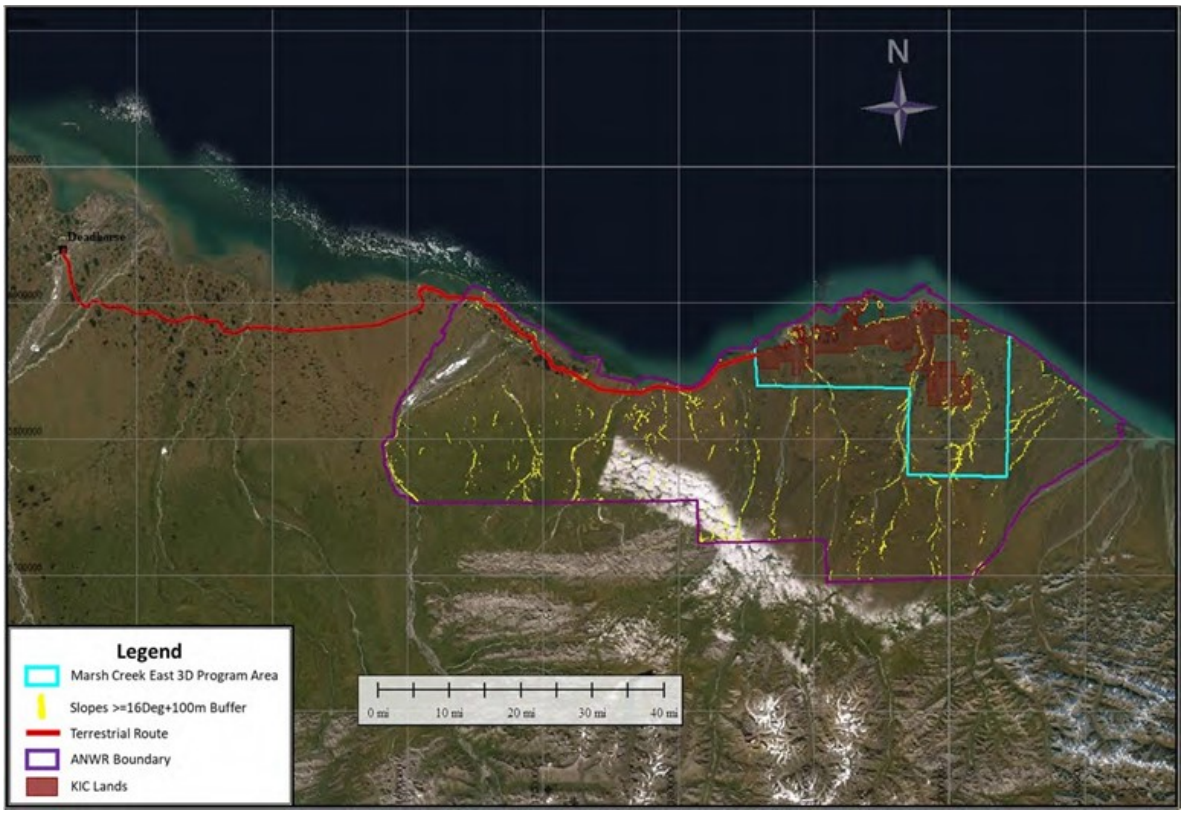

Figure 1. Access/Resupply Route and Project Area.

The total length of the tundra access snow trail from Deadhorse to Kaktovik would be approximately 136.5 miles with 48.6 miles within the Refuge but outside the seismic exploration Project Area (Figure 1). Roughly 18 miles of the access snow trail would be on native corporation lands within the Project Area. No ice roads would be constructed for this project.

Before seismic camp trailers and equipment enter the Project Area, advance survey teams using either Tucker Sno Cats (Tuckers) or Steigers (low ground pressure vehicles) would scout environmental conditions, such as snow depth and ice thickness and integrity, and would map a trail for the main seismic crew and camp to follow. All mobile equipment would have a navigation system installed for logistics and hazard identification. In addition to snow and ice integrity surveys, the advance survey crew would verify, identify, stake, and map avoidance areas including environmental hazards, slopes greater than 10°, native allotments, cultural sites, river/stream crossings, and important habitat features including (but not limited to) polar bear critical habitat and den sites, seal lairs, grizzly bear *(Ursus arctos)* den sites, and sensitive willow areas.

There could be three to four advance crews with two personnel per crew to conduct snow surveys and map avoidance areas. The advance crews would conduct surveys to substantiate snow depths and verify adequate snow cover to protect the tundra from seismic operations and camp moves throughout the Project Area. Snow depths would be recorded and mapped to ensure the best routes would be used. Access to the Project Area as well as seismic activities and camp operations would occur when soil temperatures at 12 inches below the tundra surface (defined as the top of the

organic layer) has reached 23 degrees Fahrenheit (°F) (or less) and snow depths are an average of 9 inches, or 3 inches over the highest tussocks along the line of vehicle travel (USDOI BLM 2020). KIC's operator would use the Alaska Department of Natural Resources (ADNR) snow sampling protocol to determine snow depth.

Advance survey crews would travel throughout the Project Area in advance of the main seismic camp by approximately 7-20 days. There would be one mobile base camp to support the advance crews. This base camp would include camp trailers, Steigers, Tuckers, and support trailers, and travel would be along areas with adequate freeze down and snow cover to protect the tundra (see description of "adequate" freeze down and snow cover above). The mobile base camp would also be established on areas of appropriate freeze down and snow depth to protect the tundra. Advance crews would travel from the base camp using Steigers, Tuckers or snow machines to conduct surveys and marking activities. The crews would work independently of each other to measure snow depth, ice conditions, identify and mark hazards and avoidance areas, and scout safe routes for seismic operations. Depending on the number of locations needed to be verified, crews could travel up to 10 miles per day. At the end of each day, the advance crews would return to the base camp. Once operations are too far from camp for daily travel, the camp would move location to stay close to the advance survey operations. When the main seismic camp arrives with the recording crew, the advance camp would merge with the main camp.

To determine ice conditions at rivers, lakes and on sea ice, the advance crew would use Tuckers and/or snow machines equipped with ground penetrating radar systems (GPR) to test ice thickness. In addition, ice conditions would be checked with battery operated ice augers to verify the calibration of the GPR, measure ice depths on sea ice, or verify depths where the GPR units cannot reach. Freeboard testing would also be conducted along potential routes on floating ice to ensure ice is strong enough to safely support equipment. Tuckers conducting the advance ice check operations would also be equipped with handheld or vehicle mounted FLIR devices to scan for potential polar bear dens in defined polar bear denning habitat. Preliminary trails for vibroseis vehicles would be established along lakes or rivers to reduce the potential for equipment breaking through ice. The advanced crew would also map each hazard encountered and ensure that it is entered into the navigation system so each vehicle would have an up to date display of the Project Area, hazards, and avoidance areas.

River crossings would be based on local knowledge, advanced surveys (to determine environmental and terrain conditions), and operational safety. River and streams would be crossed at low lying areas on suitable ice that would support the weight of equipment. At stream crossings and on the edge of lakes, the advance survey crew would identify steep banks and, depending on the crossing or lake, would either avoid the area and identify a different route or recommend snow ramps be constructed. Snow ramps would be built to protect the integrity of the banks and adjacent tundra, and to lessen the grade for vehicles. Snow ramps would be constructed by moving snow from drifts adjacent to the river/lake banks.

To aid in identifying safe river crossings and reduce the number of vibroseis source lines crossing major drainages, KIC would use a slope analysis tool to map slopes in the Project Area. The

advance survey crews would ground verify predicted steep slopes (greater than 10°) and map them as avoidance locations. Equipment would only cross drainages at areas of the lowest possible relief, as vibroseis vehicles are not able to operate on slopes greater than 10º. All slopes greater than 10º would also have an 82.5-foot avoidance buffer along the slopes for all source points (Refer to Section 2.2.4 Field Operations).

Based on results from the advance survey, snow-packed (prepacked) trails would be made throughout the Project Area by Tuckers and/or Steigers pulling a groomer. These trails would help reduce environmental impacts and would be used for camp moves, resupply, and crew travel (including trails between airstrips and camps). The main seismic camp would move to each predetermined camp site over prepacked snow trails with adequate snow cover using the flattest terrain possible.

Predetermined snow routes have not been identified because routes within the Project Area would be located based on snow conditions, camp locations, results of cultural and wildlife surveys, local knowledge, community consultation, and terrain and environmental conditions. KIC's operator would attempt to coordinate routes with other operators along the proposed access route in order to share the use of any existing or planned trails to access the Project Area.

Temporary airstrips would be constructed on tundra and lakes, as necessary, to support seismic activities. The advance survey crew would identify appropriate locations for airstrips in areas that have adequate space for safely landing aircraft on skis or wheels. Airstrips would be constructed on flat snow-covered tundra using a Tucker or Steiger pulling a groomer. On lakes, a rubber tracked Steiger with a blade would clear snow. Only lakes with grounded ice, that are large enough to use as an airstrip, would be identified for use. Due to the lack of lakes in the Project Area, however, the majority of airstrips would be expected to be on tundra.

Airstrips would be located within 2 miles of the camp and would be approximately 75-100 feet wide and 2,300-3,500 feet long to provide adequate space for aircraft to land. Black bags filled with snow and lights would be placed along the side of the snow berm to delineate the edge of the landing strip. Approximately three trips per week, or as operations require, would be necessary for crew changes and resupply of food.

The airstrips would only be maintained while in use unless the same location would be needed again. When an airstrip is no longer necessary, it would be inspected, the condition recorded, and the location identified with Global Positioning System (GPS) to be included in the final report.

Aircraft would not operate within 0.5 mile of polar bears and would remain 1,500 feet above ground level, except during landing and takeoff, and when required for safety reasons such as inclement weather. The aerial infrared (FLIR) surveys for maternal polar bear den sites, however, would be conducted below this altitude with FWS approval. If a polar bear is observed while the aircraft is on the ground, personnel would board the aircraft and leave the area and the pilot would not fly over the bear. Aircraft routes would be planned to minimize potential conflicts with active or anticipated subsistence hunting, as determined through community consultations. KIC's operator (SAE) has

developed a willow protocol that would ensure willow areas would be mapped and defined by size (Appendix H). Areas containing willows would first be identified via aerial photos and added to known avoidance maps. Willow habitats would then be loaded into the navigation system of vehicles so advanced survey crews could ground truth the sites and mark them as avoidance areas. If an advance crew discovers willows above the snow line, they would investigate further on foot or by snow machine. During ground truthing of willows, subsistence representatives would assist in identifying sensitive willow areas and defining the size of areas to be avoided. Crews would also look for alternative paths to avoid willow areas when willows are visible above the snow line during scouting or operations. If an area with willows is deemed accessible after coordination with the subsistence representative, the route would be marked to minimize impacts to willow habitats.

KIC has commissioned a cultural resource study to identify historic and cultural resources in the Project Area. A licensed archaeologist will work with the North Slope Borough (NSB), State of Alaska and the Refuge Manager to review existing records of all known existing cultural studies in the Project Area. The study will include the use of the Alaska Heritage Resource Survey (AHRS) database, maintained by the ADNR, and the Traditional Land Use Inventory (TLUI) database, maintained by the NSB. All cultural or historic sites within the Project Area would be avoided and have 500-foot non-activity zone buffers placed around them. This avoidance and non-activity zone protocol would include any new historic or cultural sites located during operations. Buffer locations would be entered into the navigation system of all vehicles as well as identified on maps to ensure no vehicles enter avoidance areas. The operator would not be accessing any native allotments without permission of the owners. And all native allotments not involved in the project would be avoided with a 500-foot buffer.

A polar bear awareness training project would be provided to all workers prior to the start of operations. In addition, polar bear awareness refresher briefings would be held as part of regular safety briefings and employees would be instructed to immediately notify the Project Manager or Health, Safety, and Environment (HSE) Advisor whenever a bear is detected. All personnel would be trained on the restrictions regarding "taking" of polar bears as described by the Marine Mammal Incidental Harassment Authorization. All transit outside of the Coastal Plain would be covered under the existing 2016-2021 Beaufort Sea Incidental Take Regulations (ITRs).

Two aerial FLIR surveys, with the objective to detect maternal polar bear den sites, would be conducted in January 2021. If a potential den site is located during the surveys KIC would consult with the FWS to analyze the data and determine if additional surveys or mitigation measures would be warranted. The FLIR survey would be approved by the FWS and reports would be submitted to the agency.

If a polar bear is observed in the immediate area of the camp or operations, workers would stay inside trailers or vehicles to avoid potential interactions with the bear. If a polar bear is detected near any part of the operation, the Project Manager or HSE Advisor and Permits Manager would be notified immediately. Approaching a bear for any reason would be strictly forbidden. Known polar bear den sites would be avoided with a 1-mile buffer in all directions from the beginning of operations through April or until a female with cubs abandon an area. No operations would be

allowed within the 1-mile exclusion zone without approval from the FWS. During operations, should previously unknown occupied polar bear dens be discovered within 1 mile of activities, work would cease and the FWS would be contacted for guidance. All polar bear sightings would be reported to the FWS.

In addition to the no operations buffer around polar bear den sites, designated polar bear critical denning habitat would have a 330-foot avoidance buffer. Crossings over major drainages within denning critical habitat (where necessary to cross) would be surveyed for dens using handheld or truck mounted FLIR instruments prior to movement.

In addition to the Coastal Plain Leasing ROD ROP 10 (USDOI 2020) (Appendix J) that requires protections for ringed seals, the applicant would also submit a sound verification study for BLM and National Marine Fisheries (NMFS) review six weeks before operations begin. In addition, all basking seals would be avoided by a 500 foot no activity buffer and all vehicle operations on sea ice would take place on grounded ice, with the exception of snow machines to set and retrieve recorders. On ungrounded ice, snow machine ice paths would not be greater than 3 feet wide. No unnecessary equipment or operations (e.g., camps) would be located on ungrounded sea ice or within the buffer specified from the sound verification study.

In addition to the general aircraft measures in the Coastal Plain Leasing ROD ROP 34 (USDOI BLM 2020) (Appendix J), aircraft used along the coast and shore fast ice zone would maintain minimum altitude of 3,000 feet when within 1 mile from seals, unless doing so would endanger human life or violate safe flying practices. In addition to the general training measures in the Coastal Plain Leasing ROD ROP 40, a NMFS and BLM-approved training session for all staff would be held prior to workers entering the field. The training would cover seal identification, biology, and status; seal lair descriptions; snow/ice/topographical factors that lead to birthing lair development and minimizing driving over such areas; and all applicable mitigation measures.

After completion of seismic activities, the camp and all equipment would return to Deadhorse using previously identified overland snow routes depending on the camp location at completion of the project. It is possible that the camp and equipment could also return to a pad in Kaktovik for a summer barge demobilization.

All tundra disturbance or impacts would be investigated by the HSE advisor and subsistence representative to determine the extent of the impacts and to report the event. Measurements and photos would be taken and any disturbance to the vegetative mat would be documented and reported to the BLM Authorized Officer within 72 hours of occurrence. Follow-up corrective actions would be determined in consultation with and approved by the BLM Authorized Officer.

2.2.2 Camp Facilities

There would be one main support camp located adjacent to seismic exploration activities. The mobilization of the camp would be from an existing gravel pad (at Deadhorse) and using roads located outside of the Project Area. A pre-determined route and snow trail would be used to move camp equipment to and within the Project Area (Figure 1). The camp would consist of 8-10

"strings" of trailers, typically with 5 trailers per string, and would travel in a single file configuration pulled by a rubber tracked Steiger or heavy equipment. The advance crew would identify routes for the camp move to ensure adequate snow coverage and to avoid hazards or environmentally sensitive sites. Camps would not be located on lakes or rivers and would be a minimum of 500 feet from waterbodies.

The seismic camp would be able to accommodate up to 180 people and would consist of sled-mounted units including; a kitchen and diner, sleeping areas, washrooms, laundry, offices, shops, medical clinic, generator rooms, and storage compartments. Equipment at the main seismic camp would include long haul fuel tractors, remote fuelers, water maker, incinerator, resupply and survival sleighs, tractors, loaders and Tuckers and/or Steigers. There would be up to 50 trailers in the camp. The snow trails for camp moves and resupply would be pre-packed (hardened), groomed and monitored closely for wear to the snow base. Trails would be rerouted to avoid environmental disturbance when necessary. Depending on weather, snow cover and the advancement of seismic exploration activities, the camp would be expected to move one to two miles every five to seven days. It is anticipated that there would be four to six camp moves per month. The maximum footprint for the camp would be approximately 300 feet by 400 feet and the camp would generally be located in the center of seismic operations.

Sanitary conditions in the kitchen, diner and washrooms would be maintained in full compliance with governmental regulations. Gray water would be filtered to meet the discharge requirements of the Alaska Department of Environmental Conservation (ADEC) Alaska Pollutant Discharge Elimination System (APDES) permit prior to discharge (also see 2.2.6 Waste Management). A current APDES discharge permit is in place for this purpose.

Resupply of food and other supplies would occur by aircraft and ground vehicles over packed snow trails two or more times per week. Crew changes would be twice a week and would occur by aircraft and ground vehicle (from airstrips). Rubber tracked vehicles such as Rolligons and/or Steigers would be used to resupply fuel and/or water from Deadhorse or Kaktovik to camp approximately two to three times per week. There would be no hunting or fishing allowed.

After the camp has moved, the HSE advisor and local subsistence representative would visit each camp site to review the area and ensure no damage had occurred.

2.2.3 Fuel Supply and Storage

All vehicles and equipment fuel would be ultra-low sulfur diesel. Rolligons or other rubber tracked vehicles (such as Steigers) would tow long haul sleigh fuel tanks on skis/tracks on prepacked snow trails. In the event the fuel supply is disrupted by weather or other unforeseen events, fuel could be delivered by aircraft using temporary airstrips. There would be no refueling on airstrips (except in the case of an emergency) and off-loading fuel from aircraft would be done in accordance with the operators fueling procedure which would include trained fuelers and ensuring two crew members are involved. The operator would have a Spill Prevention Countermeasure Control (SPCC) plan in place and ensure a copy is provided to the BLM.

The average daily fuel consumption of the camp and vehicles would be approximate 6,000 gallons. KIC anticipates a maximum of 20,000 gallons of fuel to be stored within 7-9 tanks that are each capable of holding 3,500 gallons. This would ensure adequate fuel in case delivery is delayed due to weather. Fuel storage and fueling would be located at least 100 feet from waterbodies and all locations would be recorded. All fueling locations would require management practices to prevent spills including drip plan placement under all parked vehicles and use of vinyl liners with foam dikes under all valves or connections to diesel fuel tanks. All fuel tanks would be double-wall tank construction capable of holding 110 percent of the fuel volume in case of a spill. In addition, fuel dye would be added to more easily detect fuel spills.

All spills, no matter what the size, would be cleaned up and their locations recorded. The operator currently holds a SPCC plan for fueling and fuel storage associated with seismic operations. This SPCC plan is site specific and would be amended for the Marsh Creek East Seismic Survey Project Area. All reportable spills would be communicated through the proper agencies and reporting requirements.

2.2.4 Field Operations

The method of seismic acquisition would be Source Driven Shooting (SDS) combined with a Compressive Sensing design. Seismic operations would be conducted utilizing rubber tracked/buggy vibroseis vehicles and wireless autonomous recording devices (nodes/geophones). Data acquisition would begin in the western portion of the Project Area.

Data would be collected over a grid of recording devices and source lines. Geophone receiver points occupied with wireless nodes and a single geophone (recorder) would be laid out along receiver lines that are perpendicular to source lines and both source and receiver lines would be spaced approximately 1,320 and 660 feet apart, respectively. Up to 5 receiver lines could be placed on the ground at one time. It would take approximately 5-7 days to layout or pick up the recording devices over a grid. The grid of source and receiver lines is referred to as an acquisition spread and the spread would encompass approximately 60,800 acres (5 miles wide by 19 miles long). As vibroseis vehicles advance, the nodes would be retrieved, data downloaded, and the nodes moved to the next acquisition spread.

The wireless nodes and geophones would be deployed and picked up using up to 7 rubber tracked Tuckers to access the sites and then by crews on foot. It is possible that receivers could be placed on ungrounded sea or freshwater ice that is safe for Tucker or snow machines to access but not by the heavier vibroseis vehicles. Each station would be placed individually and would be surveyed by GPS during deployment. Upon retrieval, all GPS data would be entered into a database.

Using the SDS methodology, multiple vibroseis vehicles could collect data at the same time. This methodology allows for a single vibroseis vehicle to travel down a source line, reducing risk of compaction or damage to the tundra. Vibroseis vehicles would only operate on snow covered tundra or grounded sea ice. Up to 12 vibroseis vehicles, spaced at least 1,320 feet apart, could collect data at the same time.

Lighter, smaller univibe vehicles (also used to conduct vibroseis) would be used in narrow riverbeds and on ungrounded freshwater ice. This would reduce potential disturbance as well as reduce the risk of working in areas of ungrounded freshwater ice. Univibes would only be used on lakes where ice is greater than 36-inch thick. Nodal devices and geophones, however, could be placed on lakes and riverbeds where ice is thick enough for Tuckers to travel but not thick enough for the univibes. Univibes could also be used on grounded sea ice. Up to 4 univibe vehicles could collect data at the same time.

The vibroseis sampling frequency along the source line would be 27.5 feet. The duration and decibel level of the source (vibroseis or univibe vehicles) varies depending on factors such as terrain and weather conditions; however, the levels are so low that hearing protection is not required for seismic crew members.

There would be approximately 4,198 miles of receiver lines and 2,104 miles of source lines in the Project Area. Receiver lines would be traveled twice, once to lay out the receivers and again to pick up equipment after recording. Source lines would be traveled by the advance crew in Tuckers to identify hazards and conduct ice stability checks and then would be traveled by one vibroseis vehicle.

Recording operations would be conducted for 24 hours per workday, based on two 12-hour shifts. Communications with the crews would be via Very High Frequency (VHF) radio systems and wireless data transfer radios.

Although encounters with polar bears or grizzly bears are unlikely, the operator and its contractors would exercise caution during operations. Should a polar bear be encountered, procedures outlined in the comprehensive Wildlife Interaction Plan (approved by the Alaska Department of Fish and Game [ADFG] and FWS) would be followed (Appendix I). Food and food waste would be kept inside vehicles during field operations. All polar bear sightings would be reported to the FWS as per the authorization from FWS. Any type of bear dens suspected or confirmed would be reported to the FWS and/or ADFG.

To minimize impacts to ringed seals, vibroseis (with vibroseis or univibe vehicles) would be conducted on grounded sea ice. Although unlikely, it is possible that receivers could be deployed beyond grounded sea ice with Tuckers or snow machines. Grounded sea ice would be determined by using ground penetrating radar and handheld drills. In addition to staying on grounded sea ice for vibroseis, impacts to ringed seals would also be minimized by having a subsistence representative from Kaktovik as an advanced crew member as well as using traditional knowledge to avoid areas used by seals during mobilization, scouting, ice checks, and operations.

KIC through its operator and contractors would work with agencies to avoid and minimize interactions with wildlife including abiding by relevant regulations and obtaining required authorizations.

2.2.5 Water Use

Potable water would be produced at camp with a skid-mounted snow-melter. Water would be produced by melting snow, transporting water to camp from Kaktovik and/or Deadhorse or, if it is a low snow year, from withdrawing water from lakes. Snow would only be removed from grounded areas of lakes.

KIC does not anticipate needing to withdraw large quantities of water from lakes for camp use. It is estimated that 2,000-3,000 gallons of water would be necessary for camp operations per day. If any water would need to be withdrawn from lakes, KIC would be required to obtain approval from the BLM and, potentially, authorization from the ADNR. If water withdrawal from lakes is necessary ROP 9 from the Coastal Plain Leasing ROD (USDOI BLM 2020) would apply. ROP 9 lists specific requirements related to fish presence and lake bathometry data necessary to determine volumes of liquid water available for use. In addition, a Temporary Water Use Authorization (TWUA) (11 AAC 93.035 (a) (b) and 11 AAC 93.220) would be required from ADNR for water use beyond 5,000 gallons per day and for any water body in which the FWS has applied for a reservation of water.

Any water withdrawn would be processed through an Alaska Department of Environmental Conservation (ADEC) approved water system, which consists of filtration and chlorination.

