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Draft Environmental Assessment for PROPOSED AMENDMENT TO REGULATIONS FOR GEOLOGICAL EXPLORATION OF THE COASTAL PLAIN 1002 AREA

U.S. Fish and Wildlife Service
Arctic National Wildlife Refuge, Alaska

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U.S. Fish and Wildlife Service

Draft Environmental Assessment For the Proposed Regulation Change for Management of the Coastal Plain 1002 Area of the Arctic National Wildlife Refuge, Alaska

Executive Summary

The U.S. Fish and Wildlife Service (Service) proposes amending and updating existing language in 50 CFR §§ 37 - *Geological and Geophysical Exploration of the Coastal Plain, Arctic National Wildlife Refuge, Alaska*, related to exploration plans based upon: (a) new information regarding resource assessments and (b) reinterpretation of the Alaska National Interest Lands Conservation Act (ANILCA) stipulations for resource assessments of the coastal plain 1002 area of Arctic National Wildlife Refuge (Arctic Refuge). The proposed action would remove the date restrictions now in place for exploration plans, and more closely align oil and gas exploration activities with comprehensive and continuing inventory and assessment of the fish and wildlife resources of the coastal plain, Arctic Refuge. The proposed action would provide applicants the opportunity to submit requests to the Service for new geological exploration plans in the 1002 area, and thereby reassess the oil and gas potential under the terms and conditions stipulated under ANILCA and existing regulations. In addition to review and processing of new explorations plan applications for completeness and environmental protections, annual plan of operations, and issuing special use permits (SUPs), the Service will monitor field activities and plan closeouts.

Associated with the proposed new regulatory language are surface geological and seismic exploration that expand the human-presence in the coastal plain 1002 area beyond the present levels. The state-of-the-industry for oil and gas exploration activities has changed considerably since the promulgation of the initial regulation in April 1983. Oil and gas exploration minimizes surface disturbances and occurs primarily during winter months (December to May) when most wildlife is absent, or otherwise less active. Integral with the Service review and processing of exploration plan applications, annual plan of operations, and issuance of SUP are environmental prohibitions, restrictions, and conditions on carrying out exploratory activities necessary and appropriate to ensure these do not significantly adversely affect fish and wildlife, their habitats, or the environment.

Due to the requirement for Federal agencies to comply with NEPA for approval of actions affecting Federally-administered lands and/or resources, additional environmental review is required through NEPA for each exploration plan in the coastal plain 1002 area. Through NEPA compliance, additional clarification for mitigation measures to avoid, minimize, rectify, reduce, or compensate direct, indirect, and cumulative impacts may be considered for their significance in both context and intensity.

Glossary of Terms Used

1002 area	identified as such in the map entitled *Arctic National Wildlife Refuge*, dated August 1980 [ANILCA § 1002(b)] (See Figure 1).
ADF&G	Alaska Department of Fish and Game
ADEC	Alaska Department of Environmental Conservation
ADNR	Alaska Department of Natural Resources
ANCSA	Alaska Native Claims Settlement Act
ANILCA	Alaska National Interest Lands Conservation Act of 1980
BLM	Bureau of Land Management, U.S. Department of the Interior
BMP	best management practice
CEQ	Council on Environmental Quality
CCP	Comprehensive Conservation Plan for National Wildlife Refuges, required by ANILCA
coastal plain	defined as that area shown on the map entitled Arctic National Wildlife Refuge dated August 1980 [ANILCA § 1002(b)], and legally described in 50 CFR Part 37 Appendix I-Legal Description of the Coastal Plain, Arctic National Wildlife Refuge, Alaska [see also 50 CFR § 37.2(d)] (See Figure 1).
cultural resource	defined as any district, site, building, structure, or object significant in American history, architecture, archeology, engineering or culture, as determined in accordance with 36 CFR § 60.6 [see 50 CFR § 37.2(e)]
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior; including BLM, USFWS, USGS
EA	Environmental Assessment, as stipulated under NEPA

EIS	Environmental Impact Statement, as stipulated under NEPA
EPA	Environmental Protection Agency
exploratory activity	defined as surface geological and geophysical or seismic exploration or both of the coastal plain and all related activities and logistics required for either or both, and any other type of geophysical exploration of the coastal plain which involves or is a component of an exploration program for the coastal plain involving surface use of refuge lands and all related activities and logistics required for such exploration [see 50 CFR § 37.2(i)]
FONSI	Finding of No Significant Impact; Federal agency decision that concludes an EA
ITR	Incidental Take Regulation (relative to the Beaufort Sea coast polar bear)
MMPA	Marine Mammals Protection Act
NEPA	National Environmental Policy Act of 1970 [40 CFR §§ 1500-1508]
NHPA	National Historic Preservation Act of 1966
NMFS	National Marine Fisheries Service
NRC	National Research Council, National Academy of Sciences
NRPA	National Petroleum Reserve-Alaska (administered by BLM)
ROD	Record of Decision, Federal agency decision that concludes an EIS
ROP	Required operating procedure, as applicable to lease conditions for exploration activities and/or oil and gas field development and production relative to the National Petroleum Reserve-Alaska final integrated activity plan/EIS (BLM 2016)
Service	U.S. Fish and Wildlife Service
SHPO	State Historic Preservation Officer, as pertinent to consultation under NHPA