2.2.6 Waste Management

Food waste generated during field operations would be stored in vehicles until the end of the shift. All garbage would be consolidated at camps in wildlife resistant containers until further disposal. A skid-mounted incinerator would be used to incinerate garbage and food waste twice daily to avoid attracting wildlife. Incinerators falls within the regulatory requirements of 40 CFR 60. As required by regulation, the operator would provide a description and weight of camp wastes burned during operations.

Paper, food, wood, petroleum products and plastic would be expected to be generated from the proposed activities. Any waste generated by seismic operations would be properly stored and disposed of in accordance with applicable permit requirements and operator controls.

Gray water would be generated and discharged from the advanced camp and main camp locations. The operator's current permit allows up to 5,000 gallons of grey water discharge per day. All grey water would be treated and discharged according general permit AKG332000 and 18 AAC 83.210 and Alaska Pollution Discharge Elimination System (APDES) discharge limits. Toilets would be "PACTO" type toilets (brand of toilet that does not use water), and waste would be burned in the camp incinerator, so there would be no black water discharges. Ash from the incinerator would be backhauled to the NSB disposal facility in Deadhorse. An inspection by the HSE Advisor would be completed after the camp has left to ensure the area is clean of all debris.

2.2.7 Community Relations

KIC represents the Iñupiat people of the Coastal Plain within the Project Area, including its shareholders and subsistence users in the community of Kaktovik. KIC would require all operations and activities to be conducted in a manner that does not damage or affect the social, cultural or community in the Project Area.

KIC would coordinate its seismic activities with the community of Kaktovik and the NSB to prevent potential conflicts when operating in close proximity of subsistence users. KIC would hold meetings in Kaktovik to discuss planned activities prior to commencement of the 2020-2021 winter season. These discussions would include text and visual documentation of the crew's activities, as well as the project boundaries. KIC anticipates that, because of these meetings, various protocols and procedures would be developed and implemented which would allow both subsistence and exploration activities to co-exist with respect to this project. Any subsistence hunting and fishing occurring in the Project Area would be identified with the help of community members and all meetings would be documented and kept on file as a resource during and after activities.

Due to the winter timing and short-term nature of the proposed activities, KIC has determined that there would be little impact on any subsistence communities other than Kaktovik. KIC has communicated directly with the Native Village of Kaktovik and the North Slope Borough (NSB) and is in the process of applying for the required NSB Development Permit. KIC would provide the BLM with a copy of the NSB Development Permit. Seismic activities would be coordinated with Kaktovik to mitigate and prevent potential conflicts when operating in close proximity of subsistence users.

KIC would hire a community liaison to coordinate with the community of Kaktovik on subsistence issues and uses. The community liaison would report back to Kaktovik and the agencies overseeing the project on how subsistence issues had been addressed. The community liaison would be the local point of contact and have the following responsibilities:

1. Meet with the community of Kaktovik prior to the start of operations to discuss any concerns.
2. Document past subsistence activities in the Project Area.
3. Conduct scoping with the operator and local subsistence representative from the community.
4. Help identify local subsistence observers to work on the seismic crew.
5. Address any key issues with community members. Issues are described as “a significant opportunity, problem, factor or trend, or challenges to KIC’s mission, direction, way of doing business, or culture.”

KIC would require the operator to hire local community members as subsistence advisors and representatives on the crews. Project vehicles and aircraft would avoid subsistence hunting areas. Based on current consultations with all parties, KIC has determined that the proposed activities could occur without any impacts to access to the Project Area by subsistence users.

2.2.8 Summer Activities

Summer cleanup and inspections would take place in July and August (2021). A single helicopter, based out of Kaktovik, would conduct flyover inspections of the Project Area looking for any debris that may have been left behind during winter activities. An aircraft use plan would be developed that identifies how impacts to subsistence hunting and activities would be minimized including consultation with local stakeholders and ensuring regulatory compliance. The coastal portion of summer cleanup activities (within 1.2 miles of the coast) would be targeted to be completed by July 19 and all cleanup activities would be expected to be completed by mid-August.

All camp locations and source and receiver lines would be inspected and all debris that could have been covered by snow and inadvertently left behind would be removed. The aircraft would land and pick up any debris identified during aerial surveys of the Project Area. In addition, any area that sustained damage to the tundra would also be surveyed. This phase of the project would require one helicopter for approximately 15 days, including possible weather days. Each day of aerial inspections and clean up would cover roughly 100 miles and entail approximately 30-40 landings and take offs. Over the course of 15 days, there could be 450-600 landings and take offs.

Aircraft routes would be planned to minimize potential conflicts with active or anticipated subsistence hunting, as determined through community consultations. During summer flyovers, the helicopter would not land within 0.5 mi of polar bears.

2.2.9 BLM Protective Measures - Lease Stipulations and Required Operating Procedures

In addition to the description of proposed seismic activities, relevant Lease Stipulations and Required Operating Procedures from the Coastal Plain Leasing Record of Decision (2020) found in Appendix J would be required for the proposed action.

The following project specific required operating procedures (ROPs) would also be followed to provide additional protections to social and environmental resources. These project specific ROPs would only apply to federal lands within the Project Area.

Administrative Operating Requirements

1. Before beginning seismic exploration activities, the applicant/operator would provide a map to the Authorized Officer (AO) showing all known avoidance areas such as bear den sites, cultural sites and Native allotments, low snow areas, spring-fed open water areas, and aufeis.

2. The applicant/operator would provide the AO with a weekly activity's summary report. The operator would provide a map (and supporting documentation, as necessary) to the AO every week during operations showing the camp/seismic activity locations, corner locations (latitude/longitude) of airstrips, snow trails, snow cover, hazards, willow avoidance areas, stream crossings, ungrounded ice with ice/waterborne attenuation buffer, aufeis, potential cultural sites, grey water discharge areas, and any other avoidance areas. In addition, spatial data of areas with ungrounded or grounded ice including snow trail stream crossings (ice

thickness and depth of liquid water) measured by GPR and physical ice-checking would be submitted to the AO in the weekly summary report.

3. Snow sampling locations (with GPS coordinates), values, and photos of transects would be reported to the AO at least every 72 hours.

4. Take offs and landings locations and track logs in a GPS format (BLM would provide the type of information required) would be kept and maintained for all aircraft operating in the Project Area during summer and winter operations.

5. At the end of the season, the number of nodes used for the project and the number of nodes retrieved would be reported.

Waste Prevention and Hazardous Materials

6. Sufficient oil spill cleanup materials (absorbents, containment devices, etc.) would be stored at all fueling points and vehicle maintenance areas and would be carried by field crews on all overland moves, seismic work trains, and similar overland moves by heavy equipment.

7. Fuel and other petroleum products and other liquid chemicals would be stored in proper containers.

8. All fuel containers, including drums and propane tanks, would be marked with the responsible party's name, product type, and year filled or purchased.

9. All oil pans (i.e., duck ponds) would be marked with the responsible party's name.

Fish and Water Resources

10. The applicant/operator would need to provide information, including specific lakes for water withdrawal, water volume and depth of lakes, and fish communities for the AO to determine that the objective and requirements identified by the Coastal Plain Leasing ROD ROP 9 would be met (USDOI BLM 2020) (Appendix J).

11. If the applicant receives approval and authorization to withdraw water from specific lakes the following ROPs would be required:

    (a) The AO would be notified within 24 hours of any observation of dead or injured fish on water source intake screens or in the hole being used for pumping. If dead or injured fish are observed, pumping from that water source would cease. Additional water from that source would only be permitted if the AO approves (on a case-by-case basis) additional preventative measures to avoid further impacts to fish (e.g., reducing the intake rate and/or moving the location of the hole).

(b) The applicant would maintain a daily record of water removed from each lake utilized as a water source and provide the AO with the spreadsheet in conjunction with the weekly report. A formatted spreadsheet provided by the AO would be used for reporting.

(c) The operator would immediately cease pumping and notify the AO within 48 hours if water removal exceeds the volume approved at any lake.

Potential New Mitigation Measures

In addition to project design features and the ROPs described above, Chapter 3 also considers potential new mitigation measures designed to further reduce impacts from the proposed action. These measures are discussed in the relevant resource sections that follow and were developed based on suggestions from BLM and FWS staff and from public comments received during the public scoping period. The decision whether to adopt each new mitigation measure will be made in the decision record.

Chapter 3 Affected Environment and Environmental Impacts

3.1 Introduction

This chapter provides an overview of the social systems, land use values, physical environment, wildlife resources, and fish and aquatic resources that could be affected by the activities described in Chapter 2. Some resources, such as air quality, bird species, climate, and floodplains are not included in the analysis because it is unlikely that they would experience any discernible impact from the proposed action. Please see Appendix F Resource Reports for additional details regarding resources located within the Project Area.

Chapter 3 also takes into consideration the No Action Alternative. The No Action Alternative would reject the proposed action and deny authorization of seismic exploration and associated activities. For all resources, the existing condition (baseline conditions) would be the same for the No Action Alternative as the Proposed Action but there would be no environmental impacts from the proposed seismic activities.

3.1.1 Past, Present, and Reasonably Foreseeable Activities

Table 3 identifies past, present, and reasonably foreseeable projects that will be considered when analyzing how these activities, along with the proposed action, could impact resources in the Project Area. These projects and activities will be taken in consideration as part of the existing condition as well as the environmental impacts described throughout the rest of this chapter.

While lease sales are reasonably foreseeable in the Coastal Plain, since they are also required by the Tax Act which authorizes the current proposed project, on-the-ground actions that may follow the issuance of leases (if any are issued) are not themselves reasonably foreseeable at this point. Such actions are considered speculative under BLM guidance (BLM NEPA Handbook Section 6.8.3.4).

Table 3. Past, present, and reasonably foreseeable activities

Project Name	Description
Point Thomson	Point Thomson is a gas condensate field that is currently producing natural gas condensate and shipping it via 22-mile pipeline to the Trans-Alaska Pipeline. The drill site and production facilities are located on State onshore lands immediately west of the Coastal Plain.
Badami	Badami is a producing oil field about 30 miles west of the western boundary of the Coastal Plain. The Badami pipeline connects to the Trans-Alaska Pipeline near pump station 1. There is a landing strip located at the field and a dock along the shoreline nearby.
Liberty Project	The Liberty Project is a proposed oil and gas development currently undergoing permitting, located 5.5 miles offshore in about 19 feet of water, inside the Beaufort Sea's barrier islands approximately 40 miles west of the western boundary of the Coastal Plain. Development would include construction of a gravel island for production facilities including 16 wells.
Transportation	Transportation includes air, land, and marine transport both for oil and gas activities and for community travel on the North Slope. Passenger and air cargo flights occur between communities within the Refuge and across the North Slope. Government agencies and researchers often charter aircraft for travel and research purposes.
Subsistence	Subsistence activities occur throughout the area. The types of subsistence use described in Chapter 3 are expected to continue into the future.
Recreation and Tourism	Recreation and tourism activities are generally pursued by non-residents of the area. The types of recreation and tourism described in Chapter 3 are expected to continue into the future.
Scientific Research	There are scientific research Programs that take place within the Project Area.
Community Development	Community development projects in the Kaktovik area would continue including both large and small infrastructure projects related to village needs.

3.2 Social Systems

3.2.1 Subsistence Affected Environment

Kaktovik, Arctic Village and Venetie are the closest communities that could potentially be affected by the proposed activity. Kaktovik is on Barter Island on the shore of the Beaufort Sea. The community relies heavily on the harvest of marine and terrestrial animals and fish on the Coastal Plain and on the nearshore marine environment. Arctic Village is located on the southern boundary of the Refuge; its residents do not hunt in the Coastal Plain but depend on caribou from the Porcupine Caribou Herd (PCH), which calve in the Coastal Plain. Venetie is located further south of the Refuge and their subsistence use areas do not include the Refuge, but like Arctic Village, they are dependent on caribou from the PCH.

One purpose of the Refuge is to provide the opportunity for continued subsistence uses by local residents in a manner consistent with the purposes of conserving fish and wildlife populations and habitats and fulfilling international treaty obligations with respect to fish and wildlife. The subsistence way of life encompasses much more than just a way of obtaining food or natural

materials: it involves traditions that are important mechanisms for maintaining cultural values, family traditions, kinships, and passing on those values to younger generations. It is considered a way of life, rather than just an activity (Alaska Federation of Natives 2010). Spring, summer and fall are periods of very high subsistence activity as migratory wildlife, waterfowl, and fish return to the Refuge and Coastal Plain in abundance for another season.

The Iñupiat community of Kaktovik on Barter Island is located within and relies heavily on the harvest of marine and terrestrial animals and fish on the Coastal Plain and the nearshore marine environment. When the community successfully harvests whales, marine resources comprise 59 to 68 percent of their total subsistence harvest (Minerals Management Service 2003). Bearded, ringed, and spotted seals are also important supplemental resources, as are ducks, geese, and several fish species (Jacobson and Wentworth 1982). Dall sheep (*Ovis dalli*), and caribou (*Rangifer tarandus*) are harvested and contribute 17 to 30 percent of the annual harvest by weight. Kaktovik's caribou hunting occurs throughout most of the year while Dall sheep hunting occurs mostly in the winter when snow machine access is possible. Hunting sheep and caribou and fishing during the winter requires snow machine access throughout the Coastal Plain and inland to the upper drainages of the Brooks Range. During the summer, Kaktovik residents use boats to access coastal regions of the Beaufort Sea and inland waters for hunting, fishing and gathering subsistence resources. Kaktovik's harvests of Arctic cisco, Dolly Varden, sculpin, Arctic cod, Arctic flounder, grayling, and chum salmon accounted for 11 percent of the estimated total edible pounds in 1994-1995 (Brower et al. 2000).

Kaktovik and all other NSB communities have a customary and traditional use determination for caribou in game management unit (GMU) 26C, where the proposed seismic survey would occur. Kaktovik is the sole community with a customary and traditional use determination for muskox in GMU 26C. Arctic Village, Chalkyitsik, Fort Yukon, Venetie, and all NSB communities have customary and traditional use determinations for sheep in GMU 26C.

The communities of Arctic Village and Venetie, are Neet'si Gwich'in communities with Arctic Village located on the southern border of the Refuge and Venetie further south in GMU 25D. Neither community travels to the Coastal Plain and they do not have a customary and traditional use determination for caribou in GMU 26C. Arctic Village and Venetie do have a customary and traditional use determination for caribou in GMU 25A, which includes the southern portion of the Refuge. Dependence on large land mammals is high for both villages. For instance, Arctic Village subsistence harvest was 10,000 to 21,000 pounds with caribou and moose (*Alces alces*) constituting 90 percent of the harvest in each year, according to the State's Community Subsistence Information System (1993–1997) and data collected by the Council of Athabascan Tribal Governments in 2001 and 2002. In 2009, the subsistence harvest estimate for Venetie (Appendix M of the Coastal Plain Leasing EIS) totaled over 35,000 pounds for moose and caribou, with both species making up nearly 48 percent of the total harvest in that year. Harvested caribou from these surveys came primarily from the migrating PCH. Because of their heavy reliance on the Porcupine Caribou Herd, the Gwich'in people consider the herd's calving grounds on the Coastal Plain as sacred ground, a birthing place for thousands of caribou each year (Gwich'in Nation 1988). Other important resources for Arctic Village include Dall sheep, rabbit, freshwater fish, waterfowl, and berries.

3.2.1.1 Subsistence Environmental Impacts

Alternative A - Proposed Action

Although winter is not a peak subsistence time, Kaktovik's caribou hunting occurs throughout most of the year and Dall sheep hunting occurs mostly in the winter when snow machine access is possible. Hunting of sheep and caribou and fishing during the winter requires snow machine access throughout the Coastal Plain and inland to the upper drainages of the Brooks Range. Hunting and trapping for furbearers also takes place during the winter, and seismic activity may overlap traditional trap lines. Hunting for other species such as muskox and moose also takes place during the winter, but these species constitute a small percentage of the overall subsistence harvest within the Project Area with small quotas limited to residents of Kaktovik. Seismic activities have the potential to deflect subsistence resources (i.e., caribou and furbearers) during the time of activity. Hardened snow trails and other hardened or packed snow berms and ruts that may result from the proposed activity could pose risks to travel by snow machine. The proposed activity could result in a dense network of such features, which could impact subsistence access by snow machine throughout the area. Use of snow trails to facilitate subsistence access could be considered a countervailing impact (a benefit). KIC has proposed providing a map showing daily activity to be displayed in the community for subsistence users and would employ subsistence representatives. KIC also proposes an advanced survey crew with a subsistence representative and a Kaktovik subsistence oversight panel that would discuss any concerns, document subsistence activities in the area, and work with a biologist hired by KIC's operator, SAE, on any wildlife or environmental issues.

Impacts to vegetation could affect forage and habitat for subsistence resources. Physical impacts from the seismic survey itself have been analyzed in this EA (see Section 3.4.1 Vegetation). Trails created by the proposed action could potentially affect 3.4 percent of the Project Area and result in short and long-term impacts to vegetation. Long-term impacts could include subsidence and changes in species composition.

Under Alternative A, potential impacts to subsistence access (primarily due to impacts from snow machine travel) could be an issue for Kaktovik winter hunters, particularly if they are not adequately informed of the locations of hardened trails and berms before the activity is underway. Kaktovik residents harvest a considerable number of Dall sheep and caribou. Kaktovik's caribou hunting occurs throughout most of the year while Dall sheep hunting occurs in the winter when snow machine access is possible. Hunting of sheep and caribou and fishing during the winter requires snow machine access throughout the Coastal Plain and inland to the upper drainages of the Brooks Range. Under the proposed action, the subsistence oversight panel and consultation/mitigation process would not begin until after a seismic permit has been received.

Impacts under the proposed action would not be anticipated to affect the overall abundance of subsistence resources for either Kaktovik, Arctic Village, or Venetie. Under the proposed action, caribou and furbearers would likely be deflected from active camps and seismic survey areas and could affect the availability of resources in areas where they are traditionally harvested. These effects would be limited to the areas of activity and would be short-term. North Slope hunters

report that aircraft make caribou skittish and difficult to harvest, and air traffic associated with any spring activity and summer cleanup could reduce the local availability of animals, potentially affecting the success rates of Kaktovik subsistence hunters.

In terms of short-term impacts to subsistence, the activity would be most likely disturb winter caribou and sheep hunting and furbearer hunting and trapping by residents of Kaktovik due to deflection of resources, impacts to snow machine travel, and hunter avoidance of industrial activity.

Some impacts to subsistence could occur in July and August during summer cleanup and inspection activities. An estimated 30-40 landings and takeoffs could take place daily over a 15-day period. This could cause disruption to some subsistence hunting or could lead to short term avoidance behavior by subsistence species like caribou.

Environmental impacts to subsistence under the proposed action would be the same as those described in the Coastal Plain Leasing EIS (USDOI BLM 2019). ROPs identified in the Coastal Plain Leasing ROD (USDOI BLM 2020) (Appendix J) would provide protection to subsistence uses and resources. They include minimizing impacts of aircraft activity on subsistence use (ROP 34), requiring coordination and consultation with subsistence users (ROPs 36 and 37), minimizing impacts on subsistence resources from non-local hunting, trapping, and fishing (ROP 38), and minimizing impacts on subsistence use and access (ROP 39) to social and environmental resources, including subsistence consultation.

Past, Present, and Reasonably Foreseeable Impacts

The Alaska Native subsistence lifestyle and economy depends on the continued ability to hunt, fish, and gather adequate resources in traditional areas. For many non-Native rural residents of Alaska (federally recognized subsistence hunters under ANILCA Title VII), hunting and gathering is also of critical economic and cultural importance. This analysis of impacts to subsistence is based on the analyses of impacts to subsistence resources, including vegetation, in the Coastal Plain Leasing EIS (USDOI BLM 2019). This analysis considers effects on subsistence access and subsistence resource distribution and abundance that would be anticipated to result from disturbances related to seismic exploration on the Coastal Plain and additional effects from activities associated with ongoing onshore development at Point Thomson and Badami, and future nearshore development at Liberty.

Because the project is limited to one year in duration, direct effects from the current proposed project alone on the PCH would be expected to be short-term. Any effects on caribou distribution and abundance due to disturbances related to past, present and reasonably foreseeable energy development projects would likely be long-term, lasting as long as the life of the North Slope oil and gas fields. Because the project is limited to one year in duration, direct effects from the current proposed project alone on the PCH would be expected to be short-term. This proposed project, considered in combination with the broader trends of North Slope energy development, would not be expected to add measurably to these broader trends.

The effects of anticipated warming of the climate regime in the Arctic could significantly affect subsistence harvests and uses if warming trends continue as predicted (Arctic Climate Impact Assessment 2004). The reduction, regulation, and/or loss of subsistence resources or reduced ability to access subsistence resources at appropriate times (Brinkman et al. 2016) would, if they occur, have severe impacts on the subsistence way of life for residents of Arctic communities. If permafrost loss increases as predicted, there could be synergistic collective impacts on infrastructure, travel, landforms, sea ice, river navigability, habitat, availability of fresh water, and availability of terrestrial mammals, marine mammals, waterfowl and fish (National Research Council 2003; Arctic Climate Impact Assessment 2004). The short-term impacts of the proposed project on subsistence would not be expected to add measurably to the broader trends of climate impacts described above.

ANILCA §810 Evaluation

The ANILCA §810 evaluation of the effects of the proposed action on subsistence uses and needs is included in Appendix K. The evaluation finds that the proposed action would not significantly restrict subsistence uses. No reasonably foreseeable and significant decrease in the abundance of harvestable resources or in the distribution of harvestable resources, and no reasonably foreseeable limitations on harvester access would result from the proposed action.

Alternative B – No Action

Under the No Action Alternative, none of the impacts described above would occur.

3.2.2 Environmental Justice/Sociocultural Systems Affected Environment

The local and regional economies which could be affected by seismic exploration are described in Section 3.4.10 of the Coastal Plain Leasing EIS (USDOI BLM 2019), which focuses on the economy and existing conditions in the North Slope Borough, Kaktovik, Arctic Village, Venetie and several other communities. That Section also describes the non-use values associated with the Refuge. Section 3.4.4 of the Coastal Plain Leasing EIS, Sociocultural Systems, contains information about the area's history, social and political organization, belief systems, and mixed cash/subsistence economy.

Environmental Justice (defined in EO 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations) requires evaluation of proposed projects for "disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations."

Kaktovik, Arctic Village and Venetie are the closest communities that could potentially be affected by the proposed activity. The official U.S. Census data from 2010 is used to determine environmental justice (EJ) populations due to the need to compare percentages of populations throughout the state. According to 2010 census data, 89 percent of the population of Kaktovik is Alaska Native or American Indian (specifically Iñupiat), an identified minority group. According to 2010 census data, 89 percent of the population of Arctic Village and 92 percent of the population of

Venetie is Alaska Native or American Indian (specifically Gwich'in Athabaskan), an identified minority group. The statewide population is 15 percent American Indian or Alaska Native. Based on the census data, the minority populations in Kaktovik, Arctic Village, and Venetie are well above the 50 percent threshold specified in the Environmental Protection Agency (EPA) guidelines and it is appropriate to consider potential environmental justice issues in evaluating the effects of the proposed activities. In addition, Arctic Village and Venetie are considered to be environmental justice populations due to their low-income status. In 2018, about 37 percent of Arctic Village residents and 51 percent of Venetie residents were considered to be in poverty, compared to about 11 percent statewide (https://headwaterseconomics.org/apps/economic-profile-system/200036990 https://headwaterseconomics.org/apps/economic-profile-system/200082420).

Because the primary stakeholders potentially impacted by the proposed activity are these two EJ populations, brief discussions of sociocultural systems (including economy) are included under the topic of environmental justice.

3.2.2.1 Environmental Justice/Sociocultural Environmental Impacts

As described above, the majority of residents in the communities that could be impacted by the proposed activity are Alaska Natives and therefore considered environmental justice populations, as are Arctic Village and Venetie residents due additionally to their low-income status.

The BLM considered the following factor in determining whether the environmental effects of the proposed seismic exploration project would be disproportionately high and adverse: Whether any of the impacts identified in this EA would significantly and adversely affect the communities of Kaktovik and/or Arctic Village and Venetie. Such effects could include impacts to subsistence, environment, cultural, human health, economic, or social systems. The Coastal Plain Leasing EIS (USDOI BLM 2019) described one impact expected to occur for all alternatives "Development also could increase tensions between different community institutions from disagreements about land jurisdiction and management and differing priorities and agendas, resulting in additional strains on social cohesion. Such changes could worsen political differences between Iñupiat and Gwich'in communities, potentially weakening social ties" (USDOI BLM 2019). The Coastal Plain Leasing EIS also described social conflict over oil and gas development in the Refuge. Another indicator of this conflict is that the Bank of America, Wells Fargo, JPMorgan Chase, Goldman Sachs, Citibank, and Morgan Stanley have made commitments not to fund Arctic oil and gas projects (https://www.eenews.net/greenwire/2020/12/01/stories/1063719601?utm_campaign=edition&utm_medium=email&utm_source=eenews%3Agreenwire).

Alternative A - Proposed Action

Kaktovik

The seismic exploration itself would not be expected to provide substantial economic benefits to local people because it would be an investment to ascertain the oil and gas resources in the area in anticipation of development. Kaktovik residents could see some minor increased economic activity in their community due to the seismic activity (increased demand for local services and a few local

jobs). According to the 2010 census, the median income in Kaktovik is $53,750 and 3.8 percent of the population lives below the poverty line. Most food is flown in and generally costs 146 percent more than in urban communities (ADOLWD 2018). Subsistence foods, therefore, constitute a critical component of the economy as part of the subsistence lifestyle. The Alaska Department of Labor and Workforce Development maintains a database of Alaskan communities that are economically distressed[1], and approximately half of all Alaskan communities qualify as distressed by the standards used. Despite the high cost of living and the fact that a greater percentage of residents live in poverty than reflected by census data, Kaktovik does not qualify as economically distressed (Denali Commission 2017).

If the proposed seismic exploration results in development of Native owned oil, most North Slope Iñupiat, as shareholders in their Native corporations, would see economic benefits. Oil development is not reasonably foreseeable and is therefore speculative. However, this information is discussed within the scope of the environmental justice analysis for the proposed seismic activity to establish that the action does not present a typical situation for Kaktovik residents wherein a project is imposed by outside industry near a minority population. For those Inupiaq-led corporations, Kaktovik leadership entities, and residents who support the proposed action, it represents long overdue justice for the community.

Arctic Village and Venetie

The communities of Arctic Village and Venetie do not travel to the Coastal Plain but do depend heavily on harvesting animals from the PCH during migration outside the Coastal Plain.

Residents in Arctic Village and Venetie would not likely experience direct impacts from the seismic exploration activities, but some Arctic Village and Venetie residents believe that the movement of the seismic camp units across the tundra would result in significant damage to the land (habitat for the Porcupine Caribou Herd) (John 2018). Residents have also expressed concerns about oil spills, air quality, and potential impacts to wolves and small mammals (John 2018). Many Gwich'in are experiencing stress, frustration, and fear over the provisions of the Tax Act that require leasing in the region and that are compelling the proposed seismic survey: they see this as a struggle for their culture and way of life (Garnett 2018). Spokespeople for the Gwich'in, including those living in Canada, have described the permitting process itself as an injustice, noting that many tribal leaders have spent their entire adult lives defending their people and their culture. The Coastal Plain Leasing EIS noted that, "Because of the spiritual and cultural importance of the Coastal Plain and PCH calving grounds to the people of Kaktovik, Arctic Village, and Venetie, any disruption to that herd or perceived contamination or degradation of calving grounds in the Project Area would have sociocultural impacts on Iñupiat and Gwich'in, in terms of their belief systems, cultural identity, and the impact of development in the sacred calving grounds of the PCH" (USDOI BLM 2019).

[1] Data available on population, employment, and earnings is used to identify those Alaska communities considered "distressed". The distressed status is determined by comparing average income of a community to full-time minimum wage earnings, the percentage of the population earning greater than full-time minimum wage earnings, and a measure of the percentage of the population engaged in year-round wage and salary employment (Denali Commission 2017).

Residents of Arctic Village, Venetie and other Gwich'in communities are not positioned to benefit economically from the limited local economic opportunities that could result from the proposed action. Furthermore, if the proposed seismic exploration results in development of oil, residents of Arctic Village, Venetie, and other Gwich'in communities would not see economic benefits. Arctic Village and Venetie, according to the Alaska Department of Labor and Workforce Development, qualify as economically distressed (Denali Commission 2017) and are considered environmental justice populations due to their poverty, as well as their Alaska Native status.

Past, Present, and Reasonably Foreseeable Impacts

The effects on subsistence of the activities listed in Table 3 in Section 3.1.1 are described in the Subsistence Section 3.2.1.1 of this EA. The oil and gas projects are contributing or have contributed to jobs and income in North Slope communities, although these benefits are likely very limited in Kaktovik.

Alternative B – No Action

Under the No Action Alternative, none of the impacts described above would occur.

3.2.3 Cultural (Prehistoric, Historic, and Ethnographic) and Paleontological Affected Environment

Cultural surveys conducted between 1980 and 2011 contributed to most of what is known about prehistoric and historic cultural resource sites in the Project Area. From the most relevant studies, it is understood that human use of the area north of the Brooks Range has been occurring for more than 10,000 years. Most studies have focused on coastal settings (e.g., Grover and Laughlin 2012; Hall 1982; Jacobson and Wentworth 1982; Libbey 1983), particularly on Barter Island (e.g., Grover 2004; NLUR 2007, 2010). Aside from Ed Hall's (1982) survey that included major river drainages in the Coastal Plain, there has been little emphasis away from the coast.

The Alaska Heritage Resources Survey (AHRS) database, maintained by the Alaska Office of History and Archaeology, contains the working inventory of cultural and historic sites in Alaska, as well as many of the reported paleontological deposits in the state. The AHRS database (OHA 2020) indicates 50 reported cultural properties within the area of seismic exploration and 10 reported cultural properties outside the proposed seismic exploration area but within the proposed overland transportation route. These include but are not limited to, historic Iñupiat sod house ruins and related features and artifacts, gravesites, prehistoric lithic scatters, remnants of a late prehistoric Thule village and the original village of Kaktovik, a reindeer herding area, and features associated with the historic U.S. Navy Distant Early Warning System site at Barter Island; the AHRS lists no paleontological sites within the Project Area. Of these 60 total properties, one site is listed on the National Register of Historic Places (NRHP), 24 were determined eligible for the NRHP, 3 were determined not eligible, and 32 remain unevaluated. Of the 60 cultural properties, 17 are reported to be intact, 11 have been partially disturbed, 23 have been destroyed through erosion or cleanup activities (i.e., removal of Distant Early Warning Line features), and the conditions of nine remain unknown.

The Iñupiat living throughout the North Slope of Alaska and northwest Canada historically used the land in which the Project Area are located and continue to access areas throughout and beyond the Coastal Plain (City of Kaktovik 2019). Interviews, historic accounts, and the North Slope Borough (NSB) Department of Planning and Community Services' Traditional Land Use Inventory (TLUI) most clearly reflect the historic and modern importance of the Coastal Plain to Iñupiat. Kaktovik elders interviewed in 2019 described modern and/or historic uses overlapping the analysis area, including hunting and fishing areas, historic cabins and campsites, and graves (City of Kaktovik 2019). The TLUI contains the NSB's working inventory of sites traditionally used by Iñupiat (e.g., camps, hunting areas, fishing areas, trapping areas, etc., many of which are traced to specific people or families) within the NSB, many of which are cross-listed in the AHRS as historic archaeological sites. NSB maintains the TLUI dataset and will require KIC to obtain a TLUI clearance from the borough for the proposed project. According to recent TLUI data from 2018, 19 TLUI sites fall within the seismic exploration area and at least 5 TLUI sites fall within the mile-wide transport corridor; these 24 sites represent sod house remains, burial sites, camps, and subsistence-use areas. It is known through oral histories that Gwich'in living in the eastern Brooks Range travelled onto the Coastal Plain. Gwich'in shared peaceful (especially pertaining to trade partnerships) and sometimes strained relationships with Iñupiat to the north into the late 19th and early 20th centuries that brought Gwich'in onto the Coastal Plain; however, specific locales on the North Slope visited by Gwich'in ancestors remains uncertain (NVVTG 2019).

Ethnographic Resources

While the Coastal Plain encompasses lands long used by Iñupiat for subsistence, travel, and camps, the Gwich'in living in eastern interior Alaska and northwest Canada identify the Porcupine Caribou Herd calving grounds as a spiritually important place. Modern Gwich'in communities including Arctic Village, Venetie, Fort Yukon, Circle, Chalkyitsik, Old Crow (Yukon, Canada), Fort McPherson, and Aklavik (N.W.T., Canada), along with their traditional home ranges, overlap with the range of the Porcupine Caribou Herd. Gwich'in call the Coastal Plain *Iizhik Gwats'an Gwandaii Goodlit* or *The Sacred Place Where Life Begins*, and believe that people should avoid the birthing and calving grounds for concern of contaminating the land, water, and air, and with it the plants and animals (NVVTG 2019).

A more detailed description of the affected environment can be found in Appendix F.

Alternative A - Proposed Action

A variety of federal, state, and local regulations govern how cultural resources are described and analyzed (USDOI BLM 2019). Although compliance requirements for these regulations are similar, the types of cultural resources considered, and the implementation of cultural resources review, differ. First, this analysis addresses potential effects to physical remnants of human activity (i.e., cultural materials and contexts) and paleontological remains. For simplicity, references to *cultural materials* in this analysis will represent physical remnants of historic and prehistoric human activity expressed through districts, sites, buildings, structures, or objects. Second, this analysis addresses potential effects to *Iizhik Gwats'an Gwandaii Goodlit*.

3.2.3.1 Cultural and Paleontological Environmental Impacts

Appendix F provides a detailed discussion of relevant background studies and effect analyses regarding cultural and paleontological materials.

The best way to avoid directly affecting the physical integrity of cultural or paleontological materials is to avoid their locations altogether. The applicant proposes to place 500-foot buffers around all known site locations that have been documented in either the AHRS or NSB TLUI. A 500-foot minimum avoidance buffer should be adequate to avoid disturbing cultural resources by vehicles and equipment. However, current information for interior portions of the Project Area is based on piecemeal, reconnaissance-level survey work last conducted prior to GPS availability or interviews conducted without field visits. The accuracy of cultural for the Project Area as reported in the AHRS and TLUI remains partially unverified, particularly geographic coordinates; thus, some sites could fall outside their respective avoidance areas.

The proposed action would also avoid other areas identified prior to or during operations, including environmental hazards, slopes greater than 10° (9,443 total acres or about 3 percent of the seismic exploration area), native allotments (441 acres), known or newly discovered cultural sites (>1,081 acres), steep banks along lake shores and at river/stream crossings, and important habitat features including but not limited to, polar bear critical habitat and den sites, seal lairs, grizzly bear den sites, and sensitive willow areas. Avoidance of these areas could help minimize the likelihood of adverse effects on cultural and paleontological materials, as these types of materials are often found on elevated landforms, lake shores, stream banks, and native allotments; similarly, avoiding erosional features commonly associated with steep slopes, particularly along stream banks would help minimize potential effects to paleontological materials. The proposed project would involve very little intentional ground disturbance—limited to installing 3 thermistors on private land near Kaktovik, each of which would require boring an approximately 2-inch hole to install. While any ground disturbance has the potential to damage materials' physical and/or spatial integrity, given the limited size of the disturbances (approximately 3 square inches each), any disturbance to cultural or paleontological materials would be expected to be negligible.

Any potential effects would involve above-ground activities relating to the proposed project. The available information indicates that, while seismic activities and overland travel can directly affect the physical and spatial integrities of cultural and paleontological remains, the potential for such effects would be largely contingent on the type of context, environmental conditions, and the nature of the remains themselves.

Vehicles and equipment would not likely affect cultural and paleontological materials in a deeply buried context contained within permafrost, even when the equipment would be operating directly above. Adequate snow depths (Felix and Raynolds 1989), soil freeze, and limitations on tundra damage through use of low-ground-pressure vehicles and prohibited bulldozing as required under ROP 11 (USDOI 2020) (Appendix J) could minimize immediate and future effects to permafrost and any cultural materials contained within. Seismic vehicles and equipment would also be unlikely to adversely affect cultural and paleontological materials buried in shallower contexts within seasonally frozen, active layer sediments that overlay permafrost. Annually-frozen

sediments would likely protect cultural and paleontological materials from seismic activities, as the project would take place during winter months when the active layer is frozen solid and active layer freeze is sufficient for tundra travel (USDOI BLM 2020, ROP 11). Frozen and snow-covered sediments would hinder soil erodibility and penetrability, protecting artifacts and features contained therein from crushing, displacement, subsidence, and erosion from vehicle traffic above. Difficulties for locating and extracting shallow-buried materials contained in frozen sediments would also minimize the likelihood of unauthorized collection. ROP 11 (USDOI BLM 2020) (Appendix J) standards would also prohibit tundra damage through use of low-ground-pressure vehicles, prevention of bulldozing, and requirements for soil freeze and snow cover, thereby adding protection to shallow-buried materials. Considering these factors, the proposed project would be unlikely to result in any immediate or future effects to cultural and paleontological materials contained in active layer sediments.

Cultural and paleontological materials exposed to the ground surface are most susceptible to direct physical and spatial disturbance by natural and human-caused forces, including trampling by animals and people (Flenniken and Haggarty 1979; McBrearty et al. 1998; Pryor 1988; Shea and Klenck 1993) or erosion and frost action (Bowers et al. 1983; Hilton 2003). Regarding the potential effects from seismic vehicles and equipment, effects would be expected to vary depending on environmental conditions and the nature of the remains. Bowers' (1984) preliminary findings suggest that abundant vegetation cover below, and/or ≥ 4 inches of snow cover above, surface-exposed (i.e., exposed in otherwise snow-free conditions) cultural artifacts may be sufficient to prevent damage to the physical and spatial integrity of artifacts (in Bowers' case, small, brittle stone tools) by the heaviest types of equipment such as D7s and loaded sleighs. Weight displacements for vehicles and equipment used in Bower's study are consistent with the heaviest displacements described for the proposed project. It can be reasonably expected that snow depths of an average 9 inches (or 3 inches over the highest tussocks) in the direction of travel as required under ROP 11 (USDOI BLM 2020) (Appendix J) would be adequate to prevent damage to, or displacement of, surface-exposed cultural and paleontological materials with a low vertical profile, such as artifact scatters. The project also includes a provision to avoid all locations for properties documented in the AHRS and TLUI by at least 500 feet, thereby decreasing the likelihood for damaging reported cultural and paleontological materials. Difficulties for locating surface materials buried under snow during the project timeframe would also minimize the likelihood of unauthorized collection, and information provided to project personnel through orientation training per ROP 40 (USDOI BLM 2020) (Appendix J) would also generate awareness to minimize the likelihood of unauthorized collection or disturbance of any visible cultural materials.

Soil freeze, snow cover, and avoiding potentially inaccurate site locations listed in the AHRS and TLUI would not likely provide adequate protection for materials with elevated vertical profiles. Examples common to northern Alaska can include wooden, stone, and metal posts and markers (particularly those associated with graves), remains of collapsed sod buildings and cabins, reindeer herding fences, and caribou drivelines (particularly lines of inuksuit). Seismic vehicles and equipment (even low-ground-pressure vehicles) have the potential to topple or crush these types of features through direct contact, thereby degrading integrity and NRHP eligibility resulting in adverse effects. These effects could reasonably be minimized by requiring monitoring for the types

of materials advance survey crews may encounter and avoiding these locations if and when they are discovered.

As discussed above, changes to visual, auditory, and olfactory aspects that alter a Historic Property's setting or the relationships between properties can degrade aspects of integrity upon which significance and NRHP eligibility rely, thereby resulting in direct adverse effects. However, the project would not be expected to result in any direct adverse effects to Historic Properties' settings or relationships.

Past, Present, and Reasonably Foreseeable Impacts

Any federal undertaking in the Coastal Plain would be subject to NHPA Section 106.

Climate change associated with the past, present, and future oil and gas development could adversely affect cultural and paleontological resources, although the degree to which this might happen remains unclear. However, any potential effects attributable to climate change are not expected to be universal or predictable across the Project Area.

Alternative B – No Action

Under the No Action Alternative, none of the impacts described above would occur.

Potential New Mitigation Measure – Cultural Resource Monitoring

Objective: Protect cultural and paleontological resources

Requirement/Standard: The advance survey crew would monitor for wood, stone, or metal objects protruding out of the ground and/or above the snow, and map paths around them using a 500-foot buffer; a professional archaeologist from BLM or elsewhere would provide further guidance to the applicant on the types of objects that could be expected.

Potential Benefits: Active monitoring would help to confirm the presence or absence of materials with elevated vertical profiles (those most susceptible to damage by the project) allowing the advance team to route seismic and camp vehicles and equipment away from these locations and decrease the likelihood of damage to cultural and paleontological materials, avoiding potential adverse effects (36 CFR 800.5).

3.2.3.2 Ethnographic Resources Environmental Impacts

Appendix F provides a detailed discussion of relevant background studies and effect analyses regarding ethnographic resources.

The cultural significance of *Iizhik Gwats'an Gwandaii Goodlit*, to the Gwich'in is connected to the Coastal Plain's ecological well-being. The combined analyses suggest that some disturbance to fauna, flora, and other aspects that make up the ecosystems within the Project Area is probable by the project. However, the required Coastal Plain Leasing ROD ROPs (USDOI BLM 2020) would

minimize or prevent long-term or wide-spread impacts to these resources, with impacts being localized, lasting for the duration of the project, and confined to periods of the year when impacts to key subsistence species and the environments they rely on would be minimal.

The Gwich'in recognize *Iizhik Gwats'an Gwandaii Goodlit* as important for maintaining their cultural identity, which is indicative of a potential Historic Property with traditional cultural significance (i.e., a Traditional Cultural Property). Therefore, if the proposed project were to significantly alter access or availability to key subsistence taxa upon which Gwich'in communities rely, or significantly alter the ecological health and sustainability of the environment upon which these taxa rely (including but not limited to, the plant, animal, soil, and water resources that make up these ecosystems), then this would constitute an adverse effect to *Iizhik Gwats'an Gwandaii Goodlit*. Given the proposed project would unlikely result in long-term or wide-spread impacts or perceivable changes relating to access to calving or pre-calving Porcupine Herd caribou, nesting or fledging migratory birds, the project appears unlikely to adversely affect the *Iizhik Gwats'an Gwandaii Goodlit*. See Appendix F for further analysis.

Past, Present, and Reasonably Foreseeable Impacts

Any federal undertaking within the Coastal Plain would be subject to Section 106 of NHPA.

The subsistence analysis (Section 3.2.1.1) indicates that the proposed project is unlikely to contribute to measurable effects on key subsistence species and habitat within the scope of past, present, and reasonably foreseeable projects in or near the Coastal Plain. However, warming trends in the Arctic could significantly affect subsistence harvests and land use if warming trends continue as predicted, potentially impacting infrastructure, travel, landform integrity, sea ice, river navigability, habitat, availability of fresh water, and availability of terrestrial mammals, marine mammals, waterfowl and fish (Section 3.2.1.1), and ethnographic resources, although the degree to which this might happen remains unclear. However, any potential effects attributable to climate change would not be expected to be universal or predictable across the Project Area. While future actions could contribute to future effects to landscapes that are part of or contribute to *Iizhik Gwats'an Gwandaii Goodlit*, it is not currently possible to predict where such effects relating to the project would occur, to what extent they would occur, or if those effects would adversely affect *Iizhik Gwats'an Gwandaii Goodlit*.

Alternative B - No Action

Under the No Action Alternative, none of the impacts described above would occur.

3.3 Land Use Values

3.3.1 Recreation Affected Environment

The Arctic National Wildlife Range was established in 1960 by Public Land Order 2214 "For the purpose of preserving unique wildlife, wilderness and recreational values.…" In 1980, ANILCA redesignated the range as part of the larger Arctic Refuge. It also designated much of the original range as wilderness under the 1964 Wilderness Act and provided four purposes that guide

management of the entire refuge. Section 20001 of PL 115-97 Act amended Section 303(2)(B) of ANILCA to add a fifth purpose related to the oil and gas program in the Coastal Plain. Activities in the Coastal Plain include backpacking, river floating, packrafting, hunting, fishing, wildlife watching, photography, and base-camping. River floating and float-hunting are primary uses on the north side of the Refuge, most common within the Coastal Plain on the Marsh Fork-Canning, main stem Canning, and Hulahula Rivers, because of their reliable streamflow during all months when water is not frozen. The Kongakut River is the most visited river in the Refuge, and a key aspect of the float trip includes traveling out through the river's delta into the lagoon waters of the Coastal Plain. The Marsh Fork-Canning, Hulahula, and Kongakut Rivers were recommended to Congress for inclusion in the National Wild and Scenic River System in 2015 because of the distinct Outstandingly Remarkable Values each river possesses (which includes at least one of the following: Cultural, Fish, Geologic, Recreational, Scenic, and/or Wildlife Outstandingly Remarkable Values). A Wild Classification accompanied these recommendations meaning, that at the time of eligibility, these rivers were free of impoundments with shorelines or watersheds still largely primitive and unpolluted waters. See Section 3.3.4 for more information about Wild and Scenic River values.

Visitor use monitoring has not been conducted, although calculated averages of known visitation based on commercial operator reports between 2001 and 2009 were 1,126 people annually. These reports showed that 77 percent of commercially supported visitor use occurs north of the Brooks Range. In 2017, 17 air operator businesses, 8 motorboat operator businesses, and 2 hunt guide use areas were authorized to provide access services supporting recreation within the Coastal Plain. The majority of these businesses are locally owned and operated. No information is known about use by independent pilots, or by those who walk into the Refuge from the Dalton Highway or from villages within the Refuge boundary.

The recent emergence of guided polar bear viewing on Coastal Plain waters immediately surrounding Kaktovik has brought a dramatic increase in the total number of visitors to the area during the open-water period. Since 2011, polar bear viewing on lands in and around Kaktovik reduced dramatically, and the use shifted to the lagoons surrounding Kaktovik, managed by the Refuge. Boat-based use has grown from 7 viewers per day during a 36-day viewing season to 42 viewers per day during a 54-day viewing seasons from 2012 to 2016 (USDOI FWS 2017). No visitor use numbers for other emerging uses on the Coastal Plain such as spring caribou hunting, fat-tire biking, and aurora-watching are known.

3.3.1.1 Recreation Environmental Impacts

Alternative A - Proposed Action

Most recreational activities occur during the summer months so recreational users potentially directly affected by the proposed winter activities would be low. While recreational users occasionally access the Project Area during the winter for overland activities such as cross-country skiing or dog sledding, such use is relatively rare; most winter users fly into Kaktovik for polar bear viewing. Because the Project Area is north of the Arctic Circle, any user of the area would notice lights from vehicles and camps during the winter months when the Project Area is in darkness. This

could be considered an impact if the user has an expectation of solitude or a wilderness setting. Packed snow trails could be considered both a hindrance and a benefit to winter travel. Packed trails could hinder or disrupt travel if users have to frequently cross them when traveling perpendicular to them. Winter trails could benefit users if the trail is oriented in the same direction of travel and provide a packed surface to travel on.

Visual signs of the seismic trails could negatively affect the summer recreational users experience in the Coastal Plain and the adjoining designated Wilderness area if they are expecting a wilderness setting that is free of signs of human disturbances. Signs of winter trail crossings and crushed vegetation in riparian areas would also adversely affect the river users experience if a primitive and natural setting is expected. These effects would be more noticeable from users flying over the Project Area and by users in the mountains overlooking the Coastal Plain than by those users on the ground.

Recreational users could also be directly impacted by noise from overflights and landings of helicopters during summer clean-up activities. Further detail on the impacts of general oil and gas exploration activity on recreation can be found in Section 3.4.6 of the Coastal Plain Leasing EIS (USDOI BLM 2019).

Past, Present, and Reasonably Foreseeable Impacts

During the winter months the proposed project would be at the far eastern end of existing activities. Most of the effects would be on those lands between Deadhorse and Refuge lands due to increased overflights and overland travel during the winter months. Winter seismic activities would be expected to have minimal effects on the majority of recreational users within the area of activity. Most recreation activities occur during the summer and fall seasons. The proposed project could have short term effects on summer recreational use because most users fly to Kaktovik or get dropped off in remote locations and would be able to see the visual signs of the seismic lines and camps from the air over a two to three year period. The recreational experience could be impacted due to the perception that the area is less natural and wild and no longer untouched. Summer helicopter use could have a direct impact from the noise of overflights and landings of helicopters. This impact could be mitigated by the operator notifying permitted users where seismic related activities would be located. This would allow the user to adjust their plans if needed to avoid interactions with the seismic summer crew.