SUP	Special Use Permit issued by the Service for exploration activities in the coastal plain 1002 area
SWPPP	Storm Water Pollution Protection Plan (administered by ADEC)
TWUP	Temporary Water Use Permit (issued by ADNR)
USACE	U.S. Army Corps of Engineers
USGS	Geological Survey, U.S. Department of the Interior

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1 Introduction & Overview

1.1 Purpose and Need

The U.S. Fish and Wildlife Service (Service), proposes to amend the regulations at 50 CFR §§ 37 - *Geological and Geophysical Exploration of the Coastal Plain, Arctic National Wildlife Refuge, Alaska*, regarding the dates when an application may be submitted for a permit for a geological and geophysical exploration plan on the Arctic National Wildlife Refuge (Arctic Refuge) lands described in the Alaska National Interest Lands Conservation Act (ANILCA). This action is an update to our regulations to allow opportunities for applicants to conduct surface geological and seismic exploration, collectively termed exploration activities hereafter. In addition, the ability to collect new information on oil and gas resources will better inform public policy decisions. This action furthers the goals described in Executive Order 13783 *Promoting Energy Independence and Economic Growth*.

The proposed action constitutes the promulgation of new regulatory language that would reopen the coastal plain 1002 of the Arctic Refuge to applications for surface geological and seismic exploration. The proposed regulatory change does not itself authorize any on-the-ground activities; it merely establishes a mechanism by which an applicant can seek authorization from the Service for such activities. As such, this assessment is necessarily general in scope lacking detail that will be developed in the context of reviewing individual applications for exploratory activity. Each application would be reviewed by the Service under all applicable laws, to include the National Environmental Policy Act (NEPA), the Endangered Species Act, and the National Historic Preservation Act (NHPA). The proposed modification of the regulation does not compel the issuance of any particular authorization to conduct exploratory activity. In addition, pursuant to the terms of section 1002 of ANILCA, the Service is only authorized to allow exploratory activity in a manner that avoids significant adverse effects on the fish and wildlife and other resources.

As a direct effect of approving the proposed new regulatory language, the Service anticipates the following actions: the submittal of, review and processing of exploration plan applications (including associated annual plan of operations) to the Service from applicants for completeness and environmental protections; the issuance of special use plans (SUPs) for each plan as described above; and related review, monitoring of field activities, and plan closeouts.

1.2 Key Environmental Requirements & Integration of Other Environmental Statutes & Regulations

1.2.1 Requirements Applicable to the Promulgation of this Regulation

National Environmental Policy Act (1969)

NEPA requires all federal agencies to provide appropriate consideration for environmental amenities and values into their decision-making equal with economic and technical considerations, specifically those actions significantly affecting the quality of the human environment. This is achieved through identifying environmental impacts of their proposed action and reasonable alternative actions including a no action alternative.

This Draft Environmental Assessment (EA) addresses the administrative action by the Service needed to allow submittal of permit applications for new exploration plans for exploratory activity in the Arctic Refuge coastal plain 1002 area. This EA does not evaluate decisions to issue SUPs for specific exploration plans as the details of those plans are unknown at this time. Additional exploration plan-specific NEPA analyses would be conducted if and when such exploration plans are submitted to the Service for review and processing.

This Draft EA is prepared in accordance with the Department of the Interior (DOI) Departmental Manual 516, and in compliance with NEPA and the Council on Environmental Quality (CEQ) Regulations (40 CFR §1500-1508).

Alaska National Interest Lands Conservation Act (1980)

ANILCA is integral to how this proposed regulation change will be evaluated. When ANILCA was passed in 1980 the Act re-designated Arctic Refuge and required the writing of a Comprehensive Conservation Plan (CCP) for the Arctic Refuge (Title III), required the identification of federal actions which could have the potential to significantly restrict subsistence users (Title VIII), and required the DOI "to provide for a comprehensive and continuing inventory and assessment of the fish and wildlife resources of the coastal plain of the Arctic Refuge; an analysis of the impacts of oil and gas exploration, development, and production, and to authorize exploratory activity within the coastal plain in a manner that avoids significant adverse effects on the fish and wildlife and other resources" (Title X). The "coastal plain" as defined by section 1002(b) of ANILCA, is depicted in Figure 1.
The Arctic Refuge was first established in 1960 through Public Land Order 2214, for the purpose of preserving unique wildlife, wilderness, and recreational values. The original 8.9-million acre Arctic National Wildlife "Range" was withdrawn from all forms of appropriation under public land laws, including mining but not from mineral leasing.