Potential New Mitigation Measures

Potential New Mitigation Measure 1 – Notification of summer helicopter use

Objective: Minimize impacts to summer recreational users

Requirement/Standard: The operator would include in their aircraft use plan information as to how they would avoid impacts to recreation users including how they would notify permitted recreation users in the Project Area of helicopter locations.

Potential Benefits: Recreational users could be directly impacted by noise from overflights and landings of helicopters during summer clean-up activities. This impact could be minimized by having the operator notify permitted recreation users of summer clean up locations. This would allow recreational users the opportunity to adjust their plans and avoid areas with helicopter activity.

Potential New Mitigation Measure 2 – Turn off lights at airstrips when not being used

Objective: Reduce winter light pollution for recreational users

Requirement/Standard: Lights on airstrips would be shut off when not actively needed for aircraft landings and take-offs.

Potential Benefits: Because the Project Area is north of the Arctic Circle, any user of the area would notice lights from vehicles and camps during the winter months when the Project Area is in darkness. Turning off lights on the airstrips when not actively needed for aircraft landings would minimize the impact to users with an expectation of solitude or a wilderness setting.

Alternative B - No Action

Under the No Action Alternative, none of the impacts described above would occur.

3.3.2 Visual Resources Affected Environment

The Coastal Plain has not had a visual resources inventory completed but is considered to contain high scenic quality within the Project Area (USDOI FWS 2015). The Coastal Plain is free from summer roads and trails and lacks any development on the landscape. The entire Project Area is above the Arctic Circle and has 24 hours of darkness during the winter. Winter use of snow machines occurs, and the use of headlights could attract the attention of the viewer. During the summer months with 24 hours of light, aircraft could attract the attention of the viewer. The visual feature that dominates is the vastness of scale of the landscape with surrounding mountains and foothills sloping down to the lower Coastal Plain and river drainages, virtually free of signs of human disturbances. There are a few small buildings associated with subsistence activities and Native allotments within the Coastal Plain along rivers although these are typically one-story.

Section 1002 of ANILCA excluded the Coastal Plain from wilderness designation, and Congress has since mandated the implementation of an oil and gas program on the 1.56 million-acre Coastal Plain. The Project Area landscape otherwise exhibits criteria typically necessary for Wilderness designation which includes being undeveloped, untrammeled, a natural setting, and offers opportunity for primitive or unconfined recreation in wilderness settings. The Hulahula and Kongakut Rivers have been evaluated and recommended for a National Wild and Scenic River designation with a classification of "Wild" meaning the condition at the time of eligibility was free of impoundments, with shorelines or watersheds still largely primitive and waters unpolluted. The Kongakut River was additionally found to possess a Scenery Outstandingly Remarkable Value.

The undeveloped and wild characteristics of the area increase the sensitivity of the observer to changes in the scenery and to development of the area.

3.3.2.1 Visual Resources Environmental Impacts

Alternative A - Proposed Action

The proposed action includes building snow trails for seismic activities, creating snow airstrips, and long seismic lines that are a few hundred feet apart. The access trails, airstrips, worker camps, and dense concentration of seismic lines would result in large areas of packed snow and a grid pattern of trails. Packed snow melts at a different rate than that of the surrounding area resulting in varying vegetation growth. Winter snow trails would likely leave grid patterns in the summer vegetation known as "green trails" that could be visible during the peak public visitation period for one to five years.

The Project Area is located above the Arctic Circle and the proposed seismic activity is planned to occur during the winter when there is 24 hours of darkness. Lights from moving vehicles, worker camps, and from airstrip lights would be dominant in the Arctic darkness. While winter is not the peak public visitation season, there is winter use of the Project Area. Recreational users access the area by flying into the village of Kaktovik for polar bear viewing or, less commonly, cross-country skiing. Light glow and glare would dominate and contrast against the dark landscape in the winter.

Summer recreational use typically involves flying to Kaktovik, over flights of the Refuge, and fly-in access for river floating and hiking. In the summer, views while flying over the Project Area could be impacted by the green trail grid patterns and vegetation impacted by winter travel. Visual impacts from tracks and green trails would diminish or eliminate several qualities typically associated with wilderness, resulting in a temporary loss of experience and temporary degradation of some wild and scenic river values. River floaters would likely notice the seismic trails through the vegetation within the riparian areas reducing the primitive and natural setting of the river viewshed. Visitors to the area in the summer could be impacted by the proposed summer activities.

Under the Proposed Action, project specific ROP 5 (Section 2.2.9) along with ROPs identified in Appendix J from the Coastal Plain Leasing ROD (USDOI BLM 2020) would reduce long-term impacts of seismic activity on the landscape, preserving the untrammeled and natural qualities of the area, prior to development.

Further detail on the impacts of general oil and gas exploration activity on visual resources can be found in Section 3.4.8 of the Coastal Plain Leasing EIS (USDOI BLM 2019).

Past, Present, and Reasonably Foreseeable Impacts

When considering the area between Deadhorse and the Canadian border, the proposed seismic exploration project would likely add to visual impacts from projects located west of the Project Area with an increase of overhead flights and ground activities to support the project. This would be limited to the winter season. The proposed seismic exploration project would result in some loss

of scenic value of the Project Area that would be expected to be short-term (3-10 years) depending on which habitats are disturbed (Jorgenson et al. 2010). The visual effects from the worker camps may last longer, as the camp sites would be larger, and more snow compaction would occur resulting in a visual contrast that would be different than a straight seismic line.

Alternative B - No Action

Under the No Action Alternative, none of the impacts described above would occur. Scenic quality would remain high and no impacts to wilderness characteristics and the proposed wild and scenic river values would occur.

3.3.3 Wilderness Characteristics and Values Affected Environment

The Arctic National Wildlife Range was established in 1960 by Public Land Order 2214 "For the purpose of preserving unique wildlife, wilderness and recreational values.…" In 1980, ANILCA redesignated the range as part of the larger Arctic Refuge. It also designated much of the original range as wilderness under the 1964 Wilderness Act and provided four purposes that guide management of the entire Refuge. Section 20001 of PL 115-97 Act amended Section 303(2)(B) of ANILCA to add a fifth purpose related to the oil and gas program in the Coastal Plain. The Refuge's 2015 CCP recommended the Coastal Plain for Wilderness designation under the Wilderness Act because it exemplifies wilderness qualities, however, the Project Area has not been designated as Wilderness and since the issuance of the CCP Congress has opened the area to oil and gas leasing and development, which is incompatible with Wilderness designation.

Wilderness is a composite resource, encompassing all the Refuge's lifeforms, from the microbial community to the big charismatic species, all landforms and waters, systems and cycles, and the ecological and evolutionary processes of their origin and unfolding, their wildness. Wilderness is protected to the degree all these are perpetuated. But beyond its biophysical qualities and scientific opportunities, wilderness is also a symbolic landscape, embodying a set of wilderness-associated historic, heritage, cultural, vicarious, and bequest values.

Studies of Refuge visitors (Christensen and Christensen 2009) and the broader national public's values and interests related to the Refuge (Bengston et al. 2010) show that these wilderness qualities are highly prominent in the public's perceptions and valuation of the entire Refuge. Wilderness and its central correlate, wildness, provide the context within which most of the Refuge's Special Values (USDOI FWS 2015a) are understood and appreciated.

Landres et al. (2015) defined the four primary qualities of wilderness described in the Wilderness Act as: (1) undeveloped - free from roads, structures, and other evidence of modern human occupation or improvements, where the land essentially retains its original character and ecological function; (2) untrammeled - essentially unrestricted and free from modern human control or manipulation; (3) natural - when ecological systems are substantially free from the effects of modern civilization; and (4) primitive or unconfined recreation in wilderness settings - characterized by freedom from management restrictions on visitor behavior. Refuge management in the Coastal Plain has, prior to the establishment of an oil and gas program, been consistent with

these qualities. There are no roads, structures or improvements on Refuge lands within the Coastal Plain, natural processes are allowed to play out unfettered by management actions, and opportunities for solitude and unconfined recreation exist across the entire area.

3.3.3.1 Wilderness Characteristics and Values Environmental Impacts

Alternative A - Proposed Action

The Project Area contains wilderness characteristics and values as indicated by the 2015 recommendation and nomination of the Project Area for Wilderness designation. This includes the four primary qualities of wilderness described in Section 3.3.3. Although not Congressionally designated wilderness, refuge management in the Coastal Plain has, prior to establishment of an oil and gas program, been consistent with these qualities. There are no roads, structures, or improvements on Refuge lands within the Coastal Plain, natural processes are allowed to play out unfettered by management actions and opportunities for solitude and unconfined recreation exist across the entire area.

The proposed action would cause a loss of some wilderness values, particularly while the seismic activity occurs and in the initial years following it. A few seismic lines and trails that were used 20-30 years ago under antiquated seismic methods in other Arctic locations can still be seen on the landscape today, however, modern seismic methods and equipment have substantially reduced visual impacts and lessened the recovery time. The proposed action could temporarily affect wilderness values due to visual evidence of tracked or wheeled vehicular activity during periods of peak visitation, which would take place in the snow free summer months. ROP 11 identified in the Coastal Plain Leasing ROD (USDOI BLM 2020) (Appendix J) contains provisions that limit ground disturbance by only allowing surface vehicle activity once surface and subsurface conditions are achieved. The presence of seismic tracks and trails from the proposed seismic exploration could eliminate several of the qualities that give value to wilderness. The area would no longer appear as primitive, undeveloped or a natural setting due to the presence of seismic trails. This would result in a temporary loss of wilderness characteristics. The summer use of helicopters to conduct site cleanups would have a temporary short-term impact on the wilderness setting but would not have a long-term negative effect. ROP 34 identified in Coastal Plain ROD (USDOI BLM 2020) (Appendix J) includes provisions which would minimize aircraft interactions with recreationists and minimize take-offs and landings to the extent possible for the proposed action.

Beyond the tangible impacts that could be experienced by visitors, vicarious and symbolic values (Bengston et al. 2010) would also be affected by the proposed action. As previously noted, (Sections 3.2.3.1 and 3.2.3.2) the Coastal Plain is considered to be spiritually important to some indigenous groups.

Past, Present, and Reasonably Foreseeable Impacts

There would be a loss of wilderness values in some areas for up to several years due to the disturbance associated with the proposed activity. This would be most relevant within the Project Area as the lands outside the Refuge are already under development and have had previous overland

activities that resulted in the loss of wilderness characteristics and values. The seismic project would cause a temporary loss of the primary values that make up wilderness characteristics: (1) undeveloped - free from roads, structures, and other evidence of modern human occupation or improvements, where the land essentially retains its original character and ecological function; (2) untrammeled - essentially unrestricted and free from modern human control or manipulation; (3) natural - when ecological systems are substantially free from the effects of modern civilization; and (4) primitive or unconfined recreation in wilderness settings - characterized by freedom from management restrictions on visitor behavior. This loss of values would persist until marks left on the land by the seismic activity fade away over time. From the perspective of the visitor, the adjacent Congressionally designated Wilderness could experience some indirect diminished wilderness values as a result of the proposed action.

Alternative B - No Action

Under the No Action Alternative, none of the impacts described above would occur. Scenic quality would remain high and no impacts to wilderness characteristics and the proposed wild and scenic river values would occur.

3.3.4 Wild and Scenic Rivers Affected Environment

The Wild and Scenic Rivers Act mandates protections for rivers that are designated rivers of the National Wild and Scenic River System (NWSRS), and for those that are recommended for inclusion in the NWSRS. A river's Classification (either Wild, Scenic, or Recreational; based on level of infrastructure) and Wild and Scenic River Values (free flowing condition; water quality at time the river was found Eligible; and Outstandingly Remarkable Values (ORV) for each river segment) must be maintained. Numerous rivers bisecting the Coastal Plain were found to be eligible during the Wild and Scenic River Review completed as part of the 2015 Refuge CCP (USDOI FWS 2015a) (See CCP Table 3-1. Eligible Rivers). Protections are required once a river or river segment is found eligible, but once an eligible river is found non-suitable, there is no legal mandate to protect the values that made the river eligible.

An eligible and suitable river recommended for inclusion must be managed under existing management authorities to protect and enhance the river's Classification and Wild and Scenic River Values until which time Congress determines whether to include the river in the National Wild and Scenic River System. The Atigun, Marsh Fork-Canning, Hulahula, and Kongakut Rivers were found to be eligible and suitable, and the recommendation for inclusion of these four rivers in the NWSRS was carried forward to Congress in 2015. The Hulahula River, recommended based on its recreational and cultural ORVs, begins in the mountains south of the Coastal Plain and flows through the eastern portion of the Project Area. The Marsh Fork-Canning River, recommended for its recreational ORV, also originates in the mountains south of the Coastal Plain and joins the main stem of the Canning River before flowing along the western edge of the Refuge boundary. The Kongakut River, recommended for its recreational, scenic, and geologic ORVs, ends in the easternmost coastal lagoons. These coastal lagoons are part of the recreational corridor for river trips that start at the mouth of the river, continue along the lagoons, and end in Kaktovik. All of the recommended rivers were given a preliminary Classification of "Wild," meaning their condition at

the time of eligibility was free of impoundments, with shorelines or watersheds still largely primitive and waters unpolluted.

3.3.4.1 Wild and Scenic Rivers Environmental Impacts

Alternative A - Proposed Action

Since the issuance of the CCP Congress has opened the Project Area to oil and gas leasing and development, which requires the activity to be conditioned so as to not degrade the rivers' Classification and Wild and Scenic River Values prior to a designation decision by Congress. The Hulahula River has been recommended for designation, classified as a Wild river which means its condition at the time of eligibility was free of impoundments, with shorelines or watersheds still largely primitive and waters unpolluted. The river values for the Hulahula River include free-flowing condition, water quality, and recreation and cultural ORVs at the time of eligibility. Federal managers of recommended rivers are obligated to use existing management authorities to "protect, and where possible, enhance" (WSRA, Public Law 90-542 as amended; 16 U.S.C. 1271 *et seq).*

Seismic trails would be located within the recommended wild and scenic river corridor and viewshed for the Hulahula River. Trails through vegetation and across the recommended wild Hulahula River could impact river floaters and result in a degradation of the outstanding and remarkable recreation values within the river corridor until such time that the vegetation would recover and restore the primitive setting of the river banks.

The preliminary classification of "Wild" would not be affected because the proposed project would not create impoundments, and though shorelines or watersheds could sustain some reductions in primitive condition and some polluting, they would still largely remain primitive and unpolluted. Recreational users could also be negatively impacted by noise and overflights of helicopters during summer clean-up activities in the Project Area, although these effects would be during the peak public visitation period, they would be localized and short-term in nature.

Under Alternative A, project specific ROPs 5-8 (Section 2.2.9) along with ROPs identified in Appendix J (USDOI BLM 2020) would reduce the impacts to ORVs but all impacts would not be eliminated. There could be short-term impacts to the WSR ORVs over one to five years that would be replaced with vegetation regrowth.

Further detail on the impacts of general oil and gas exploration activity on Wild & Scenic Rivers can be found in Section 3.4.7 of the Coastal Plain Leasing EIS (USDOI BLM 2019)**.**

Past, Present, and Reasonably Foreseeable Impacts

The proposed project would have no significant effect on the Hulahula River shorelines or watersheds, and so the classification and river values for which the river was recommended to Congress for inclusion in the Wild and Scenic River System, would remain intact.

Alternative B - No Action

Under the No Action Alternative, none of the impacts described above would occur.

3.4 Vegetation Affected Environment

Vegetation in the Coastal Plain is influenced by the physiography, cold Arctic climate, short summers, low precipitation, and permanently frozen ground. The Refuge is geologically and ecologically different from the rest of Arctic Alaska (Raynolds et al. 2020). The North Slope of Alaska extends northward from the Brooks Range mountains to the Beaufort Sea, varying in width from 186 miles in the west to <31 miles within the Refuge. There, the Brooks Range is close to the Beaufort Sea. This compressed distance makes for a much more rapid transition from the mountains to the ocean and, as a result, the geography of the Coastal Plain is six to eight times steeper than the coastal lands further west. Strong winds are also much more common than those in the NPR-A located west of the Coastal Plain. The varied terrain results in higher diversity of vegetation, soils, and permafrost including vegetation types sensitive to disturbance, such as drier sites and tall shrubs in riparian areas and dwarf shrub tundra on slopes. Shallow, ice rich permafrost is believed to be extensive in the region (Pastick et al. 2015), which requires thick, intact organic mats and vegetation to be stable and protected from melting and subsidence (thermokarst). Detailed biological community descriptions are provided in the Refuge CCP (USDOI FWS 2015a), which this EA incorporates by reference.

The three major ecoregions in the Coastal Plain are the coast, the hilly coastal plain, and foothills. The coast has bays and inlets, lagoons with barrier islands, exposed peat bluffs, drained breached lake basins and deltas. The Beaufort Coastal Plain ecoregion is a smooth treeless plain rising gradually from the Arctic Ocean to the foothills of the Brooks Range. This ecoregion is mainly undulating plains and vast floodplains, with a small proportion of thaw lake plains. The dominant vegetation along the coast and within the Coastal Plain is moist sedge-willow or moist sedge-Dryas tundra; however, salt marshes are found in coastal depressions along the coast while wet graminoid occupy basins on the Coastal Plain.

On the southern end of the Coastal Plain, the Brooks Range Foothills ecoregion has rolling hills and plateaus with better defined drainages and fewer lakes. Vegetation in the foothills is mainly moist tussock tundra due to the high prevalence of ice-rich permafrost. Mineral-rich granite and limestone bedrock and glaciers of the Brooks Range mountains south of the Coastal Plain feed its numerous rivers and floodplains and have carved the landscape into deep ravines and channels. (Raynolds et al. 2020). The steep topographic gradients are reflected in the diverse geology, soils, snow regimes, hydrology, and vegetation, which form a complex mosaic of habitats supporting the high biological diversity of the region.

Permafrost-related features include extensive networks of ice-wedge polygons, beaded streams, oriented lakes, peat ridges, and frost boils. There are few if any known non-native or invasive species within the Coastal Plain.

3.4.1 Vegetation Environmental Impacts

Alternative A - Proposed Action

The area of seismic exploration would encompass 352,416 acres (92,000 acres of KIC lands with ASRC subsurface and 260,416 acres of federally managed lands). However, an additional 150 acres would be impacted by the access route outside of the area of seismic exploration but within the Refuge boundary (Figure 1), bringing the total Project Area to 352,566 acres.

The total length of the tundra access snow trail (resupply road) from Deadhorse to Kaktovik would be approximately 136.5 miles with 48.6 miles within the Refuge but outside the area of seismic exploration (Figure 1). Roughly 18 miles of the access snow trail would be on native lands within the area of seismic exploration. There would be approximately 4,198 miles of receiver lines and 2,104 miles of source lines in the Project Area. Receiver lines would be traveled twice, once to lay out the receivers and again to pick up equipment after recording. Source lines would be traveled by the advance crew in Tuckers to identify hazards and conduct ice stability checks and then would be traveled by one vibroseis vehicle. The proposed action (access trail, camps and camp trail, airstrips and seismic lines) would be expected to impact an estimated 12,000 acres or 3.4 percent of the entire Project Area (area of seismic exploration and access/resupply trail).

Seismic exploration would occur solely during winter months once conditions are determined to be sufficiently protective. Impacts to vegetation associated with seismic activities depend on the type of vehicle, number of passes, vegetation type, soil physical properties, ground ice content, and snow conditions (NRC 2003; Jorgenson et al. 2010). Because vegetation, soils, ground ice and snow conditions vary substantially east of the Canning River, careful site-specific monitoring to meet state standards would need to occur in order to minimize impacts.

Camp move trails and repeated use of the snow access/resupply trail would be expected to have a greater impact on tundra vegetation than other activities, even though moves would follow snow packed trails. Camp moves would use more and heavier vehicles than those used for the seismic surveys including Steigers or heavy equipment pulling up to 50 trailers on skis. Furthermore, camp move trails would also be transportation routes for resupply of water, fuel, camp supplies, etc. which would involve heavy loads and increased traffic volume. Vehicle tracks could affect vegetation, soil chemistry, soil invertebrates, soil thermal properties, and potentially cause localized irreversible hydrologic changes (Kevan et al. 1995).

Sufficient snow depth, density and hardness would act as a buffer against these impacts. Snow cover in the Project Area is generally shallow due to low precipitation and sublimation in a dry cold climate, and snow cover is highly variable in the Coastal Plain because of redistribution by high winds, resulting in sparse cover on hillcrests and deep accumulations in water courses and low areas (Jorgenson et al. 2010). Adhering to minimum snow depth criteria should minimize impacts in most instances. Avoidance of areas with low snow cover, use of low-ground-pressure vehicles, use of appropriate vehicles for assisting other equipment that may be stuck, and minimizing sharp turns could help minimize damage. The access/resupply and camp move trails would be expected to have higher levels of impact than seismic lines due to heavy vehicle traffic and repeated use. It is critical

that the access/resupply and camp trails maintain sufficient protective snow cover throughout operations.

In general, wet areas are less affected by disturbance than moist and dry areas (Walker 1996). Wet vegetation types and soils usually freeze more rapidly and solidly than drier areas and generally provide a higher load-bearing capacity for vehicle traffic. In wetter tundra areas, impacts from seismic exploration are usually limited to "green-up" of trails caused by compression of snow and dead plant material, where standing dead vegetation has been laid down, leaving only newer, greener vegetation standing in the following summer. Such trails are often visible for one to several growing seasons (NRC 2003).

In drier tundra, travel over low shrubs can cause breakage and tussocks could be broken or crushed. Higher levels of damage to the vegetation, which serves to insulate the permafrost from warmer air temperatures, could result in changing thermal regimes of the active layer and lead to thermokarst (e.g., melting of ground ice), or collapse. Evidence of this type of disturbance is still visible from a 1984 seismic exploration project (NRC 2003), though the methods utilized for that prior effort are no longer allowable and are generally not comparable to those proposed for this project.

Response of arctic tundra plant communities to winter vehicle disturbance depends on the level of disturbance. Following disturbance, plant cover values would be expected to be lower at most sites especially for nonvascular plants, such as mosses, lichens and evergreen shrubs (Jorgenson et al. 2010). Graminoids are typically less affected by disturbance, however, compression of snow and plant material would likely impact the vegetation in the short term. Impacts at higher levels of disturbance could include ground surface subsidence at moist sites, with replacement of shrubs and mosses by hydrophytic sedges. Identification and avoidance of sensitive willow habitats before and during seismic activities would minimize crushing and breaking of stems and branches of shrubs, in particular, where shrubs are common such as along streams and in tussock tundra and other moist tundra types.

Tussock tundra whose tussocks project above the surrounding land surface, and sedge-dryas tundra, notable for a hummocky surface topography, are both vulnerable to disturbance by winter tundra travel (Yokel and Ver Hoef 2014). Dryas is a genus of perennial cushion-forming dwarf evergreen shrubs in the family Rosaceae, native to arctic and high alpine regions. They are one of two highly sensitive plant communities identified as being high risk for impacts due to overland travel from seismic exploration and associated actions. Much of the mapped sensitive Dryas habitats follows along terraces of the Niguanak River on the eastern side of the Project Area and on slightly elevated hummocks along other smaller drainages in the Coastal Plain. Along with sensitive willow habitats these cover classes are identified as the greatest risk for long-term disturbance.

Damage to sedge-dryas tundra, unlike tussock tundra is not easily identifiable immediately following winter disturbance. Plant species are differentially sensitive to vehicle disturbance. Species with the poorest recovery are evergreen shrubs (including Labrador tea) (*Rhododendron decumbens*), low bush cranberry (*Vaccinium vitis-idaea)*, mountain avens (*Dryas integrifolia*), deciduous shrubs (dwarf birch) (*Betula nana*), dwarf willows (*Salix phlebophyla, S. reticulata, S.*

arctica), cotton grass tussocks (*Eriophorum vaginatum*), some mosses, especially Sphagnum spp. and feather mosses (*Tomentypnum nitens*), and all lichens (Jorgenson et al. 2010). Some vascular plants and moss species appear to be particularly sensitive to compression of the depth hoar snow layer at the base of the snowpack (Walker et al. 1987). Felix and Raynolds (1989a) noted that the taller the tussocks the more likely they would be disturbed through seismic activity.

Tussock tundra would likely recover well if disturbance was low and ground ice was not affected, resulting in thaw settlement. Felix and Raynolds found that micro relief of an area was important in determining its susceptibility to disturbance, because high mounds or tussocks had less snow cover and were easily scuffed or crushed by vehicle tracks. Jorgenson et al. (2010) emphasized the importance of sufficient snow cover to minimize vehicle damage to tundra and that snow had to be deep enough to cover tussocks in tussock tundra. Sedge-willow tundra would recover well with low disturbance, but higher levels of disturbance could cause soil subsidence and change in species composition to wet sedge tundra. Low shrubs have a substantial proportion of live tissue above snow level during winter. Frozen branches are readily broken off by passing vehicles. Wet sedge tundra would be expected to incur little vegetation damage from winter tundra travel due to lower stature growth in flatter terrain and would recover rapidly due to dominance of the sedge growth form if disturbance is low. Those land cover classes containing evergreen shrubs and bryophytes would show little recovery if damaged in contrast to deciduous shrubs that would be expected to recover within a decade. Table 4 shows the abundance of each vegetation type within the entire Project Area and Table 5 shows the abundance of each vegetation type within federally managed lands within the Project Area.

Table 4. Vegetation classes for the Project Area

Land Cover Classes of Program Area			
Count	**Land Cover Description**	**Percent Cover**	**Likelihood of Long-Term Disturbance**
17268783	Moist Sedge-Shrub Tundra with Wet Inclusions	43.59	Low
6297346	Water	15.90	None
4349319	Wet Sedge Meadow Tundra	10.98	Low
4131898	Tussock Tundra	10.43	Medium
3031487	Wet Sedge Meadow Tundra with Moist Inclusions	7.65	Low
1597319	Moist Sedge-Dryas Tundra, Dryas Dwarf Shrub	4.03	High
1282595	Barrens, Parially Vegetated	3.24	Low
1239736	Moist-Sedge-Willow Tundra, Willow Shrub	3.13	High
227389	Salt Marsh, and Freshwater Marsh	0.57	Low
161709	Snowbed, Snow and Ice	0.41	Low
30104	Low, Dwarf, and Ericaceous Dwarf Birch Shrub	0.08	Medium
*Percent Cover based on entire Program Area			

Table 5. Vegetation classes on federally managed lands in the Project Area

Land Cover Classes on Federally Managed Lands within Program Area			
Count	**Land Cover Description**	**Percent Cover**	**Likelihood of Long-Term Disturbance**
12814674	Moist Sedge-Shrub Tundra with Wet Inclusions	44.92	Low
5198508	Water	18.22	None
3473552	Tussock Tundra	12.18	Medium
2733099	Wet Sedge Meadow Tundra	9.58	Low
1529533	Wet Sedge Meadow Tundra with Moist Inclusions	5.36	Low
1176643	Moist Sedge-Dryas Tundra, Dryas Dwarf Shrub	4.12	High
967292	Moist-Sedge-Willow Tundra, Willow Shrub	3.39	High
453220	Barrens, Parially Vegetated	1.59	Low
127055	Snowbed, Snow and Ice	0.45	Low
30052	Low, Dwarf, and Ericaceous Dwarf Birch Shrub	0.11	Medium
21246	Salt Marsh and Freshwater Marsh	0.07	Low
*Percent Cover based on (FWS/BLM) federally managed lands (not including Alaska DNR lands or Native lands)			

Moist-sedge willow and moist sedge-dryas tundra are the two land cover classes that would be most prone to disturbance by vehicles and susceptible to the potential for long-term damage from seismic activity (Table 4 and 5). Damage to moist-sedge willow could be severe, especially on raised areas with high-centered surface morphology. Seismic trails in this vegetation type showed ruts, bare ground and severe shrub damage following surveys in the 1980's (Jorgensen 2010), though methods utilized for that prior seismic effort are no longer allowable, and are generally not comparable to those proposed for this project. To protect willow habitats, the operator would use a willow protocol to define, map and avoid sensitive willow habitats (Section 2.2.1). During ground truthing of willows, subsistence representatives would assist in identifying sensitive willow areas and define the size of areas to be avoided. Crews would also look for alternative paths to avoid willow areas when willows are visible above the snow line during scouting or operations. If an area with willows is deemed accessible after coordination with the subsistence representative, the route would be marked to minimize impacts to willow habitats.

Typical effects of individual seismic trails in the Coastal Plain would be expected to be minor but could vary greatly with topography, vegetation type, vehicle type, operator skill, snow cover and snow depth (NRC, 2003). Under the proposed action, seismic activity would likely result in both short and long-term impacts to vegetation. Long term impacts could include isolated areas of an irreversible eroding thermal process (e.g thermokarst), ground subsidence, and changes in species composition, such as a reduction in mosses and evergreen shrubs and increase in sedges. Aesthetic impacts from linear "scars" could also persist. The timeframe for full vegetation recovery could be highly variable. While Jorgenson et al. (2010) showed that after 25 years, none of the seismic survey trails were still disturbed, but 9 percent of the camp move trails were, it should also be noted that many of the methods utilized for the 1984-85 seismic work evaluated in Jorgensen are no longer allowable, and are generally not comparable to those proposed for this project.

Vegetation impacts analyzed in this document, though more detailed and site specific, do not differ greatly from the Coastal Plain Leasing EIS (USDOI BLM 2019) and are within the scope of the Coastal Plain Leasing ROD (USDOI BLM 2020).

Past, Present, and Reasonably Foreseeable Impacts

While it is not part of the proposed action, climate change may eventually lead to far larger shifts in the composition of Arctic tundra toward increased shrub height and cover extent, tree encroachment north of the Brooks Range and increased grass and sedge species (Chapin et al. 1995; Naito and Cairns 2011; Sturm et al. 2001; and Walker et al. 2006). These increases would likely be at the expense of lichen and moss cover (Chapin et al. 1995, Jorgenson and Buchholtz 2003, Epstein et al. 2004, Walker et al. 2006, Jandt et al. 2008). In addition, warmer soil temperatures are likely to increase thermokarst, and increases in sea level may inundate low-lying tundra areas, increasing salt marsh, aquatic, and wet tundra vegetation types and erosion of coastal bluffs (Arctic Climate Impact Assessment 2004). Such impacts of climate change could accumulate with any changes in soil thermal regimes that might occur as a result of past and future non-oil and gas and oil and gas activities in and near the Coastal Plain, potentially leading to synergistic impacts to vegetation.

Potential New Mitigation Measures

Proposed Mitigation Measure 1 – Use of Snow Water Equivalent (SWE) in Snow Sampling

Objective: Protect vegetation and soil resources.

Requirement/Standard: Incorporation of SWE measurements in snow sampling.

Potential Benefits: Use of a minimum SWE standard of 3, would better help to mitigate impacts from winter seismic activities and would include adhering to a minimum snow density and depth requirement versus relying on a minimum depth requirement.

Potential New Mitigation Measure 2 – Use of L-shaped snow sampling transects

Objective: Protect vegetation and soil resources

Requirement/Standard: Use 100 meter by 100-meter L-shaped transects to characterize snow depths at a 1-mile intervals or as approved by Authorized Officer (AO). Averages of each L-shaped transect would be calculated independently to determine sufficient depth criteria have been met. Sampling protocol would be approved by AO in advance. A magna-probe or other high frequency GPS enabled sampling device should be used with proper training to make more rapid measurements on transects.

Potential Benefits: Use of an L-shaped transect at snow sampling sites would yield more accurate snow depth data as it virtually eliminates user sampling bias and accounts for cross section measurements both within and perpendicular to the direction of prevailing winds. Average depths of each transect would be independent for each location sampled and would not be averaged across

the whole of the Project Area. Adequate monitoring of snow density and depth in advance of seismic activities would ensure a sufficient level of protection and avoidance of low snow areas. This would reduce potential adverse impacts to sensitive vegetation types and minimize long-term impacts.

Potential New Mitigation Measure 3 – Avoidance of Dryas plant communities

Objective: Protect sensitive Dryas plant communities

Requirement/Standard: Route planning should be conducted in a way which eliminates the need to cross through Dryas vegetation types to the maximum extent possible.

Snow machine, foot traffic, and low-ground pressure summer authorized vehicles would be permitted to cross sensitive Dryas plant communities, similar to what is allowed under stage 3 of the Willow Protocol in thick, tall concentrations of willow (Appendix H). Univibe vibroseis vehicles could also be permitted with prior approval by the AO.

For either safety reasons or because it was determined that the trail location would be less impactful than alternative routing, special permission may be granted to the applicant to cross known Dryas communities with prior approval by the AO.

Potential Benefits: Dryas plant communities are prone to disturbance by vehicles and would be susceptible to long-term damage from seismic activities. Avoiding Dryas vegetation communities would minimize disturbance to these sensitive communities and prevent long term impacts and potential changes in species composition.

Potential New Mitigation Measure 4 – Cutting willows impacted by access routes

Objective: Promote willow regeneration and sprouting

Requirement/Standard: In cases where trails could not be routed to avoid important willow stands (as identified by the subsistence representative), the operator, with prior authorization from the AO, would be allowed access through the willow stand after cutting willows as low as possible along the line of travel.

Potential Benefits: Cutting willows to the soil surface (or as low as possible) would create a higher probability of rapid vegetation recovery post operations than crushing and breaking of branches by passing equipment. Willows would be more resilient and be expected to recovery more quickly through pruning and cutting of plants.

No Action Alternative

Under this alternative, there would be no impacts to vegetation from seismic exploration on federally managed lands.

3.5 Soils and Permafrost Affected Environment

Soil types have only been generally described and mapped within the Coastal Plain (Jorgenson et al. 2015; Rieger et al. 1979; Soil Survey Staff 2016). Five soil types have been documented in the Coastal Plain and all are characterized by a cold temperature regime: Fluvaquentic Aquorthels, Oxyaquic Gelorthents, Terric Fibristels, Typic Haplogelepts, and Typic Histoturbels (Soil Survey Staff 2014, 2016). Soil texture varies across topographic features. Uplands slope gently northward and are generally composed of silt, rocky silt and peat with some glaciated uplands containing a broader range of particle sizes. Lowlands such as the plains and floodplains have coarser textured soils composed of sand, gravel and peat. The majority of uplands are located in the western half of the coastal plain and extend from the southern boundary to near the coastline. In the eastern half of the coastal plain, uplands are primarily located along the southern boundary and extend approximately one-third of the way to the coast.

Permafrost is any soil that remains below 32 degrees Fahrenheit for at least two consecutive years. Permafrost underlies most of the land surfaces on the North Slope and as much as 88 percent of the Coastal Plain is underlain by ice rich permafrost (>50 percent water). Massive ice occurs in the form of ice wedges, buried ice in glacial deposits, and intrusive ice (Jorgenson et al. 2015). Permafrost on the Coastal Plain is generally between 650–1,300 feet thick (Gold and Lachenbruch 1973). The presence of this ice rich permafrost along with some soil types results in approximately 34 percent of the area being comprised of soils with maximum potential settlement of up to 98 feet (Jorgenson et al. 2015). Degradation of permafrost can be significant in soils with high ice content and surface cover sensitive to mechanical disturbance (Gold and Lachenbruch 1973).

The top layer of the soil profile that typically thaws and refreezes annually is known as the active layer. Within the Coastal Plain, the active layer is generally between one to four feet thick (deep) (USDOI FWS 2015a). Nearly all the biological activity in soils takes place within the active layer and it is critical to the ecology and hydrology of permafrost terrain, as it provides rooting zone for plants and acts as a seasonal aquifer for near-surface groundwater (Burn 1998; Hinzman et al. 1991). Active layer thickness can vary from year to year and depends on factors such as ambient air temperature, aspect, gradient, vegetation, drainage, snow cover, water content and soil type (Alaska Department of Natural Resources 2018).

3.5.1 Soils and Permafrost Environmental Impacts

Alternative A - Proposed Action

The thermal regime of permafrost is the dominant control on soil formation and soil properties in the Project Area. Damage to the insulative vegetation and soil surface would directly impact the thermal regime of permafrost. Impacts to permafrost stem from alteration of ground temperature that can be caused by compression or damage to vegetation. Any disturbance that alters the insulating surface organic layer significantly or decreases the solar reflectance of the surface can result in differential thawing of the permafrost and cause irreversible thermokarst, subsidence, and increased potential for soil erosion and sedimentation (USDOI BLM 2012). Thermokarst most often results where permafrost thawing occurs in ice-rich, fine-grained sediments (USDOI BLM

2004). Upland areas of the Coastal Plain have silty soils with higher ice content relative to NPR-A or other coastal areas. Thermokarsting and subsidence would be exacerbated by this greater ice content. Soils in the Project Area are subjected to cold and anoxic conditions that slow the rate of soil formation, allowing exposed mineral soil layers to persist for decades.

Breaking the tundra mat, creating ruts and channeling of water into vehicle tracks, and exposure of frozen soil have the potential for localized permafrost thawing and thermokarsting. Repeated vehicle passes, particularly with heavier vehicles, in areas where snow depth and density are not properly managed, could adversely affect vegetation and result in a braided pattern as tracks diverge from these areas (Racine and Johnson 1988 and Slaughter et al. 1990).

Operations over snow cover would likely show some evidence of crushed tussocks, however, if damage levels are kept to a minimum, new growth would preclude any exposed soils or extensive changes in the active layer. If damage is severe or extensive, irreversible thermodegredation would occur causing permanent thermokarsting and subsidence. Degradation of permafrost below seismic lines could also alter water storage and flow processes, with implications for the water balance at local and regional scales (Dabros et al. 2018). Small-scale thermokarst could occur due to added insulation of deep compacted snow which reduces frost penetration during winter months (O'Neill and Burn 2017).

Snowdrifts caused by camp locations would increase the soil surface temperature in winter and increase thaw depth in the soil near the structures. Blockage of natural drainage patterns could lead to the formation of impoundments or redirection of surface water flow and could cause deposition or erosion of sediment.

Even under a minimally impacted scenario, seismic operations would be expected to displace small areas of soil in isolated locations. Because of snow depth restrictions and sensitive vegetation avoidance procedures that would be placed on this activity, impacts to soils would be limited to the compression (reduction) of the insulating mat, similar to what happens during other winter operations following traffic by low-ground-pressure vehicles.

Under the proposed action there could be some areas where soils are impacted due to damage of the protective vegetation. These effects would be long lasting and could include subsidence, rutting, ponding, and lake drainage. These effects would most likely occur in areas where snow cover is not adequate to protect the vegetative cover such as drainage crossings with taller shrubs and wind scoured sites with shallow cover. Avoiding areas with inadequate snow cover and sensitive vegetation types would help minimize these risks. Minimum snow thickness requirements identified in the Coastal Plain Leasing ROD ROP (USDOI BLM 2020) (Appendix J) would minimize impacts to soils/permafrost and vegetation. Increased disturbance, however, could occur if terrain is excessively steep, vegetation species are less resilient, turning radiuses for vehicles are too tight, snow cover is shallow, or soils are insufficiently frozen.

Soil impacts analyzed in this document though more detailed and site specific do not differ greatly from the Coastal Plain Leasing EIS (USDOI BLM 2019) and are within the scope of the Coastal Plain Leasing ROD (USDOI BLM 2020).

Past, Present, and Reasonably Foreseeable Impacts

Arctic permafrost is experiencing record warming (Richter-Menge et al. 2017). The volume of ice-rich permafrost soils is decreasing, which results in subsidence of the surface. Subsidence may occur over a broader area than solely in those areas that are directly impacted by seismic traffic.

In addition to effects from the proposed action, warmer soil temperatures are expected due to increased temperature from elevated ambient air temperatures and changes in timing and intensity of snowfall. Elevated mean annual soil temperatures are likely to increase thermokarst and increases in sea level may inundate low-lying tundra areas, increasing salt marsh, aquatic, and wet tundra vegetation types and erosion of coastal bluffs (Arctic Climate Impact Assessment 2004). Such impacts of climate change would be additive with any changes in soil thermal regimes that might occur as a result of past and future non-oil and gas and oil and gas activities in and near the Coastal Plain.

Alternative B - No Action

Under this alternative, there would be no impacts to soils and permafrost from seismic exploration on federally managed lands.

3.6 Wildlife

3.6.1 Caribou Affected Environment

Caribou are the most abundant large mammal in the Refuge and are an important subsistence species for Iñupiat and Athabascan (Gwich'in) hunters in Arctic Village, Venetie, Stevens Village, Beaver, Fort Yukon, Chalkyitsik, and Kaktovik, and several communities in the Yukon and Northwest Territories of Canada. Caribou are also hunted and viewed by other visitors to the Refuge and are prey for grizzly bears and wolves (*Canis lupus*). The two caribou herds most commonly occurring in the Refuge are the Porcupine and Central Arctic herds. The Porcupine Caribou Herd (PCH) is one of the two largest herds in North America. In 2017, this herd was estimated to comprise 219,000 caribou (ADFG 2017b). The Porcupine Caribou Herd ranges over 130,000 square miles in northeastern Alaska and northwestern Canada (Lenart 2007). The Coastal Plain is key calving, post-calving, and insect-relief habitat for the PCH in most years (Griffith et al. 2002), and some caribou are found there during other seasons. The Central Arctic Herd (CAH) currently numbers about 23,000 caribou (2016 estimate; ADFG 2017a). The annual range of this herd overlaps that of the PCH in the western part of the Refuge. Most calving by Central Arctic caribou occurs on State lands west of the Refuge, but the western Coastal Plain is often used by the CAH during post calving, summer, and fall. Some caribou from this herd and the neighboring Teshekpuk Caribou Herd occasionally use the Coastal Plain during winter.

In recent decades, the PCH generally migrates to winter areas south or southeast of the Coastal Plain, but some caribou may remain on the Coastal Plain during winter (November-March). In addition, caribou from the CAH and Teshekpuk Caribou Herd may occur in the Project Area during winter months (Dau 2013, Lenart 2015). In late winter and spring (April-May), PCH caribou may also be found approaching and entering the Coastal Plain in preparation for calving season, which starts in mid to late May. Therefore, caribou could be encountered during the proposed seismic surveys on the Coastal Plain. Additionally, caribou use the Coastal Plain during the post-calving and insect relief seasons and could be encountered during summer clean-up activities associated with the proposed seismic surveys.

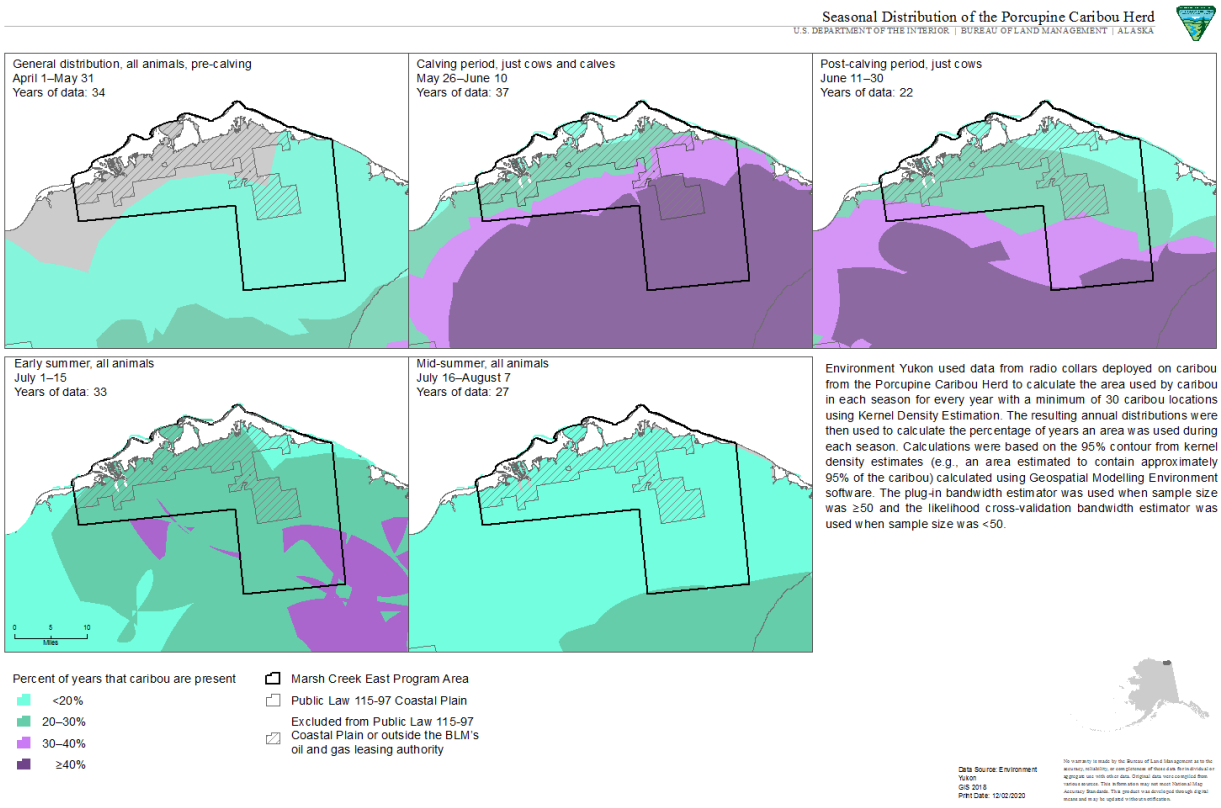

Figure 2. Seasonal distributions of the PCH within the proposed Project Area.

Figure 2 shows the seasonal distributions of the PCH within the proposed Project Area based on the 95 percent contour from kernel density estimates. All lands within the proposed Project Area are used in at least some years by 95 percent of PCH caribou during the critical calving, post-calving, and early summer insect relief periods. Of the 352,416 acres identified for the proposed activity area, 308,580 acres are above water. Of those acres of land above water, 135,657 acres (44 percent) are used for annual calving grounds (areas utilized from May 26 – June 10) by the PCH in at least 40 percent of years; 215,064 acres (70 percent) are used for annual calving grounds by the PCH in at least 30 percent of years; and 295,149 acres (96 percent) are used for annual calving grounds by the PCH in at least 20 percent of years. These percentages reflect the high fidelity to calving grounds exhibited by the PCH.

For annual post-calving grounds (areas utilized from June 11 – June 30) of the PCH, 17,428 acres (6 percent) are used in at least 40 percent of years; 86,594 acres (28 percent) are used in at least 30 percent of years; and 257,352 acres (83 percent) are used in at least 20 percent of years.

For annual early summer grounds (areas utilized from July 1 – July 15 for insect relief) of the PCH, 23,924 acres (8 percent) are used in at least 30 percent of years; and 285,312 acres (92 percent) are used in at least 20 percent of years.

Caribou are particularly active during the post-calving and insect-relief periods, seeking optimal forage and escape from pests, resulting in lower localized site fidelity, but high regional site fidelity. The longest cumulative distances traveled per day throughout the entire year by PCH caribou typically occur in July, when mosquito harassment peaks (Fancy et al. 1989; Prichard et al. 2014; Dau 2015). Further detail on seasonal site fidelity is given in Section 3.3.4 of the Coastal Plain Leasing EIS (USDOI BLM 2019).

3.6.1.1 Caribou Environmental Impacts

Alternative A - Proposed Action

Overwintering period (November-April)

Winter seismic activities could have adverse impacts on caribou overwintering in the survey areas, potentially causing displacement. The displacement of caribou could have a negative effect on their energy balance, resulting from a reduced intake of quality forage and an increased energy expenditure to relocate to other areas (Reimers et al. 2003). Although caribou are mobile and the seismic operations would be short in duration (e.g., five to seven days in one area), it is possible that this disturbance could have an additive effect on winter mortality and disproportionately impact young of the year and pregnant cows (Cameron et al. 2005). However, the program area is used very little by overwintering caribou overall, so direct impacts during this period would likely be negligible. The limited use of the Project Area by overwintering caribou is further detailed in Section 3.3.4 of the Coastal Plain Leasing EIS (USDOI BLM 2019).

Pre-calving and Calving periods (May-June)

Seismic activities that occur during the spring pre-calving and calving periods especially have the potential to have a greater impact on migrating caribou. In particular, PCH parturient cows migrating to their calving grounds during May could be negatively impacted. Seismic and demobilization activities could act as a deterrent to calving caribou, deflecting them to areas not as suitable for calving, potentially with greater predation and lower-nutrient forage options, factors which both have negative implications for cow and calf health and survival (Kuropat 1984; Griffith et al. 2002: Johnstone et al. 2002). Alternative calving areas adjacent to the primary PCH calving grounds contain less high-quality forage, higher predator densities, different climatic conditions, and more topographic relief. Additionally, although calving grounds can vary annually within the larger primary calving region, USFWS (2015a) has concluded that the PCH requires this large region in order to select the best conditions for calving in a given year. Displacement away from a

selected calving area could therefore have negative effects for both cow and calf, even if the alternative site is still within the primary calving region.