In ANILCA Title III, the Arctic Refuge was expanded to 19-million acres (Figure 1). Under ANILCA § 303(2) the "purposes for which the Arctic National Wildlife Refuge was established and shall be managed include –

(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 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; and

(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."

In Title VIII of ANILCA § 810, Congress recognized the importance of federal lands to local residents of Alaska who had been using those lands to support their subsistence lifestyle for generations. As a result, federal land managers are required to identify whether a proposed land management action has the potential to significantly restrict subsistence opportunities. If so, then the manager is required to consult with local subsistence users and to seek to minimize such restrictions. In Title X of ANILCA § 1002, Congress provided for a "comprehensive and continuing inventory and assessment of the fish and wildlife resource of the coastal plain of the Arctic Refuge; an analysis of the impacts of oil and gas exploration, development, and production, and to authorize exploratory activity within the coastal plain in a manner that avoids significant adverse effects on the fish and wildlife and other resources."

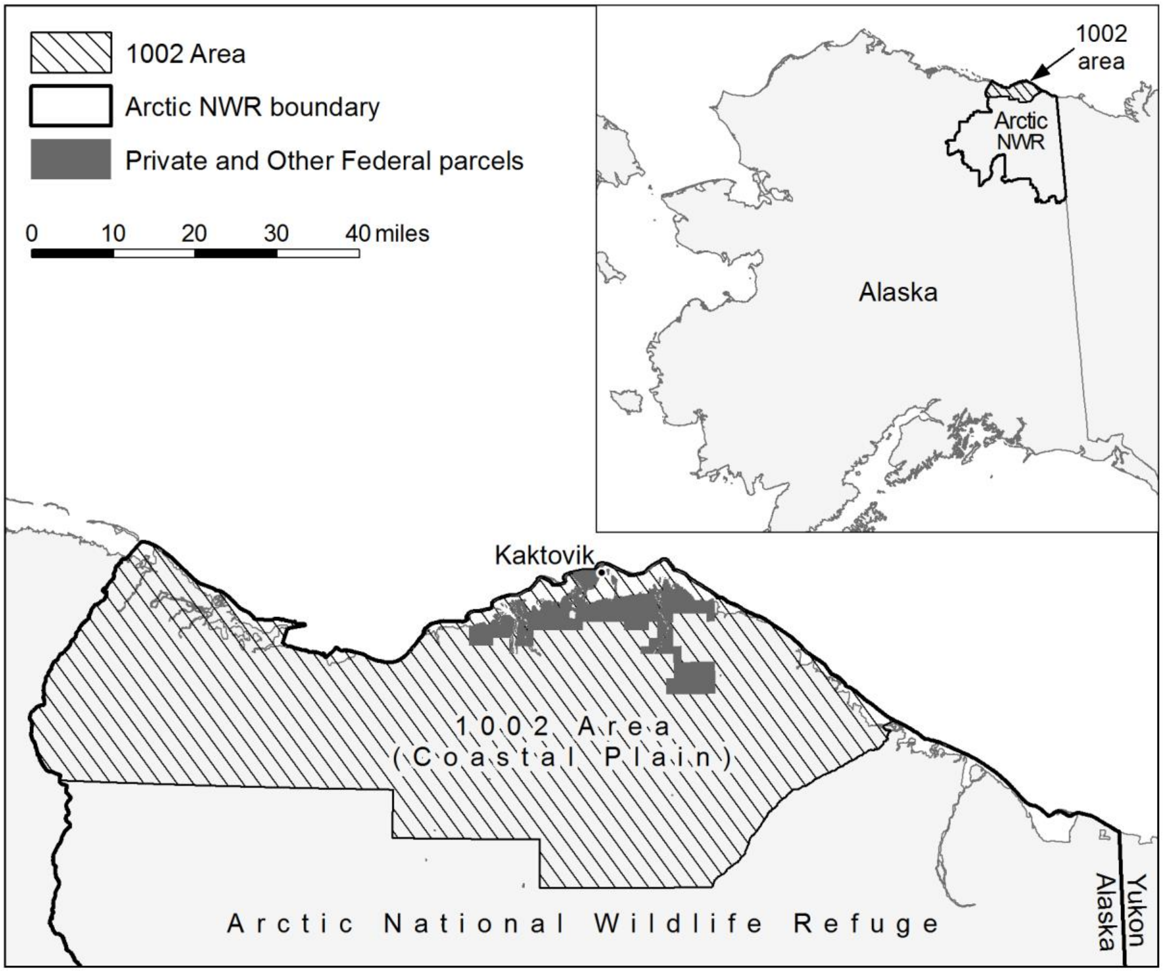


Figure 1. Arctic National Wildlife Refuge showing the coastal plain 1002 area (based upon the original map included with the authorization of ANILCA, dated August 1980).

1.2.2 Requirements Applicable to Specific Proposals for Exploration if the Proposed Regulation is Modified

Assuming the regulation is modified, proposed exploratory activities will be subject to an array of other federal, state, and local statutory and regulatory requirements designed to protect the environment prior to exploration taking place. Further, this may include negotiations regarding international treaty obligations with Canada for caribou. Federal requirements include promulgated under the following authorities:

National Wildlife Refuge System Administration Act (1966) and Wildlife Refuge System Improvement Act (1997)

The *National Wildlife Refuge System Administration Act*, as amended by the *National Wildlife Refuge System Improvement Act*, 16 U.S.C. 668dd-668ee serves as the "organic act" for the National Wildlife Refuge System. The Act, as amended, consolidated the various categories of lands administered by the DOI Secretary through the Service into a single National Wildlife Refuge System. The act establishes a process for determining compatible uses of refuges, stating that first and foremost, that the mission of the National Wildlife Refuge System be focused singularly on wildlife conservation, and reinforces and expands the compatibility standard of the Refuge Recreation Act.

Endangered Species Act (1966)

Section 7 of the *Endangered Species Act* (Act) (16 U.S.C. 1536) requires the DOI Secretary to ‘‘review other programs administered by him (or her) and utilize such programs in furtherance of the purposes of the Act’’ and to ‘‘insure that any action authorized, funded, or carried out is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of [critical] habitat . . . .’’ The amendment of these regulations alone will have no on-the-ground impact and thus would result in a “no effects” determination. However, prior to approving specific plans for exploratory activity under these proposed regulation changes, we would consult under section 7 of the endangered species Act to ensure that any application for exploration in the 1002 area of the coastal plain of Arctic Refuge is not likely to jeopardize the continued existence of any species designated as endangered or threatened, or modify or destroy its critical habitat, and that the plan approvals are consistent with conservation programs for those species.

Marine Mammal Protection Act (MMPA)
Clean Water Act
Clean Air Act
National Historic Preservation Act (NHPA)
Migratory Bird Treaty Act

Major Federal Permits and Authorizations potentially required

- U.S. Army Corps of Engineers (USACE), Section 404 permit for fill in wetlands and other waters of the U.S., under Clean Water Act (administered by Environmental Protection Agency - EPA).

- Service Section 7 consultation under the Endangered Species Act.

- National Marine Fisheries Service (NMFS) consultation under MMPA.

- Service MMPA incidental take permit.

- NMFS Essential Fish Habitat Consultation.

- Arctic Refuge *Compatibility Determination/Special Use Permit*

Major State Permits and Authorizations may include but are not limited to:

- Alaska Department of Environmental Conservation (ADEC) Section 401 Water Quality Certification (Certificate of Reasonable Assurance); generally processed as part of the Section 404 Corps permit.

- ADEC Construction General Permit for Storm Water Discharges and Storm Water Pollution Prevention Plan (SWPPP).

- Alaska Department of Fish and Game (ADF&G) Title 16 Fish Habitat Permit, for activities or structures below ordinary high water in designated anadromous fish streams, and fish passage requirements in all streams that support anadromous or resident fish

- ADEC Spill Prevention, Containment, and Contingency Plan for handling and storage of petroleum products.

- Alaska Department of Natural Resources (ADNR), Division of Mining, Land and Water, Water Section for Temporary Water Use Permit (TWUP) for construction of ice roads or other water usage.

- ADNR, State Historic Preservation Office Section 106 concurrence under NHPA.

1.3 BACKGROUND

The passage of ANILCA triggered three actions in relation to administration of the Arctic Refuge: (1) a CCP for the Arctic Refuge was to be written; (2) the DOI Secretary was to assess wildlife values and oil reserves in an area described in ANILCA § 1002; and, (3) the DOI Secretary was authorized to permit exploratory activity within the coastal plain, but only “in a manner that avoids significant adverse effects on the fish and wildlife and other resources.” First, ANILCA § 304(g) directed the preparation of a CCP for each refuge in Alaska. Each plan is based on an identification and description of resources of the refuge, including fish and wildlife resources and wilderness values, and must “designate areas within the refuge according to their respective resources and values; specify programs for conserving fish and wildlife and the programs relating to maintaining the identified values proposed to be implemented within each such area; and specify uses within each area which may be compatible with the major purposes of the refuge."

An initial CCP and related Environmental Impact Statement (EIS) were prepared for Arctic Refuge (FWS 1988a). The Record of Decision (ROD) implemented the minimal management alternative (FWS 1988b) which emphasized managing for natural, unaltered landscapes and natural processes. This decision was reiterated in 2015 when the CCP was revised (FWS 2015a, 2015b). In this updated CCP and EIS, recommendations for Congressionally-designated Wilderness and four additional Wild and Scenic River designations were also included (FWS 2015a, 2015b).