The location of caribou calving grounds in key areas with few predators and with abundant early-emergent, high-nutrient forage, and the impact of disturbance and displacement during the calving period is further detailed in Section 3.3.4 of the Coastal Plain Leasing EIS (USDOI BLM 2019). Some protections for calving habitat are provided by ROP's 34 and 42 of the Coastal Plain Leasing ROD (USDOI BLM 2020)(also see Appendix J). ROP 42 minimizes disturbance of wildlife or alteration and hinderance of wildlife movements through the Coastal Plain by prohibiting the following of caribou with ground vehicles or aircraft. ROP 34 minimizes the number of helicopter landings within calving habitat, requires a minimum flight altitude of 1,500 feet above calving habitat, and prohibits hazing of caribou. However, flight activity for the proposed project is planned for later in the summer, in July and August, when caribou are no longer calving.

Post-calving and Insect relief periods (June-July)

During early July, caribou are highly aggregated in most years on the Coastal Plain or uplands (Caikoski 2018, ADFG). Insect harassment can be significant on these summer ranges during this period, resulting in dense aggregations and movements to seek insect relief (Lawhead et al. 2015, Cameron et al. 2005). In many years, the PCH moves south or east during the latter half of July, often leaving the Coastal Plain and crossing the Brooks Range to the south. In other years, caribou have remained on the North Slope through July (Lenart 2015).

Impacts to caribou from low flying helicopters during summer clean-up activities in July and August would be exacerbated by numerous take-offs and landings of the aircraft (USDOI BLM 2012). All camp locations and areas of "high use" would be inspected and debris collected and removed. The number of helicopter landings would vary depending on camp locations, areas of concern and amount of debris, but it is estimated there would be up to 600 take-offs and landings over a 15-day period during clean-up activities. Disturbance to caribou during this 15-day period from low flying aircraft and landings could cause animals to flee, increase stress, separate calves from their mothers, and potentially expose calves to predation (Fancy et al. 1989, Griffith et al. 2002, Webster 1997). Low-level aircraft traffic in the vicinity of calving grounds and early post-calving aggregations can reduce calf survival (Wolfe 2000). Flights in early July would be more disruptive to maternal females and calves than flights occurring in the latter part of July when calves are older (Caikoski 2018 and Dau 2013).

The impacts of aircraft operations on post-calving caribou and insect relief aggregations are further detailed in Section 3.3.4 of the Coastal Plain Leasing EIS (USDOI BLM 2019). Some protections for post-calving and insect-relief ranges are provided by lease stipulations (LS) 6, 8, 9, and ROPs 34, and 42 of the Coastal Plain Leasing ROD (USDOI BLM 2020) (Appendix J). The objective of LS 6 is to minimize disturbance and hindrance of caribou and alteration of caribou movements in summer habitat. LS 9 protects the Coastal Area by minimizing hindrance or alteration of caribou movement in caribou coastal insect-relief areas. ROP 34 minimizes the number of helicopter landings within calving habitat, requires a minimum flight altitude of 1,500 feet above calving

range whether during calving periods or post-calving, and prohibits hazing of caribou. ROP 42 minimizes the disturbance of wildlife or alteration and hinderance of wildlife movements through the Coastal Plain by prohibiting the following of caribou with ground vehicles or aircraft.

Overall, given adequate mitigation protections, direct impacts to the PCH due to the proposed activities would likely to be minimal and short-term. The length of the proposed project period is limited to one year, and any unmitigated disturbance and displacement caused to the PCH by the project would likely to be limited to that timeframe. Although concurrent impacts to vegetation quality and availability could occur (see 3.4.1 Vegetation) making the Project Area potentially less attractive to maternal caribou as future calving and post-calving habitat, the proposed project alone would not likely deter caribou from migrating to and utilizing the area in future years after the project is completed, particularly if vegetation is given adequate time to recover. Mitigations designed to protect the calving and post calving periods would ensure that effects to caribou due to the proposed project are minimized.

Past, Present, and Reasonably Foreseeable Impacts

Effects on caribou distribution and abundance due to disturbances related to past, present and reasonably foreseeable energy development projects are likely to be long-term, lasting as long as the life of the North Slope oil and gas fields. Any reduction in calving and summer habitat use by cows and calves of the CAH as a result of future onshore development on adjacent lands to the west could result in long-term effects on the caribou herd's productivity and abundance. Cascading effects on neighboring herds, including the PCH, could also occur, as more animals compete for a smaller pool of available resources.

As the duration of the current proposed activity is limited to one year, it is possible that impacts due to displacement would be temporary. However, if energy development in the surrounding area continues and displacement in both the CAH and PCH is recurring, impacts on productivity and abundance could become enduring due to additive and combined effects (Johnson et al. 2019). Seismic impacts to tundra that lead to changes in forage quality and availability over the long term could also play a compounding role in caribou health and survival. The PCH has typically had lower productivity but more stable herd size than other Arctic herds (Fauchald et al. 2017; Coastal Plain Leasing EIS 3.3.4). Although caribou herd sizes are naturally variable, growth of the PCH in particular has been highly correlated with the Arctic Oscillation, which affects snowfall and summer vegetation conditions (Joly et al. 2011). This correlation suggests that the PCH may be more sensitive to changes in vegetation conditions in calving and post-calving areas. Vegetation changes, when viewed in combination with broader disturbances across the North Slope related to past, present and reasonably foreseeable energy development projects, could incrementally contribute to herd health declines in the long-term. Impacts associated with indirect effects on calving and post-calving caribou are discussed in further detail in Section 3.3.4 of the Coastal Plain Leasing EIS (USDOI BLM 2019).

Proposed New Mitigation Measures

Proposed Mitigation Measure 1 – Aircraft would maintain 1,000 feet above overwintering caribou

Objective: Protect overwintering caribou

Requirement/Standard: Aircraft would maintain an altitude of at least 1,000 feet above ground level (except for takeoffs and landings) over wintering caribou from December 1 through May 1, unless doing so would endanger human life or violate flying practices.

Potential Benefits: Maintaining an altitude of 1,000 feet above overwintering caribou by aircraft would minimize disturbance to and displacement of caribou in the Project Area, preventing potential negative effects on energy balance, particularly in young of the year and pregnant cows, due to reduced intake of forage and increased energy expenditure associated with relocating to other areas (Reimers et al. 2003; Cameron et al. 2005).

Proposed Mitigation Measure 2 – Summer clean-up activities would occur from July 25-August

Objective: Protect post calving caribou and calves

Requirement/Standard: Summer clean-up activities would not start until July 25.

Potential Benefits: Preventing summer clean-up activities until after July 25 would minimize disturbance to caribou from low flying aircraft and landings and prevent animals from fleeing. This would reduce stress as well as prevent the separation of calves from their mothers which would potentially expose calves to predation (Fancy et al. 1989, Griffith et al. 2002, Webster 1997). In addition, minimizing low-level aircraft traffic in the vicinity of post-calving aggregations would protect calf survival (Wolfe 2000).

Proposed Mitigation Measure 3 – Prevent seismic activities in PCH pre- and primary caribou calving habitat during May

Objective: Protect pre- and primary caribou calving habitat

Requirement/Standard: Seismic activities would be suspended in the PCH pre- and primary calving habitat area shown in Figure 3 from April 30 through June 20.

Potential Benefits: Preventing seismic activities in May would minimize impacts to PCH parturient cows migrating to their calving grounds by reducing deterrents to calving caribou that would deflect them to areas not as suitable for calving, potentially with greater predation and lower-nutrient forage options, factors which both have implications for cow and calf health and survival (Kuropat 1984; Griffith et al. 2002: Johnstone et al. 2002). The area in blue in Figure 3 shows the land used in up to 20 percent of years for pre-calving habitat by 95 percent of collared caribou.

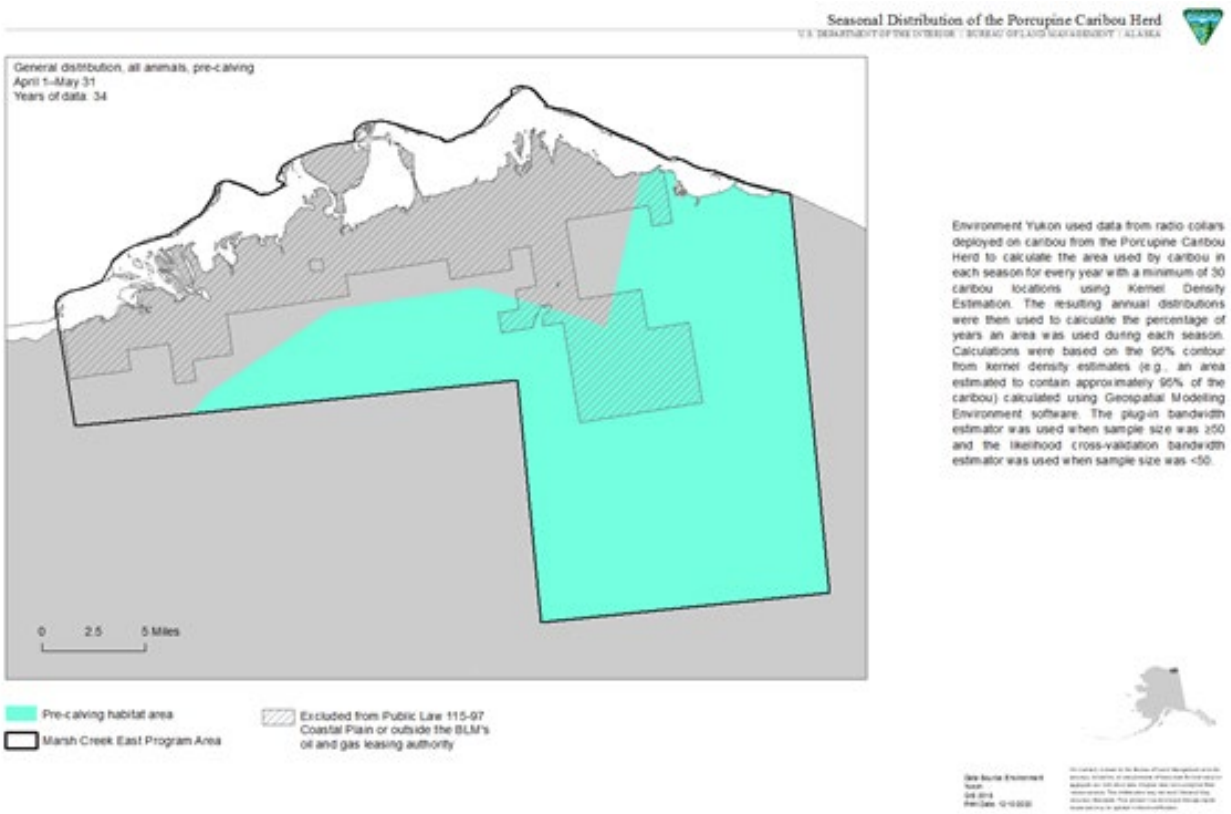

Figure 3. Project Area pre- and primary calving caribou use locations.

Alternative B - No Action

Under this alternative, there would be no impacts from seismic exploration to caribou on federally managed lands.

3.6.2 Other Terrestrial Mammals Affected Environment

In addition to caribou, the Coastal Plain provides habitat for many species of terrestrial mammals, including muskoxen (Ovibos moschatus), moose, grizzly bear, wolves, Arctic fox (Alopex lagopus), red fox (Vulpes vulpes), wolverine (Gulo gulo), and numerous small mammal species. Muskoxen were reintroduced to the region in 1969 and 1970. The population increased and spread across the Coastal Plain through about 1998, then declined steeply through 2006. Currently, few muskoxen reside within the Refuge year-round (USDOI FWS 2015a) but populations are stable or increasing in nearby areas to the east and west. Moose on the Coastal Plain are largely restricted to patches of woody vegetation along streams during winter, but moose spread out across the area during summer. Moose populations in the Refuge increased rapidly during the 1980s, and then declined during the 1990s. More recently, moose abundance has apparently increased in the northeastern part of the Refuge, but there is little information available about the population in the Coastal Plain east and west of the Canning River area.

Grizzly bears, wolves, and wolverines all occur on the Coastal Plain, but are more common in the foothills and mountains of the Brooks Range. Some grizzly bears den on the Coastal Plain during winter, but bear abundance in the area is highest in early summer during caribou calving. Arctic fox are widespread and relatively common near the Arctic coast during summer. Red fox are fairly common inland, and appear to be increasing in abundance along the coast.

Little is known about the abundance, distribution, and species composition of small mammal communities in the Refuge. Of the more common species, arctic ground squirrels (*Spermophilus parryii*) have a patchy distribution on the Coastal Plain because denning habitat is limited. Microtine rodents, particularly brown lemmings (*Lemmus trimucronatus*), are year-round residents of the Coastal Plain and are an important source of food for many predators in years when they are abundant. Arctic fox abundance cycles in response to changes in small mammal abundance, particularly lemming abundance, which has pronounced effects on alternate prey species, such as ground-nesting birds. Lemming populations and recruitment are affected by winter snow characteristics (Reid et al 2012; Bilodeau et al 2013). Snow depth, density, and hardness strongly influence population dynamics and the amplitude and periodicity of lemming population cycles (Domine et al 2018; Bilodeau et al 2013). Shallow, hard, and dense snow has adverse impacts on lemming populations. Seismic machinery and activities may cause snow compaction, high-density snowpack and shallower snow depths. Lemming cyclical population fluctuations impact the whole tundra food web (Domine et al 2018). No mammals on BLM's Special Status Species list are found in the Coastal Plain.

3.6.2.1 Other Terrestrial Mammals Environmental Impacts

Alternative A - Proposed Action

Potential causes of disturbance to terrestrial mammals from seismic activities would include surface vehicular traffic on frozen tundra or ice and fixed-wing aircraft traffic. In most cases, these activities would cause short-term displacements of and/or disturbance to terrestrial mammals. These disturbances, however, could result in animals having to relocate to less favorable areas to avoid the disruptive activities associated with seismic exploration. Where seismic exploration survey lines are located, localized displacement of terrestrial mammals could last for several days or lead to complete abandonment of localized habitat. Mortality in small mammals unable to effectively relocate could also occur, with potential cascading trophic consequences.

Previous studies of the effects of oil and gas exploration on muskoxen in Alaska and Canada focused on disturbances associated with winter seismic operations. Some muskoxen reacted to seismic activities at distances up to 2.5 miles from the operations; however, reactions were highly variable among individuals (Reynolds and LaPlant 1986). Responses varied from no change in behavior to becoming alert, forming defense formations, or running away (Winters and Schideler 1990). The movements of muskoxen away from the seismic operations did not exceed three miles and had no apparent effect on muskox distribution (Reynolds and LaPlant 1986). Unlike caribou, muskoxen are not able to travel and dig through snow easily. In the winter, they search out sites with shallow snow, and greatly reduce movements and activity to conserve energy (USDOI FWS 1999). Muskoxen survive the winter by using stored body fat and reducing movement to

compensate for low forage intake (Dau 2001). Because of this strategy, muskoxen may be more susceptible to disturbances during the winter. It is possible that repeated disturbances of the same animals during winter could result in increased energetic costs that could increase mortality rates. Depending on the location of seismic exploration and the location of muskoxen, it is anticipated that impacts on muskox populations would be non-existent to minor. Further detail on the impacts of general oil and gas exploration activity on muskoxen is given in Section 3.3.4 of the Coastal Plain Leasing EIS (USDOI BLM 2019).

During winter, moose, wolves, Arctic fox, red fox, and wolverines may occur in the Project Area. These species are mobile and could possibly move to other locations. This is not the case for grizzly bears. Most grizzly bears spend several months in an energy-saving state of hibernation in a den. A review of responses to disturbance from grizzly bear showed that activity closer than approximately ½ mile and especially within 656 feet caused variable responses. For females with young of the year, den abandonment can lead to increased cub mortality with potential deleterious effects on adults as well (Linnell et al. 2000). If an active grizzly bear den is encountered, avoiding seismic activity in the vicinity of the den could reduce potential deleterious impacts, particularly to females with young of the year. Specific protections for grizzly bears and occupied dens are provided by ROP's 2, 4 and 10 of the Coastal Plain Leasing ROD (USDOI BLM 2020) (Appendix J). Further detail on the impacts of general oil and gas exploration activity on moose, wolves, Arctic fox, red fox, wolverines, and grizzly bears is given in Section 3.3.4 of the Coastal Plain Leasing EIS (USDOI BLM 2019).

During winter, small mammals depend on the subnivean zone (the area between the surface of the ground and the bottom of the snowpack) for access to resources necessary for survival. The home ranges for many small mammals are generally very small, especially during the winter. Although snowpack limits access to food, snow also provides protection from predation, insulation from low surface temperatures and ease of travel in low density unconsolidated snow. Compaction of snow and tundra vegetation from seismic activities could fragment individual home ranges, increase the amount of energy expended to travel in search of food, reduce thermal stability, block travel corridors, and cause individuals to surface, increasing the potential for predation and mortality. Bilodeau et al. 2013 noted that snow density and depth had large impacts on subnivean mammals, with increased snow density having a negative effect. Snow density would be expected to increase in tracks of machinery. This could have negative effects locally for small mammal populations as well as cascading trophic effects on the local food web, as predators turn to alternate prey species, such as tundra-nesting birds, for food. It is possible that, given the short timeframe of the proposed project, these effects could be short-term. ROP 25 of the Coastal Plain Leasing EIS (USDOI BLM 2020) (Appendix J) aims to protect ground-nesting birds by avoiding human-caused changes in predator populations, including foxes, however it does not address protecting alternate prey species such as small mammals to avoid indirect impacts to ground-nesting birds. Further detail on the impacts of general oil and gas exploration activity, including compaction, on small mammals is given in Section 3.3.4 of the Coastal Plain Leasing EIS (USDOI BLM 2019).

Past, Present, and Reasonably Foreseeable Future Impacts

It is anticipated that if appropriate mitigation measures are implemented that long-term negative impacts on muskoxen, moose, and grizzly bear could be avoided. Disturbance activities associated with future oil and gas activities could displace muskoxen, moose, and grizzly bears from preferred habitats. The proposed seismic activities would be for the time period of winter 2020 through fall 2021, and it would be unlikely that any overlap or combined effects would result from oil and gas development during this short timeframe.

Alternative B - No Action

Under this alternative, there would be no impacts from seismic exploration to terrestrial mammals on federally managed lands.

3.7 Marine Mammals

All marine mammals found in US waters are protected under the Marine Mammal Protection Act of 1972, as amended (MMPA; 16 USC 1631 et seq.) (Appendix F Section 6.1). Whales and seals are managed by the NMFS and polar bear and Pacific walrus are managed by the FWS. Many of these species receive additional protection under the Endangered Species Act (ESA) (16 USC 1531 et seq.). The bowhead whale is listed as endangered under the ESA, and the polar bear, bearded seal, and ringed seal are listed as threatened.

The proposed project would be conducted during the winter and summer months (January through August). No whale species would be present in the Project Area during this time and would not be exposed to project activities. Similarly, bearded seals remaining in the Beaufort Sea during the winter season occur farther offshore in shelf waters rather than in nearshore areas of less than 10 feet of water depth. Consequently, they are not expected to occur in the Project Area. The only marine mammals expected to occur in the Project Area during project activities are ringed seals and polar bears.

3.7.1 Polar Bear Affected Environment

Population Status, Trends, and Threats

Polar bears have a circumpolar distribution in the Northern Hemisphere. In Alaska, they occur most commonly within 200 miles of the coast of the Arctic Ocean (Amstrup and DeMaster 1988). Nineteen subpopulations (stocks) of polar bears have been identified throughout their range, ranging from several hundred to several thousand animals each and, in the previous estimate, totaling approximately 26,000 individuals range wide (Wiig et al. 2015; Durner et al. 2018). In their analysis, Hamilton and Derocher (2019) further refined the global population estimate to 23,315 bears (Appendix F Section 6.2.1).

Bears from three stocks occur in US waters off Alaska: the Northern Beaufort Sea stock, the Southern Beaufort Sea (SBS) stock, and the Chukchi Sea stock (Bethke et al. 1996; Amstrup 2003a; Amstrup et al. 2004a; Schliebe et al. 2006; Obbard et al. 2010; Durner et al. 2018). The SBS stock

is the subpopulation most likely to occur in the Project area. The best available analyses suggest that the SBS stock is declining (Obbard et al. 2010; Bromaghin et al. 2015; USFWS 2017). The estimated population size of the SBS stock was approximately 900 bears in 2010 (Bromaghin et al. 2015), significantly reduced from previous estimates of approximately 1,800 in 1986 (Amstrup et al. 1986) and 1,526 in 2006 (Regehr et al. 2006). Using mark-recapture data from 2001 to 2016, Atwood et al. (2020) analyzed the abundance of the SBS stock and calculated an index. They concluded that there was a high degree of correlation in the previous analysis (Bromaghin et al. 2015) and that with information from the additional years (2010 – 2015) there has not been a sizable change in the SBS population abundance since 2010.

The FWS described reductions in sea ice due to climate change as a primary threat to the polar bear and its habitat (73 FR 28211, May 15, 2008; 75 FR 76086, December 7, 2010; USFWS 2016). While the largest threat to polar bears is the loss of sea ice due to climate change, polar bear subpopulations face different combinations of human-induced threats (Obbard et al. 2010). Other threats include accumulation of persistent organic pollutants in polar bear tissue, tourism, human-bear conflict, and increased development in the Arctic (Obbard et al. 2010).

In general, polar bears have no natural non-human predators. Young cubs are vulnerable to predation during the brief period after den emergence and before moving onto sea ice (Richardson and Andriashak 2006). Cannibalism by adult males on cubs and occasionally on adult bears is also known to occur (Amstrup et al. 2006a; Derocher and Wiig 1999; Stirling and Ross 2011; Taylor et al. 1985). The largest human-caused loss of polar bears is from subsistence hunting of the species, but for the Alaska subpopulations where subsistence hunting of polar bears occurs, it is a regulated and/or monitored activity (Obbard et al. 2010).

Movements and Distribution

Polar bears of the SBS stock range over large areas, with annual activity of collared individuals ranging from 2,805 to 230,426 square miles (Amstrup et al. 2000). They are transient throughout the nearshore areas of the Beaufort Sea coast, including the Project area. The largest monthly movements occur during early winter and the smallest in early spring; females with cubs move less and cover smaller areas than do males and other age classes. Movements are increasing as sea ice cover diminishes. From 1979 to 2006, collared female polar bears moving from pack ice to denning areas onshore experienced an average increase in travel distance of 3.7 miles per year, and future increases of greater than 10 miles per year have been estimated out to 2060, based on ocean circulation models (Bergen et al. 2007).

Peak numbers of polar bears observed on land generally occurred in late September and early October (USFWS 1995; Schliebe et al. 2001, 2008; Kalxdorff et al. 2002). The number of polar bears on shore is related to sea ice dynamics, although the distribution of bears on shore was influenced most strongly by the availability of food from subsistence whaling (Wilson et al. 2017).

During winter and spring, polar bears tend to concentrate in areas of ice with pressure ridges, at floe edges, and on drifting seasonal ice at least 8 inches thick (Stirling et al. 1975, 1981; Schliebe et al.

2006); the greatest densities occur in the latter two categories, presumably because those habitats provide greater access to seals. Although most of the SBS bears remain on sea ice during summer (Pongracz and Derocher 2017), their use of terrestrial habitats has been increasing as sea ice cover has declined (Atwood et al. 2016b) (Appendix F Section 6.2.2 and 6.2.3).

The use of landfast ice increases in the spring, during the pupping season of ringed seals, and multi-year ice is used in late summer and early autumn, as the pack ice retreats to its minimal extent (Johnson and Derocher 2019; Derocher et al. 2013; Durner et al. 2004). Adult males usually remain with multi-year ice during late summer and early fall and rarely come ashore (Schliebe et al. 2006). SBS polar bears begin to appear on the mainland and barrier islands in increasing numbers during the open-water period in August when the pack ice can be very far from shore (Miller et al. 2006; Schliebe et al. 2008). During the open-water season, bears of the SBS population occur more commonly along the coast and barrier islands of the Beaufort Sea (Derocher et al. 2013; Kalxdorff et al. 2002; Rode et al. 2015).