Second, under ANILCA § 1002 the DOI Secretary was required to assess the petroleum and wildlife values for a 1.5 million-acre portion of Arctic Refuge coastal plain referred to as the "1002" area (Figure 1). The assessment of the 1002 area of the coastal plain was essential to identifying potential oil and gas reserves and whether development activities would significantly and adversely affect fish, wildlife, habitats or the environment.

Biological studies and geological exploration coordinated by the Service, U.S. Geological Survey (USGS), and Bureau of Land Management (BLM) over a 2-year period on the coastal plain were initiated shortly after the enactment of ANILCA. Studies were to conclude 5 years after enactment of the Act, with final results and recommendations submitted to Congress.

In April 1982, the Service completed the initial report summarizing current information regarding fish and wildlife, and their habitats occurring on the Arctic Refuge coastal plain (FWS 1982). Between 1982 and 1987 over 50 separate biological field studies in the 1002 area of the coastal plain documented baseline conditions, most summarized in annual reports (Garner and Reynolds 1983, 1984, 1985, 1986, 1987). The baseline assessment period ended in 1987 with the submittal of the *Arctic National Wildlife Refuge, Alaska, Coastal Plain Resources Assessment: Report and Recommendation to the Congress of the United States and Final legislative Environmental Impact Statement* (hereafter, *Coastal Plain Report*) (Clough and others 1987). The recommendation to Congress at the time was to open the entire 1002 area of the coastal plain to an orderly oil and gas leasing program and as the Secretary determines will avoid unnecessary adverse effects on the environment (DOI Secretary Recommendation pp. 182-192 in Clough and others 1987).

Baseline biological and water resource assessment in or near the 1002 area of the coastal plain continued from 1988 through 2002, coordinated among the Service, USGS, BLM, ADF&G, Canadian Wildlife Service, Yukon Department of Renewable Resources, Northwest Territories Department of Resources, Wildlife, and Economic Development, and academic institutions (Truett 1990; McCabe and others 1992; FWS 1994; Douglas and others 2002). Since 2002, biological studies have become increasingly landscape oriented, focusing on ecosystem processes and functions (Martin and others 2009).

Concurrent with the biological studies, oil and gas resource exploration and assessment were ongoing in the 1002 area of the coastal plain but ended with the submission of the 1987 *Coastal Plain Report* (Bird and Magoon 1987; Clough and others 1987; FWS 1990; GAO 1993). The *Coastal Plain Report* concluded that the coastal plain 1002 area was potentially rich in oil and gas resources. Based on these findings, there was a 95 percent chance the coastal plain 1002 area contained more than 4.8 billion barrels of oil and 11.5 trillion cubic feet of gas in-place (Clough and others 1987). At that time, there was a 19 percent chance that economically recoverable oil occurs. The average of all estimates of conditional economically recoverable oil resources is 3.2 billion barrels (Clough and others 1987; GAO 1993).

Finally, in order to conserve the wildlife resources of the area, Congress required in § 1002(d) that exploration plans and regulatory guidelines for these geological exploratory activities be developed to ensure these activities do not significantly adversely affect fish and wildlife and their habitats, or the environment. Accordingly the Service may not approve any plan for exploratory activity that would significantly impact fish and wildlife, their habitats, or the environment. Some of the requirements included a prohibition on the carrying out of exploratory activity during caribou calving and immediate post-calving seasons or during any other period in which human activity may have adverse effects; temporary or permanent closing of appropriate areas to such activity; specification of the support facilities, equipment and related manpower that is appropriate in connection with exploratory activity; and, requirements that exploratory activities be coordinated in such a manner as to avoid unnecessary duplication.

In April 1983, DOI published the final 50 CFR §§ 37 guidelines (DOI 1983; FWS 1983). This regulation defines the general provisions for surface geological and seismic exploration within the coastal plain of Arctic Refuge, including: purpose and definitions [Subpart A]; general requirements for exploratory activities [Subpart B]; exploration plans and the application process [Subpart C]; environmental protection to avoid significant adverse impacts to natural and cultural resources [Subpart D]; general administration [Subpart E]; and, reporting and data management to preclude unnecessary duplication [Subpart F].

In that rule, three permit application openings were established as described in Table 1. Each application opening allowed either continued work from a previous work session or new work to begin in the upcoming work session. All exploration work, regardless of when it was initiated, was to be completed by May 31, 1986. No new exploration plans have been accepted since 1984 and no new exploration work has occurred since 1986.

In a November 2017 memorandum, the USGS identified shortcomings in the vintage 2-D seismic data collected in the 1002 area during 1984-85, and recommended that the 50 CFR. Part

37 regulations be revised in order to allow for the collection of 3-D seismic data using modern technology in order to allow for a substantially better understanding of critical aspects of the subsurface geology that are not resolved in the vintage 2-D data, particularly in the eastern "deformed" part of the 1002 area.

Table 1-1. Exploration Work Sessions and Their Respective Application Due Dates as Stipulated in 50 CFR § 37.21.

Type of Exploration Work	**Exploration Work Sessions as Allowed in 50 CFR 37.21**	**Applications Due**
Any exploration plans	April 19, 1983 – May 31, 1986	May 20, 1983
Exploration plans other than seismic exploration	June 1, 1984 – May 31, 1986	April 2, 1984
Any exploration plans	October 1, 1984 – May 31, 1986	June 4, 1984

1.4 AGENCY AND PUBLIC INVOLVEMENT

The Service developed this EA. For a 60-day period following the publication of the proposed rule in the Federal Register, the public may submit comments on both this draft EA and the proposed rule. After considering the comments received, the Service will issue a final EA and if it determines that the proposed action will not result in significant impacts it would issue a Finding of No Significant Impact (FONSI) for the EA, thus completing the NEPA analysis for the proposed action.

1.5 CONSULTATION WITH FEDERALLY-RECOGNIZED TRIBES AND NATIVE CORPORATIONS

In compliance with Executive Order 13175 *Consultation and Coordination with Indian Tribal Governments*, federal agencies are required to consult with federally recognized tribal governments during the NEPA process for certain proposed actions, including the development of regulations, that may have a substantial direct effect on the tribes. Pursuant to Public Law 108-199, the Executive Order also applies to Native corporations established under the Alaska Native Claims Settlement Act (ANCSA). Within the Service and DOI, the Executive Order is implemented by the DOI policies on Consultation with Indian Tribes (December 2011) and Consultation with ANCSA Corporations (August 2012). The Service has identified tribal governments and ANCSA Corporations potentially substantially affected by the proposed rule change, who are being invited to consult with the Service on this proposed regulation change. Additional consultation opportunities will be provided prior to issuance of permits for exploration activities on the refuge.

1.6 SUMMARY OF ISSUES

In order to clarify the issues of greatest concern, the following two tables describe the issues being dismissed and further considered in this EA. If an issue has been considered but dismissed from further evaluation, a reason is given in Table 1-3 and the issue will not be discussed further in this EA. Issues being further evaluated are listed in Table 1-4. These issues will be further evaluated in Chapter 3 Affected Environment and Chapter 4 Environmental Consequences.

Table 1 - 3: Issues Considered but not Further Evaluated

AFFECTED ENVIRONMENT	REASON FOR NOT-EVALUATING FURTHER
Geology	Neither the change in regulation nor the resulting exploration activities, which are non-extractive, will change the geology of the area.
Air Quality	With anticipated use of low sulfur fuel it is not expected that emissions concentrations or ice fog from motorized vehicles and equipment would ever reach levels that pose an environmental hazard or cause any significant degradation in air quality.
Steller and Spectacled Eiders	As migratory birds, neither of these threatened eiders would occupy breeding habitat during the period of winter exploration. Even if there were temporal overlap, only the very northwest corner of the 1002 area of the coastal plain is within the breeding range of the spectacled eider, and they only occur there as a rare breeder at very low densities. Steller's eiders do not breed in the 1002 area of the coastal plain and are rare visitors along the coast.
Environmental Justice	Under Executive Order 12898 *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, federal agencies are required to develop strategies to address environmental justice concerns in their approach to operations.
Visual	Due to the relatively flat nature of the landscape, equipment associated with seismic exploration will be noticeable to recreationalists and residents in the

	vicinity.

Table 1 - 4: Issues Considered for Further Evaluation

AFFECTED ENVIRONMENT	REASON FOR FURTHER EVALUATION
Soils	Although the overall geology of the coastal plain 1002 area would not be affected, the construction of ice or gravel roads and pads and other associated infrastructure may expose areas to erosion or create conditions conducive to thermokarsting. There is also a risk of fuel spills from equipment being used.
Water Resources, Hydrology and Wetlands	The coastal plain 1002 area is a water-limited system. In any proposed winter exploration activity on Arctic Refuge, water withdrawals would be necessary to construct ice roads and other infrastructure that would potentially impact hydrology, aquatic habitats, wetlands and species that depend on them. There is also a risk of fuel spills and release of other contaminants that could impact water quality. Depending on the amount of water needed for needed for exploration activities, water quality and quantity to maintain viable aquatic and wetland habitats may be affected.
Climate	Although climate will not be affected by either of the alternatives directly, a description of past and present climate is useful in considering cumulative effects of the proposed action to other resources. For this reason a description of climate trends is included in Chapter 3.
Vegetation	In any proposed industrial activity on Arctic Refuge, there is a concern that invasive species will be introduced. The development ice roads and ice pads and other associated infrastructure may also impact vegetation.
Fish	Water needed for the construction of ice roads and other infrastructure may be withdrawn from rivers and lakes reducing overwintering and spawning habitats or directly affecting fish populations. Seismic testing over water bodies may also impact fish via soundwaves.
Golden Eagles	Golden Eagles are rare breeders on the Beaufort Sea coastal plain and initiate nesting very early in the spring on the North Slope (earliest of 23 March, with three annual mean initiation dates of 5 April, 14 April, and 22 April); thus, could be affected by "winter" seismic exploration.
Resident Birds	Gyrfalcons are rare breeders on the coastal plain, and initiate nesting very early in the spring; thus, could be affected by seismic exploration. Their primary late winter/early spring prey is rock and willow ptarmigan