Foraging

Although they are classified as marine mammals and are strong swimmers, polar bears rely principally on sea ice to provide a substrate on which to roam, hunt, breed, den, and rest. Bears often travel great distances in search of prey and require large home ranges in order to meet foraging requirements (Auger-Méthé, Lewis, and Derocher 2015; Derocher et al. 2013).

Polar bears are upper level predators in the Arctic marine ecosystem, preying primarily on ringed seals, and to a lesser extent on bearded and spotted seals (Stirling and Archibald 1977; Pilfold et al. 2014; Rogers et al. 2015; Schliebe et al. 2008; Smith 1980; Muto et al. 2018). They will also capture and consume larger prey, such as walruses, belugas, caribou, and narwhals (Derocher et al. 1993; Gaston and Elliott 2013; Rode et al. 2015; Stempniewicz 1993) and will opportunistically forage on birds, eggs, and coastal plants (Derocher, Andriashek, and Stirling 1993; Gaston and Elliott 2013; Rode et al. 2015; Stempniewicz 1993). Carrion, most notably the remains of subsistence-harvested bowhead whales at bone piles at Barter Island, Cross Island, and Point Barrow, are an increasingly important food source, particularly for SBS polar bears (Appendix F Section 6.2.4).

Reproduction

Polar bears are characterized by a late age of sexual maturity, small litter sizes, and extended parental investment in raising young – factors that combine to contribute to a very low reproductive rate (Schliebe et al. 2006) (Appendix F Section 6.2.5). The peak of breeding season appears to be from early April through mid-May. The timing of implantation, and therefore the timing of birth, is likely dependent on body condition of the female, which depends on a variety of environmental factors, including availability of seal prey (Schliebe et al. 2006).

In comparison with core denning areas known to support relatively high concentrations of maternal females of other population stocks, the southern Beaufort Sea is an area of widespread, low-density denning by maternal polar bears (Amstrup 2003b; Schliebe et al. 2006; USFWS 2017). The total

number of maternal dens occupied annually by females of the SBS stock has been estimated at 140 to 240 (Amstrup and Gardner 1994; 75 FR 76099). The most recent SBS annual maternal den estimate is 123 dens per year (Atwood et al. 2020). Although female polar bears do not show fidelity to specific den locations, they tend to den on the same substrate (sea ice or land) from year to year and may return to the same general area to den (Amstrup and Gardner 1994; Amstrup 2003b; Schliebe et al. 2006; Fischbach et al. 2007). Most terrestrial dens were located between the Colville and Canning Rivers, followed by the Coastal Plain and the NPR-A.

Polar bears 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. Only pregnant females den for an extended period during the winter; other polar bears may excavate temporary dens to escape harsh winter conditions, but otherwise remain active year-round (Amstrup 2003a). Some pregnant females construct and enter natal dens in October, but most do so in mid- to late November (Amstrup and Gardner 1994). Pregnant polar bears denning in terrestrial habitats excavate maternal dens in compacted snow drifts next to coastal banks of barrier islands and mainland bluffs, river, stream, and lake banks, and other areas with suitable topographic relief (Amstrup and DeMaster 1988; Durner et al. 2001, 2003, 2006). The most important characteristic of maternal denning habitat is the presence of topographic features of sufficient height and slope to catch blowing snow and form persistent drifts in early winter, with at least 4.3 feet of vertical topographic relief and steep slopes (mean 40°) (Amstrup and DeMaster 1988; Durner et al. 2001, 2003, 2006).

Birth occurs typically in late December or early January, and mothers and cubs emerge from natal dens in late March or April (Amstrup and Gardner 1994; Amstrup 2000; Smith et al. 2007). Researchers monitored den emergence and abandonment along the Beaufort Sea coast in or near the Prudhoe Bay area from 2000 to 2013 (Streever and Bishop 2014). On average, over the 13 years of this study, female bears emerged from their dens on March 16 and stayed at den sites until March 23. After this initial emergence, bear families remained at the den site for periods ranging from 1 to 18 days, with an average stay of 6.5 days (Streever and Bishop 2014). Survival of cubs is dependent on their weight when they exit dens (Derocher and Stirling 1992). Most cub mortality occurred early in the period after emergence from the den (Amstrup and Durner 1995; Derocher and Stirling 1996). Polar bears are long-lived mammals and in large part are not known to be susceptible to disease, parasites, or injury.

Sensory Abilities

Polar bears communicate through their body language, vocalizations, and scent markings (Owen et al. 2015; Wemmer et al. 1976; Stirling and Derocher 1990; USFWS 2013a). Hearing is also vital for successful prey capture. Although polar bears primarily use their sense of smell while hunting, their hearing becomes essential during the latter stages of hunting because at close distances sound propagates more rapidly than scent (Cushing et al. 1988) (Appendix F Section 6.2.6).

Presently, limited information on polar bear hearing exists and no hearing threshold criteria specific to polar bears have been described. The U.S. Navy has assigned polar bears to the 20 Hertz (Hz) to 60 Kilohertz (kHz) frequency range (Ciminello et al. 2012). Nachtigall et al. (2007) used

electrophysiological methods to measure the in-air hearing abilities of three anesthetized polar bears and found that the best sensitivity occurred in the frequency range from 11.2 to 22.5 kHz. Recently, Owen and Bowles (2011) used behavioral procedures to measure the in-air auditory thresholds and hearing sensitivity of five female polar bears at frequencies between 125 Hz and 31.5 kHz. Results showed that the greatest sensitivity occurred between 8 and 14 kHz. Sensitivity declined sharply between 14 and 20 kHz, suggesting an upper hearing range 10 kHz to 20 kHz lower than small terrestrial carnivores (Bowles et al. 2008; Fay 1988 in Owen and Bowles 2011).

In addition to hearing, and olfaction, polar bears have well-developed vision, akin to that of other bear species that aids in detection and capture of prey (Stirling 1974 in Dehnhardt 2002). Polar bears also have a highly developed olfactory system that allows them to locate subnivean seal lairs when foraging (Stirling 1990) and detect scent markings left in the tracks of other bears (Owen et al. 2015).

3.7.1.1 Polar Bear Environmental Impacts

Alternative A - Proposed Action

During winter exploration activities, non-denning polar bears could be attracted to or avoid the area of activity, depending on the individual bear. If attracted to the Project Area, polar bears could be impacted by incidental harassment, intentional hazing near occupied work sites, increase in subsistence harvest due to increased access, mortality due to collisions or defense of life kills, and contamination from spills of toxic fluids. The primary causes of potential impacts to denning polar bears would be related to noise and activity caused by vehicle and aircraft traffic with the potential that the female polar bear would abandon her den and result in mortality of young or that early den emergence due to disturbance could lead to decreased survival of cubs (Rode et al. 2018).

During summer inspections and clean up, polar bears could be impacted by aircraft traffic and humans on foot in the Project Area which could cause temporary habitat loss of feeding areas, incidental harassment of polar bears or defense of life kills.

The proposed action states that no activities would occur within one mile of known or suspected polar bear dens and that surveys would be conducted to locate polar bear dens prior to activities commencing. An advance survey crew would verify, identify, stake, and map avoidance areas around polar bear den sites. During seismic operations, should previously unknown occupied polar bear dens be discovered within one mile of activities, work would cease and the FWS would be contacted for guidance. A Wildlife Interaction Plan was prepared by the applicant detailing how crews would manage wildlife attractants (food and non-food materials) and respond to human-polar bear interactions (Appendix I). Subsistence hunters may utilize the Project Area; and snow trails may provide increased access to areas where higher concentrations of polar bears may be found. However, impacts to polar bear subsistence harvest levels would be expected to be low due to the fact that most bears would be actively hunting on sea ice during that time of year, and that females with cubs are not allowed to be harvested under the Iñuvialuit-Iñupiat Polar Bear Management Agreement (76 Federal Register 47021). The applicants SPCC plan for fueling and fuel storage would reduce the probability of contamination of polar bears from spills of toxic fluids.

Protections to polar bears and polar bear critical habitat would be provided by the Coastal Plain Leasing ROD Stipulations 5 and 9 and ROPs 1, 2 3, 4, 10, 15, 34, 40 and 42 (USDOI BLM 2020) (Appendix J) and the project specific ROP that requires the applicant to keep logs of all aircraft landings in the Project Area during both summer and winter operations (Section 2.2.9).

The FWS's draft Incidental Harassment Authorization (IHA; 85 FR 79082, December 8, 2020) also provides a number of mitigation and monitoring measures which the applicant would be required to implement as part of its specified activities. The FWS IHA analysis to determine incidental take included analysis of surface-level impacts, analysis of aircraft impacts to surface bears, and analysis of impacts to denning bears. The draft IHA proposed a finding that any incidental take by harassment resulting from the proposed project could not be reasonably expected to, and would not reasonably likely to adversely affect the SBS stock of polar bears through effects on annual rates of recruitment or survival. The draft IHA concluded that the proposed project would have no more than a negligible impact on the SBS polar bear stock. Approximately 3 non-injurious takes by harassment (disturbance) of polar bears from the SBS stock over the course of the proposed project are estimated to occur, affecting about 0.33 percent of the total population of the stock. Based on these numbers, the FWS draft IHA proposed a finding that only a small number of polar bears would be taken as a result of the proposed action. The proposed IHA concluded that no injuries or mortalities would be anticipated to result from the proposed project, and none would be authorized.

The finding of negligible impact only applies to incidental take associated with the proposed activities as mitigated by the avoidance and minimization measures identified in the applicant's mitigation and monitoring plan, the BLM Lease Stipulations and ROPs (Appendix J), and in the proposed IHA.

Although disturbances to polar bears would be reduced from procedures outlined in the Wildlife Interaction Plan, FLIR surveys, den site buffers and other required FWS Terms and Conditions which are determined from the ESA consultation and MMPA authorization, there could be unforeseen disturbances to polar bears. However, with the application of project design features, the required Coastal Plain Leasing ROD ROPs (USDOI BLM 2020) (Appendix J), the required FWS ESA Biological Opinion Terms and Conditions, and requirements of the FWS's proposed IHA, no biologically significant impacts to polar bears would be anticipated.

Past, Present, and Reasonably Foreseeable Impacts

Impacts to polar bears and their habitats, including designated critical habitat, could result through temporary habitat loss, disturbance, incidental harassment, intentional hazing, direct mortality, research activities, recreation and tourism, transportation, pollution and contaminants and climate change.

The primary threat to polar bears is climate change. Climate change is a global issue where climate warming is expected to be most dramatic in the Arctic, with rates of warming nearly twice that experienced globally (ACIA 2005; Wendler et al. 2014). The effects of these global trends are complicated; yet the forecast models based on current trends that have been constructed to examine

the likely effects on habitats, point to dramatic declines in the extent and thickness of arctic sea ice cover. This loss of sea ice has serious implications for the future of ice-associated species, such as polar bears (Durner et al. 2009; Species At Risk Committee 2012; Joint Secretariat 2015; Regehr et al. 2016) (Appendix F Section 6.2.1).

Oil and gas activities may result in disturbance to individual polar bears and may prevent some polar bears from using small portions of habitat. In particular, some polar bear denning habitat has likely been altered or made unavailable as a result of construction and human activity. The amount and effect is unknown, but likely minimal, since the majority of historic dens were offshore and most land dens were to the east of major development. The main land-based polar bear travel corridor (within one mile of the coast) and nearshore area on the North Slope of Alaska have been fragmented by oil and gas development but the effect has likely been minimal, although it has led to greater human-polar bear interactions. This minimal effect can be attributed to the small amount of development that has occurred relative to the total area, and the ability of polar bears to cross man-made routes, including roads and causeways. Whereas industrial activities have had some impacts on individual polar bears, the impact of these changes to polar bear populations is unknown (USDOI BLM 2012).

Onshore and offshore seismic activity has occurred within the range of the SBS polar bear population for decades. It is likely that past and present seismic and exploration activities have resulted in numerous types and instances of disturbances, including those caused by aircraft, vehicle, pedestrian, and vessel traffic, construction and drilling activities, and noise and activity at facilities. Extensive oil and gas development on the North Slope over the past several decades has likely altered polar bear use of these now developed areas but assessing the magnitude of these effects is difficult. It is reasonable to assume that some bears have been excluded from habitat that they may have otherwise used for movements along the coast and denning. However, documented impacts on polar bears by the oil and gas industry in Alaska during the past 30 years have been minimal. Polar bears have been encountered at or near most coastal and offshore production facilities, or along roads and causeways that link these facilities to the mainland.

Substantial differences between the areas of existing oil and gas development and the Project Area include 1) the density of polar bear dens in the Project Area is significantly higher than in existing industrial areas, so disturbance would likely be greater; 2) the changing substrate used for denning (i.e., increased land-based snowdrift denning) may cause more polar bears to den on land and; 3) the conclusion that bears in the SBS tend to be more nutritionally deficient (Rode et al. 2014) and are likely to become even more so with loss of sea ice means that the impacts to bears will become greater and could lead to biological effects.

With the application of project design features, the required Coastal Plain Leasing ROD ROPs (USDOI BLM 2020) (Appendix J), the required FWS ESA Biological Opinion Terms and Conditions, and requirements of the FWS's IHA, the anticipated effects of the proposed activity would not be expected to result in significant impacts to the Southern Beaufort Sea population of polar bears or created adverse effects to designated critical habitat.

Alternative B - No Action

Under the No Action Alternative, none of the impacts described above would occur.

3.7.2 Ringed Seal Affected Environment

Population Status, Trends, and Threats

Ringed seals are year-round residents in the Beaufort Sea and are the most common seal species in the Refuge. Ringed seals in US waters are considered to be from a single Alaska stock (Kelly et al. 2010; Allen and Angliss 2011). Using the most recent estimates from surveys by Bengtson et al. (2005) and Frost et al. (2004) in the late 1990s and 2000, Kelly et al. (2010) estimated the total population in the Alaska Chukchi and Beaufort seas to be at least 300,000 ringed seals (Appendix F Section 6.3.1). This is likely an underestimate since the Beaufort Sea surveys were limited to within 25 miles from shore. Frost and Lowry (1981) estimated 80,000 ringed seals in the Beaufort Sea during summer and 40,000 during winter. Ringed seal numbers are believed to be considerably higher in the Bering and Chukchi seas, particularly during winter and early spring (71 FR 9783). Current and reliable data on trends in population abundance for the Alaska stock of ringed seals are unavailable (NMFS 2016).

Diminishing sea ice and snow cover were identified as the greatest challenges to the persistence of Arctic ringed seals (Kelly et al. 2010). Ringed seal may experience shifts in distribution or abundance that are associated with changes in sea ice distribution. Ringed seal appear most threatened by decreases in spring sea ice cover, which could have negative implications for den construction and whelping. Ringed seals could also be affected by an increase in killer whale predation and modifications to prey resources. Additional threats include changes to parasites, diseases, and environmental contaminants. The significance of these concerns would become more pronounced for populations diminished by the effects of climate change or other threats (Kelly et al. 2010).

Movements and Distribution

Ringed seal densities in the Beaufort Sea are greatest in waters with more than 80 percent ice cover (Stirling et al. 1982) and depths between 16 and 115 feet (Frost et al. 2004). Few ringed seals inhabit ice-covered waters shallower than 10 feet due to water freezing to the bottom and/or poor prey availability caused by the limited amount of ice-free water. Ringed seal densities also are highest on relatively flat ice and near the fast-ice edge, declining both shoreward and seaward of that edge (Frost et al. 2004). Historically, the population densities of ringed seals have been substantially greater in the eastern Beaufort Sea than in the western Beaufort (Burns and Kelly 1982; Kelly 1988), likely due to shallower water depths between the shore and barrier islands in the western Beaufort Sea.

During the open water period, ringed seals in the eastern Beaufort Sea are widely dispersed as single animals or small groups (Harwood and Stirling 1992). In late summer and early fall, ringed seals often aggregate in open-water areas where primary productivity is thought to be high

(Harwood and Stirling 1992). Optimal wintering areas for ringed seals in the Beaufort Sea should occur in waters between 33 and 115 feet deep, preferably in the shorefast ice close to lead systems.

Within the Project Area during January to May, ringed seal density is unknown but is estimated to be low due to the shallow (primarily less than 10 feet in depth) nature of the lagoonal areas, which is primarily grounded ice during the winter. In 1997, seal surveys in Foggy Island Bay, approximately 50 miles west of the Project Area, found low densities (0.03 seals per square mile) of ringed seals in water less than 10 feet deep compared with an overall average of 0.17 seals per square mile in water greater than 10 feet (Miller et al. 1998). Based on presence in surveys of nearby areas of the same depth and within the same time period as the Project Area, a small number of ringed seals are assumed to be present (Coltrane et al. 2001, Williams et al. 2001) in the Project Area.

Foraging

Ringed seals feed on a variety of fish and invertebrates. Diet depends on prey availability, depth of water, and distance from shore. Polar cod (*Boreogadus saida*) is often reported to be the most important prey species for ringed seals (Labansen et al. 2007). Other important prey includes saffron cod (*Eleginus gracilis*), shrimps, amphipods, and euphausiids (Holst, Stirling, and Hobson, 2001; Kelly, 1988; Lowry, Frost, and Burns, 1980; Reeves, Stewart, and Leatherwood 1992).

Reproduction, Survival, and Sources of Mortality

Female ringed seals reach sexual maturity at 4 years while males do not reach maturity until 7 years. Males are thought to be monogamous breeders. A single 8.8 to 9.9 pounds pup is born in the spring (March to May), with the peak of pupping occurring in early April (Frost and Lowry 1981). Births occur in subnivean lairs excavated in snowpacks that accumulate upwind and downwind of ice ridges (Smith and Stirling 1975 and Furgal et al. 1996), or in cavities occurring between ice chunks in pressure ridges (McLaren 1958 and Kelly 1988). Snow depths of at least 20 to 26 inches are required for functional birth lairs, and such depths typically are found only where 8 to 12 inches or more of snow has accumulated on flat ice and then drifted along pressure ridges or ice hummocks. These lairs provide thermal protection against cold temperatures, wind chill, and some protection from predators. Shore-fast ice is the best habitat for pupping, though many ringed seals successfully whelp and rear their pups in some areas of pack ice (Wiig et al. 1999). Seal mothers move young pups between lairs within their network of lairs (usually 4 to 6 per female) if one or more lairs are compromised and older pups can travel between lairs as their swimming skills develop (Lydersen and Hammill 1993a, b). After a 5 to 8-week lactation period, pups wean when approximately 44 pounds (Moulton et al. 2002).

Reproductive rates for ringed seals are capable of approaching 95 percent annually (Smith 1973; Burns 1981; Quakenbush and Sheffiel 2006); however, more recent estimates of reproductive rates appear to be lower than the maximum recorded for this species. For example, only 69 percent of females sampled in the Bering and Chukchi seas between 2000 and 2005 were pregnant (Quakenbush and Sheffield 2006).

Molting for ringed seals occurs between mid-May to mid-July, and during this time they remain hauled out on the edge of the pack ice, or on remnant landfast ice until their old pelt dries out and sheds (Reeves 1998). Because of the need for dry skin during the molt, ringed seals refrain from entering the water and forgo foraging activities, making the molt a particularly stressful time for this species (Ryg et al. 1990).

Polar bears are the main predator of ringed seals (ADFG 1994). Polar bears attack ringed seals resting on the ice or in their natal dens. Ringed seals are an important subsistence species for Alaskan Native hunters. The best estimate of the statewide annual ringed seal subsistence harvest is 9,567 (Allen and Angliss 2011).

Sensory Abilities

Ringed seals vocalize underwater in association with territorial and mating behaviors. Underwater audiograms for phocids suggest they have very little hearing sensitivity below 1 kHz, although they can hear underwater sounds at frequencies up to 60 kHz and make calls between 90 Hz and 16 kHz (Richardson et al. 1995b). A more recent review suggests that the functional auditory bandwidth for pinnipeds in water is between 75 Hz and 75 kHz, with the greatest sensitivity between approximately 700 Hz and 20 kHz (Southall et al. 2007) (Appendix F Section 6.3.5).

Ringed seals and other pinnipeds lack the well-developed underwater auditory capabilities, or the sound production system associated with the highly developed and sophisticated echolocation abilities of odontocetes (i.e., toothed whales) (Supin, Popov, and Mass 2001). Instead, they generally depend on visual and tactile senses to locate prey, at least when sufficient light is present (Reidman 1990), although they generally have good low frequency hearing. Ringed seals vocalize underwater in association with territorial and mating behaviors.

3.7.2.1 Ringed Seal Environmental Impacts

Alternative A – Proposed Action

Seismic activities could impact ringed seals by noise disturbance, vehicle presence, and birthing lair collapse from on-ice travel. Ringed seals are disturbed by received airborne sounds exceeding 100 decible (dB) re 20 µPa (micropascal) and from aquatic sounds exceeding 120 dB re 1 µPa. Airborne sound from project-related activities would be unlikely to harm seals, because sound would originate from within groundfast ice away from seals and hauled-out ringed seals would typically be within lairs, associated with undgrounded ice which are good insulators from airborne sound. However, exposure to vibroseis sounds could adversely impact nearby seals while they are in the water column. Project-related sound could induce hauled-out seals to escape from their lairs into the water, possibly resulting in biologically meaningful consequences, such as increased energy expenditure from fleeing, increased stress levels, disruption of feeding, disruption of resting, and disruption of mating, and ultimately could reduce fitness in individual animals. Disruption of unweaned pups could result in hypothermia or separation of mother and pup.

The layout would be a seismic grid of ice paths 660 feet (non-vibroseis vehicles such as Tucker Sno cats) by 1320 feet (vibroseis vehicles), with each ice path approximately 12 feet wide. Additional driving distance would be necessary for vibroseis vehicles to avoid ungrounded ice. The area of nearshore ice within the Refuge that lies in waters less than 10 feet in depth is roughly 71,400 acres, and the maximum area of ungrounded ice that could be traversed by non-vibroseis vehicles would be 1,280 acres (or 1.8 percent of waters < 10 feet deep), although the actual acreage would likely much lower.

The sound in any area within or near the operation would be nearly continuous until the operation moved through the area. A large portion of the nearshore area in waters less than 10 feet deep (71,400 acres) in the Refuge could be subject to aquatic sound levels above the 120dB re 20 µPa threshold, which could have biologically significant impacts to seals due to flushing. Exposure to vibroseis sounds could adversely impact nearby seals while they are in the water column. However, sound from proposed action-related activities would be unlikely to harm seals, because sound would originate from within grounded ice away from seals. Additionally, the buffer from the Sound Source Verification Study (Section 2.2.1) would be established to ensure that sound is attenuated below disturbance thresholds before entering water. Seals are not usually present basking on the surface of the ice until May and would not be subject to disturbance from airborne sound until this time. The maximum airborne sound levels of proposed equipment would be 117dB re 20 µPa at 32.8 feet, and this number would be reduced below 100dB re 20 µPa at an additional distance of approximately 26 feet (58.6 feet total) from the equipment. Seals present on the ice would likely flush as a result of vehicle presence prior to experiencing sound capable of acoustically harassing them.

The proposed seismic operation would be anticipated to be operating on ice in the nearshore, lagoon systems of the Refuge during the entirety of ringed seal birthing season (March-April). Seals in birthing lairs, especially pups, would be the most vulnerable cohort exposed to seismic activity because the pups must remain in the lair until they can survive water exposure. Vibroseis vehicles and the planned paths they travel would not likely impact subnivean seal lairs due to their restriction to grounded ice. Non-vibroseis vehicles would drive at 660-foot intervals on grounded and ungrounded ice in waters less than 10 feet deep, where subnivean seal lairs could be present in low densities.

The impact of tracked vehicles traveling over seal structures has not been accurately measured or studied. Impacts from driving over a lair could range from minor structural disturbance and minor behavior effects on seals inside them, to a collapse of the lair and lethal take of animals. The collapsing of a birthing lair by a vehicle could directly crush a pup or could flush a pup into water before it has the fat to avoid lethal hypothermia. However, it is extremely unlikely that a seal pup would be killed during the portion of the program occurring on ungrounded ice because the probability of a lair collapse due to seismic activity is very low (USDOI BLM 2020). Additionally, predation on the fleeing or exposed pups could occur, while pups separated from mothers may not find breathing holes or alternative lairs. Lethal or injurious adverse impacts from the destruction of non-birthing lairs, such as those used by a male or female without a pup would be unlikely since they would likely flee to another lair.