	which are uncommon and common permanent residents, respectively, on the coastal plain.
Migratory Waterfowl, Shorebirds and Landbirds	Water needed for the construction of ice roads and other infrastructure could be withdrawn from aquatic habitat impacting migrating waterfowl and shorebird populations.
Caribou	The coastal plain is within the territory of the Porcupine Caribou Herd which travels north and south and is a primary subsistence resource for many of the Native people who live in and around the Refuge.
Terrestrial Mammals, Not Including Caribou	Both muskox and moose are now rare on the coastal plain; their populations have declined in recent years. Muskox may be particularly sensitive to late winter disturbance given nutritional challenges and calving beginning in mid-April. Bears, wolves, and wolverines all occur on the coastal plain, although they are more abundant in the foothills and mountains. Brown bears emerge from their dens from late March through May; this period could well overlap seismic exploration periods.
Polar Bears	A majority of female polar bears of the Southern Beaufort Sea population den in the coastal plain 1002 area in high densities. As a result much of the area has been designated critical habitat. Pre-survey logistics for exploration activities will probably increase potential for bear-human conflicts.
Bowhead Whale	Now that there is limited sea ice during much of the year, exploration equipment could be transported to the area via barges through a known bowhead whale migration corridor. Pre-survey and staging for exploratory activities may affect subsistence resources in early winter or early spring.
Ringed and Bearded Seals	Now that there is limited sea ice during much of the year, exploration equipment could be transported to the area via barges through known bearded and ringed seal habitat.
Cultural Resources	The reverberation created by seismic exploration is known to damage buried artifacts.
Socioeconomic	Exploration activities have the potential to create employment opportunities within communities neighboring the Refuge and may also affect subsistence resource availability.
Subsistence	Exploration activities have the potential to affect resource availability by creating disturbances that change caribou and polar bear movements. Pre-survey and staging for exploratory activities may affect subsistence resources in early winter or early spring and these activities remain poorly defined.

Noise	Noise from vehicles, generators, aircraft, and human presence has the potential to change the natural soundscape during seismic exploration.
Wilderness Values	The resulting exploration activities may result in a substantial level of activity during the exploration work season in limited areas.

2 Proposed Action and Alternatives

2.1 Alternative 1 (No Action/Status Quo Alternative)

Under the no action alternative, the existing regulation would not be amended or updated. Management of the Coastal Plain, Arctic Refuge, would continue as stipulated in the ROD for the Arctic Refuge CCP (FWS 2015a, 2015b). There would continue to be no oil and gas exploration on Arctic Refuge.

2.2 Alternative 2 - Proposed Action

The Service proposes to allow opportunities for submission of applications for surface geological and seismic exploration by amending and updating the regulatory language of 50 CFR Part 37 - *Geological and Geophysical Exploration of the Coastal Plain, Arctic National Wildlife Refuge, Alaska*, specifically § 37.21(b) and (c) as follows:

PART 37 – GEOLOGICAL AND GEOPHYSICAL EXPLORATION OF THE COASTAL PLAIN, ARCTIC NATIONAL WILDLIFE REFUGE, ALASKA

Subpart C – Exploration Plans

§ 37.21 Application Requirements.

(a) Prior to submitting an exploration plan, applicants may meet with the Regional Director to discuss their proposed plans and exploratory activities and the requirements of this part.

(b) Any person wanting to conduct exploratory activities may apply for a special use permit by submitting for approval one or more written exploration plans, in triplicate, to the Regional Director, Region 7, U.S. Fish and Wildlife Service, 1011 East Tudor Road, Anchorage, Alaska 99503.

(c) In addition to containing the information required in paragraph (d) of this section, any exploration plan submitted shall describe the applicant's plan for carrying out an integrated program of exploratory activities in such a manner as will satisfy the objective and limitations stated in § 37.1. If an applicant submits an exploration plan in any given year with the intention of submitting another exploration plan the following year, the applicant shall describe in its initial plan how its future exploratory activities will be integrated with those proposed under its initial plan. Each exploration plan submitted must be published and be the subject of a public hearing in accordance with requirements of § 37.22(b).