Past, Present, and Reasonably Foreseeable Impacts

Diminishing sea ice and snow cover were identified as the greatest challenges to the persistence of Arctic ringed seals (Kelly et al. 2010). Ringed seal may experience shifts in distribution or abundance that are associated with changes in sea ice distribution.

Birthing conditions for ringed seals are expected to degrade with increasing rain-on-snow events compromising the integrity of subnivean ringed seal birthing lairs. In the Bering Sea, sea ice would continue to form, though likely to areas farther north than presently occurs, and those seals should continue to successfully reproduce, and birthing conditions should not change significantly. During the open water season, ringed seal spend most of their time in the water feeding, and have been known to haul out onshore in some areas. Onshore haulouts by ringed seals may increase into the future as sea ice disappears, providing such areas remain undisturbed.

The expected increases in pelagic fish and invertebrate production may be a positive effect of climate change on ringed seals. If there is an increase in other seal species or sub-arctic whales (i.e., fin, humpback and minke whales) or an influx of immigrant species (i.e., harbor, harp, hooded or gray seals, or Steller sea lions, etc.) then there could be a rise in interspecies competition that may be detrimental to seals.

In the long-term, ocean acidification could result in a net loss of the food base for seals. Such effects are unlikely to occur in the near future; however, with the expected losses among marine micro-biota the entire marine food web would undergo some level of change from its current state, which could be harmful to seals.

Sea ice losses during the summer in the Arctic Ocean would also permit increasing numbers of commercial, tourism, and scientific vessel activity. As the Northwest Passage and Northern Sea Route remain clear of ice for longer periods of time, more vessels would likely travel through the Arctic. Growing numbers of commercial vessels could impact seals by increasing the potential for boat strikes and would introduce additional sound and disturbance into the marine environment. The numbers of scientific and oil and gas industry survey vessels (and associated noise) in the Beaufort Sea is also likely to increase. US Navy and US Coast Guard vessel presence is also likely to increase.

Commercial, military, and scientific aircraft operations are expected to increase into the foreseeable future and introduce additional noise into the arctic environment. Aircraft have little effect on seals when they are in the water; however, when hauled out, seals may display flight reactions if approached too closely by low-flying aircraft by quickly slipping into the water.

There would be both a spatial and temporal overlap between the proposed action and certain reasonably foreseeable future actions including oil and gas development, climate change, subsistence hunting, and temporal overlap with vessel traffic. The effects of climate change and subsistence hunting would also spatially overlap with effects of the proposed action. Overall, however, due to the location of the proposed action and limited influence within the greater North Slope (of Alaska) oilfields, the potential negative effects of the proposed action on ringed seals

would not appreciably add to or synergistically interact with other past, present, or reasonably foreseeable projects.

Alternative B - No Action

With no action, no impacts to seals or other marine mammals would occur.

3.8 Fish and Water Resources

3.8.1 Water Resources Affected Environment

The Coastal Plain is considered 99 percent wetlands. Lakes are relatively scarce compared to areas further to the west on the North Slope, and account for less than two percent of the land surface area. Lakes are not evenly distributed across the Coastal Plain; they are concentrated near the mouth of the Canning River and in the region of the Sadlerochit and Jago Rivers with very few lakes occupying the central Katakturuk River region (Trawicki et al. 1991). Lakes vary in surface area from 1,500 acres to less than an acre, and 90 percent are less than 12 acres. During winter, most waterbodies on the Coastal Plain freeze solid as they are typically not as deep as the depth of freeze (approximately 7 feet; Trawicki et al. 1991; Lyons and Trawicki 1994). Small pockets of unfrozen water occur in lakes with depths that exceed ice growth. By the end of the winter season, the volume of liquid water in these lakes has been estimated to be reduced by 98 percent (Craig 1989b). Eighty percent of this volume is concentrated in seven lakes in the Canning River delta and one of these lakes is known to have salinity concentrations close to that of seawater. Up to 40 percent of snowmelt serves to recharge the evaporation deficit from the previous summer (Bowling et al. 2003), with the remainder coming from direct precipitation.

Ten major rivers and numerous smaller streams and rivers flow north from mountain and tundra watersheds and traverse the Coastal Plain before flowing into the Arctic Ocean. During winter, some rivers have small pockets of unfrozen water beneath ice hummocks and along spring-fed reaches. During spring, snowmelt begins in the foothills and proceeds to the Coastal Plain providing as much as 50 percent of the annual flow to rivers (Clough et al. 1987 and Sloan 1987).

The perennial springs in the Coastal Plain are unique when compared to the coastal plain to the west of the Refuge, which lacks major spring-fed habitats. Spring-fed reaches maintain relatively stable flows and temperatures year-round, have relatively large productive stands of riparian vegetation, and produce extensive fields of aufeis, an expansive mass of layered ice formed by successive freezing of emerging groundwater. Aufeis formations near springs can be 20 feet high and more than a mile wide by the end of the winter. Aufeis persists throughout much of the summer season, providing insect relief to caribou and contributing to river flow as it melts. Some spring-fed reaches stay ice-free during the winter and provide critical overwintering habitat for extraordinarily high concentrations of macroinvertebrates and Dolly Varden (Craig 1989a). Spring systems on the Coastal Plain are also known to harbor rare plants (Afonina and Breen 2009) and bird species. The most prolific springs on the Coastal Plain are the Canning, Hulahula, Sadlerochit, Okerokovik, and Tamayariak Springs. The FWS has applied to ADNR for 152 state-based instream flow

reservations of water in the Refuge and Project Area to ensure the protection of aquatic habitats and wildlife.

The nearshore environment in the southern Beaufort Sea, adjacent to the Coastal Plain, is a mix of open coast and lagoons bounded by barrier islands. In summer, water along the coast becomes brackish and relatively warm because of flow from the Mackenzie River and other rivers along the eastern Arctic coastline (Craig 1984; Hale 1991; Dunton et al. 2006). The lagoons are relatively shallow, the amplitude of the tides is very small (≤12 inches), waters are considerably less salty and much warmer than sea water.

3.8.2 Fish Affected Environment

The Coastal Plain hosts few species of fish due to limited availability of freshwater habitats. Common species present in freshwater lakes and rivers within the Coastal Plain include Dolly Varden (*S. malma*), Arctic grayling (*Thymallus arcticus)*, round whitefish (*Prosopium cylindraceum)*, burbot (*Lota lota)*, and ninespine stickleback (*Pungitius pungitius)*. Round whitefish and burbot are present in the Canning River, but nowhere else in the Coastal Plain (Fruge and Palmer 1994). Dolly Varden occur as two forms: anadromous populations that rear in freshwater rivers for 2-4 years then begin migrating to sea to feed each summer; and dwarf populations that exist in isolated lakes or perennial springs (McCart and Craig 1973; Craig 1977; Craig 1978). Arctic grayling occur in some lakes and also in rivers with perennial springs (Craig and McCart 1974; Fruge and Palmer 1994). Ninespine stickleback occur as both freshwater residents and as anadromous forms. They are common in lakes and the lower reaches of many rivers and streams throughout the Coastal Plain.

The lagoons are very productive environments for marine and anadromous species during summer. Lagoons become hypersaline and very cold environments under ice. As winter approaches and the lagoons begin freezing, anadromous fishes return to freshwater and marine fishes retreat to offshore environments. Common anadromous species that occur in the nearshore marine environments adjacent to the Coastal Plain include Dolly Varden, ninespine stickleback, Arctic cisco (*Coregonus autumnalis)*, broad whitefish (*C. nasus)*, humpback whitefish (*C. clupeaformis)*, least cisco (*C. sardinella)*, chum salmon (*Oncorhynchus keta)*, pink salmon (*O. gorbuscha)*, and rainbow smelt (*Osmerus mordax)* (Craig 1984; Fruge and Palmer 1994; Brown 2008). Dolly Varden and ninespine stickleback are the only anadromous species in this group that maintain populations within the rivers of the Coastal Plain. Arctic cisco, broad whitefish, humpback whitefish, least cisco, and rainbow smelt feed along the coast but have natal origins in either the Mackenzie River to the east or the Sagavanirktok or Colville rivers to the west (Craig 1984). Salmon species are thought to be strays from southern Chukchi or northern Bering Sea populations (Craig and Haldorson 1986; Stephenson 2006; Irvine et al. 2009).

While there are numerous marine species in the Beaufort Sea, only four are abundant in the nearshore marine environments adjacent to the Coastal Plain (Craig 1984 and Brown 2008). These are fourhorn sculpin (*Myoxocephalus quadricornis)*, Arctic flounder (*Pleuronectes glacialis)*, saffron cod (*Eleginus gracilis)*, and Arctic cod (*Boreogadus saida)*. While anadromous species

migrate along shore in the southern Beaufort Sea, marine species migrate towards shore during summer and away from shore during winter (Craig 1984).

3.8.3 Fish and Water Resources Environmental Impacts

As identified in the 2019 Coastal Plain Leasing EIS (USDOI BLM 2019), seismic operations could potentially impact overwintering fish, fish habitat, surface water hydrology, water availability, water quality, stream banks and lake shorelines, and waterbird habitat.

Sound waves from vibroseis vehicles could potentially cause fish physical injury or elicit a flight response. High-intensity acoustic energy can lead to damaged auditory sensory hair cells in fish (McCauley et al. 2003; Popper 2003; Smith et al. 2004; Popper et al. 2005), underwater shock waves can cause injury to the swim bladder and other organs and tissue (Wright 1982), and fleeing behavior is also a well-documented response by fish to anthropogenic sounds (Popper 2003; Popper et al. 2004). However, much of the research related to the impacts of noise on fish has been conducted using airgun arrays, explosives, or long-term background noise (Popper et al. 2004). In order to specifically investigate vibroseis sound waves, the State, BLM, NSB, Utqiagvik and Nuiqsut community members, and WesternGeco conducted a winter study in 2003 with vibroseis vehicles operating on ice above caged fish (Morris and Winters 2005). Fish fleeing behavior was the most obvious effect. No mortalities were observed and there was no indication of damage to swim bladders, muscle tissue, or blood vessels (auditory sensory cells were not examined). Observed eye injuries were thought to be a result of fish swimming into the side of the holding cage during a flight response. Under the proposed action, explosive based surveys would not be used and larger vibroseis vehicles would only operate over tundra and grounded ice. However, the operator would use smaller, lighter univibe vehicles to conduct vibroseis over areas of ungrounded freshwater ice on lakes. Fish have routinely been documented in both isolated and river-connected lakes within the Coastal Plain (Trawicki et al. 1991; Wiswar 1994). As a result, vibroseis vehicles operating on frozen lakes could potentially impact overwintering fish. Impacts on overwintering fish due to vibroseis vehicles are thought to be minimized if operating guidelines, identified by the Coastal Plain Leasing ROD ROP 14 (USDOI BLM 2020), are carefully followed (Appendix J). In addition, the greatest concentrations of overwintering fish occur in spring-fed open water areas rather than unfrozen pools under ice. These critical overwintering areas are outside the proposed area for exploration, further minimizing potential impacts to fish due to seismic activities.

Snow use can impact overwintering fish habitat because when snow is removed over ungrounded ice, the insulating property of the snow is reduced, and ice thickness will increase at a greater rate. This increased ice thickness could impinge on fish overwintering habitat by reducing the liquid space under the ice. Snow would be required to construct ramps in steeper terrain and would be intended to be the primary source of water for domestic camp needs. However, under the proposed action snow to construct ramps would come from drifts adjacent to the river/lake banks and snow for drinking water would only be removed from grounded areas of lakes (i.e., unsuitable overwintering habitat), thereby minimizing potential impacts to overwintering fish habitat.

Snow used to build ramps would be unlikely to impact surface water hydrology because displaced snow would remain in channels and melt directly into the respective stream or river (i.e., this is a non-consumptive activity). However, the consumptive use of snow from areas of grounded lakes could potentially impact surface water hydrology because recharge capacity of lakes within the Coastal Plain are primarily driven by snow cover and local precipitation (Stuefer and Kane 2016). Within the Project Area, a total of 50 lakes have been surveyed for surface area, water depth, and volume (Trawicki et al. 1991). The size of surveyed lakes ranges from approximately 6 to 370 acres.

The magnitude of potential lake level impacts to any one lake from snow or water use would be dependent on multiple factors, including the total volume of snow removed, seasonal snow accumulation, lake surface area, and precipitation. As a theoretical example, if consumptive use of snow for domestic camp needs (i.e., 3,000 gallons/day) was removed from the frozen surface of the smallest lake (i.e., 6 acres) every day for a month (i.e., total of 90,000 gallons), it would account for a little more than 50 percent of the volume that would cover the surface area one inch deep or 2 percent of the volume that would cover the surface area 1 foot deep. The magnitude of this snow removal may potentially impact recharge capabilities and subsequent summer lake levels, but this would be dependent on local environmental conditions, such as large high-wind events, that could redeposit snow on lake surfaces. In contrast, if a total of 90,000 gallons were removed in the form of snow over a 30-day period from the frozen surface of the largest lake (i.e., 370 acres) within the area of proposed action, it would account for 0.9 percent of the volume that would cover the entire surface area 1 inch deep or 0.08 percent of the volume that would cover the entire surface area one foot deep. Camp water use under this scenario would be unlikely to have a detectable impact to lake level and recharge capability. Ultimately, this theorical example illustrates potential impacts on lake surface water hydrology are variable but minimal. Under the proposed action, camp moves are anticipated to occur every 7 to 10 days. If consumptive use of snow for domestic camp needs were collected from 1 or more different lakes every 7 to 10 days (i.e., in coordination with camp moves), potential impacts to any 1 lake in the area of the proposed action would be minimized.

In the case that domestic water needs cannot be fulfilled by melting snow, liquid water could be hauled overland or removed from under the ice in lakes; removing unfrozen water from streams, rivers, and springs is prohibited (ROP 8 in Appendix J) and is not being proposed. Potential impacts of concern related to lake water removal include changes to mid-winter water quality (especially dissolved oxygen), reduction of fish overwintering habitat, and impacts to spring recharge and lake levels that could subsequently affect vegetation and summer bird habitat. The proposed action specifies that, prior to withdrawing any water from lakes, the operator would request approval from the BLM. In addition, a TWUA (11 AAC 93.035 (a) (b) and 11 AAC 93.220) would be required from ADNR for water withdrawal requests beyond 5,000 gallons per day and for any water body that has a pending or granted water right or reservation. As identified in project specific ROP 10 (Section 2.2.9), information provided to the BLM at the time of request would include: (1) coordinates for the proposed water source lake(s); (2) volume and liquid depth information; and (3) fish occupancy. Because the amount of liquid water available under lake ice each year is influenced by local environmental conditions, such as snow accumulation (Duguay et al. 2003; Lilly 2007), this information would somewhat reduce potential impacts by ensuring

sufficient liquid water is available so withdrawal volumes do not exceed guidelines outlined in the Coastal Plain ROD ROP 9 (USDOI BLM 2020) (Appendix J). If guidelines in ROP 9 are met, water withdrawals for camp use would be unlikely to have a detectable impact on overwintering fish habitat (liquid volume below ice), as these impacts have not been clearly demonstrated in lakes within the NPR-A (USDOI BLM 2017).

Although potential water source lakes have not been identified for the proposed action, there are a limited number of lakes with sufficient depths to support water withdrawal requests. This is because the maximum depth of lakes generally do not exceed depth of freeze down (i.e., between 6 and 7 feet) within the Coastal Plain (Trawicki et al. 1991; Lyons and Trawicki 1994). This was illustrated in a 1989 survey of winter water availability in the largest lakes within the Coastal Plain where lakes too small or shallow were excluded from sampling (Trawicki et al. 1991). A total of 119 lakes were surveyed, of which 50 are within the Project Area. Of these 50 lakes, 27 were determined to be too shallow to exceed the depth of freeze-down, leaving a total of 22 lakes in the Project Area with sufficient depth to support liquid water (Figure 4). Of these 22 potential water source lakes, only 3 do not have a pending water reservations. The size of potential water source lakes within the Project Area ranges from 22 to 173 surface acres.

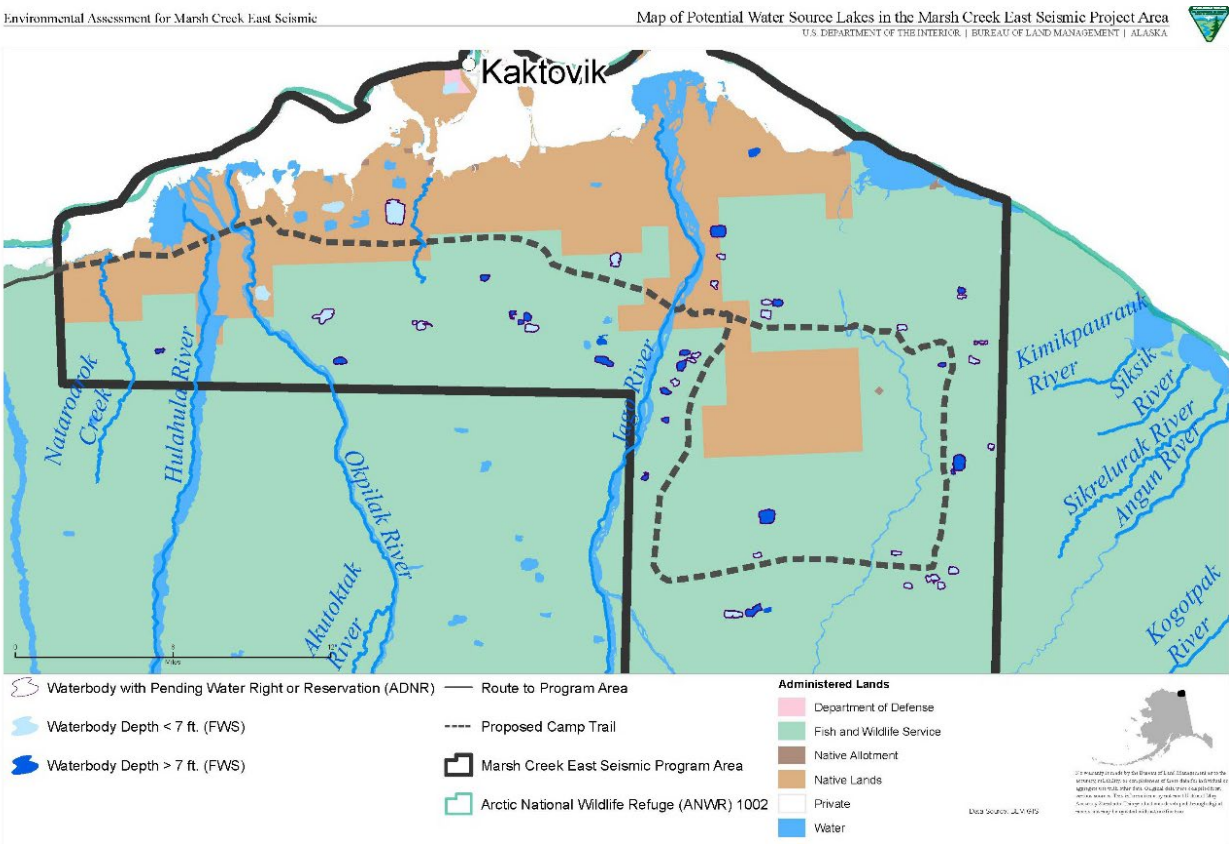

Figure 4. Potential lake water sources in the Project Area.

Water withdrawals for domestic camp use in lakes of sufficient depth within the area of proposed action are unlikely to have a detectable impact on lake levels during spring break up. This is because the magnitude of volume necessary for domestic camp use is insignificant compared to the total volume of water within potential source lakes. For example, as identified above, the consumptive use of water for domestic camp needs is estimated to be 3,000 gallons/day. Under the proposed action, camp moves are anticipated to occur every 7 to 10 days. It is possible that approximately 3,000 gallons/day may be requested from a single lake for up to 10 consecutive days, for a total of 30,000 gallons/lake. However, the volume of water estimated to cover the surface area of the smallest lake (i.e., 22 surface acres) 1 inch deep and 1 foot deep is approximately 600,000 and 7.2 million gallons, respectively. The amount of water necessary for domestic camp use would be approximately 5 percent and 0.4 percent of these surface volumes and even less for lakes that have a greater surface area (i.e., the remaining 21 lakes in the area of proposed action). These measurements do not account for water below depths of one foot, illustrating even with a large error, the total volume of water in potential water source lakes is significantly greater than what is necessary for domestic camp use. However, water use is not well-studied in the area of proposed action (as compared to the NPR-A).

When pumping water out of lakes, it is possible for fish to be injured, killed, or otherwise entrained at the intake. Under the proposed action, intake screens must be approved by ADFG Habitat Division, which addresses screen mesh size and flow rates (ROP 9) (USDOI BLM 2020) (Appendix J). This approval requirement has proven to be highly effective in the NPR-A and in many other areas of the state, where only in rare cases have fish injury or mortality occurred.

Additional freeze down could also occur from compaction caused by seismic vehicles traveling over ungrounded ice. However, the impacts could be limited by only having a small number of lower weight vehicles travel over ungrounded ice and only during a short duration. Travel over ungrounded ice in any given area would be limited to a few days, as seismic operations are continually advancing across the landscape.

Stream banks and lake shorelines could be damaged by seismic vehicles, especially on steeper terrain. However, under the proposed action crossings would be scouted ahead of time and made on low angle terrain, where possible. While terrain determined to be too steep would be avoided, snow ramps would be constructed on intermediate terrain to help protect stream banks or lake shorelines and lessen the grade. The State of Alaska would also evaluate stream and river crossing plans, as ADFG Fish Habitat Permits would be required for the activity (AS 16.05.781).

Seismic activities have the potential to cause localized and irreversible change to surface water/overland flow that results in areas of ponding, drying or altered flow paths of water by disturbing vegetation, soils or permafrost that result in thermokarsting. This disturbance would be more likely to occur on steeper terrain, in vegetation communities consisting of tussock tundra and sedge-dryas tundra, or areas of ice rich soils that are sensitive to mechanical disturbance resulting in permafrost degradation (Gold and Lachenbruch 1973) and thermokarsting. Additional discussions related to vegetation communities and soils and permafrost can be found in Section 3.4 Vegetation and Section 3.5 Soils and Permafrost. The greatest impacts would be expected from the camp-move

trail (200 miles) and access/resupply trail (136.5) due the number of trips, weight of vehicles and the expected vehicle tracks that would be created. Adequate snow cover, avoiding steep terrain, avoiding sensitive vegetation communities along with route planning and skilled operators would minimize this irreversible change.

Seismic activity could affect water quality as a result of the large number of industrial vehicles and camp modules required. Maintaining an operation of this magnitude requires managing sizeable quantities of fuels, other mechanical fluids, and domestic waste. Water quality could potentially be degraded by leaking vehicle fluids, leaks from fuel storage, spills during fuel transfers, and wastewater and solid waste handling. However, handling and spill response planning for waste and hazardous materials would mitigate that risk. Also, small spills of fuels or waste could be effectively cleaned up during the winter by collecting contaminated snow or ice before it melts.

Summer clean-up activities planned for the area of seismic activity, commonly known as "stickpicking", would not impact fish or water resources, as this activity generally entails terrestrial helicopter landings and individuals walking on the tundra picking up debris from the past winter's activity.

Seismic operations in the Project Area would not be anticipated to substantially impact fish and water resources. A small number of individual fish could be injured or killed at water intakes, although even this risk would be considerably reduced using screens approved by ADFG. Further, the Coastal Plain Leasing ROD ROPs (USDOI BLM 2020) (Appendix J) and project specific ROPs (Section 2.2.9) would minimize direct impacts on overwintering fish by limiting the amount of additional freeze down that could occur in fish overwintering areas under-ice, minimizing direct impacts to shoreline bird nesting habitat through sufficient lake levels recharged at breakup, and providing adequate measures to protect water quality. Consumptive water use would be low enough that changes to natural lake levels would not be detectable. Any impacts occurring to fish and water resources would be very localized and short-lived.

Past, Present, and Reasonably Foreseeable Future Impacts

No effects from the Coastal Plain seismic activity would be expected to be additive or synergistic to effects that may be accumulating within coastal developments to the east (Point Thomson, Badami, and Liberty Project). Similarly, no other activity in the region (e.g., transportation, subsistence, recreation and tourism, scientific research, and community development) is anticipated to impact fish or water resources in a manner that would persist and contribute to regional effects.

Alternative B - No Action

Under the No Active Alternative there would be no seismic operations in the area of proposed action and no impacts would occur to fish or water resources.