(d) An exploration plan shall set forth in general terms such information as is required by this part and by the Regional Director in determining whether the plan is consistent with this part, including, but not limited to:

(1) The name and address of any person who will conduct the proposed exploratory activities, i.e., the applicant/permittee, and, if that person is an agency, firm, corporation, organization, or association, the names and addresses of the responsible officials, or, if a partnership, the names and addresses of all partners;

(2) The names and addresses of all persons planning at the time of plan submittal to participate in the proposed exploratory activities or share in the data and information resulting therefrom through a cost-sharing or any other arrangement;

(3) Evidence of the applicant's technical and financial ability to conduct integrated and well designed exploratory activities in an arctic or subarctic environment and of the applicant's responsibility in complying with any exploration permits previously held by it;

(4) A map at a scale of 1:250,000 of the geographic areas in which exploratory activities are proposed and of the approximate locations of the applicant's proposed geophysical survey lines, travel routes to and within the refuge, fuel caches, and major support facilities;

(5) A general description of the type of exploratory activities planned, including alternate exploratory methods and techniques if proposed, and the manner and sequence in which such activities will be conducted;

(6) A description of how various exploratory methods and techniques will be utilized in an integrated fashion to avoid unnecessary duplication of the applicant's own work;

(7) A schedule for the exploratory activities proposed, including the approximate dates on which the various types of exploratory activities are proposed to be commenced and completed;

(8) A description of the applicant's proposed communication techniques;

(9) A description of the equipment, support facilities, methods of access and personnel that will be used in carrying out exploratory activities;

(10) A hazardous substances control and contingency plan describing actions to be taken to use, store, control, clean up, and dispose of these materials in the event of a spill or accident;

(11) A general description of the anticipated impacts that the proposed exploratory activities may have on the refuge's wildlife, its habitat, the environment, subsistence uses and needs, and cultural resources, and a description of mitigating measures which will be implemented to minimize or avoid such impacts;

(12) A description of the proposed procedures for monitoring the environmental impacts of its operation and its compliance with all regulatory and permit requirements;

(13) A statement that, if authorized to conduct exploratory activities, the applicant shall comply with this part, its special use permit, its approved exploration plan, plan of operation, and all reasonable stipulations, demands and orders issued by the Regional Director;

(14) A description of the applicant's proposed data quality assurance and control program; and

(15) Such other pertinent information as the Regional Director may reasonably require.

Proposed Surface Geological and Seismic Exploration Activity

Briefly described, current 3-D seismic methods generate images of subsurface structure by sending energy waves into the ground or water and then recording the reflected energy waves upon return. One of the most common methods for creating these energy waves in the Arctic is through vibroseis operations which use truck-mounted vibrators that systematically put variable frequency energy into the earth. Several of these truck-mounted vibrators are located along a line and vibrate in synchrony in order to record energy along a linear transect. The reflected energy image is recorded and the whole line moves ahead.

Exploration activities generally occur in the winter with crews beginning to mobilize and build ice roads and pads in December (Table 2.1). Full crews arrive in January and commence seismic operations if the ice infrastructure has been completed. Seismic operations continue through most of April, with demobilization finishing by the first part of May. Staging activities may extend beyond the December to May timeframe. Crews may include 40 to 160 people depending on the planned activity with operations occurring 24 hours per day. The camp facility often includes sled-mounted units for preparing and eating meals, sleeping areas, washrooms, offices, shops, medical facilities, generator rooms, and any other support needed. The camp moves along with the exploration work. Ice roads or pads constructed during the winter are left in place. If gravel is substituted for ice when necessary, this is cleaned and removed. Any ice bridges built across rivers are removed in order to decrease the chance of ice damming during the melt season. Frozen lakes are often used for landing strips.

Table 2.1. Anticipated activity periods for winter seismic exploration in the coastal plain 1002 area based upon NPRA Integrated Activity Plan/EIS (BLM 2012) and Greater Mooses Tooth Unit (BLM 2016)

Annual Timeframe Work Period	Proposed Activity
10 December	Scouting and early crew mobilization
10 January	Full crew mobilization
15 January	Begin seismic operations
25 April	Complete seismic operations
25 April-1 May	Seasonal demobilization

No specific exploration activity is evaluated for this proposed regulatory change EA. Information regarding exploration activities and best management practices (BMPs), required operating procedures (ROPs), or other environmental protections to avoid, minimize, rectify, reduce, or compensate direct and indirect effects of exploration are taken from similar activities in the BLM-administered National Petroleum Reserve-Alaska (NPRA), or adjoining areas. Exploration activities and associated environmental precautions are described in detail in recent 3-dimensional (3-D) seismic exploration of the NPRA Integrated Activity Plan/EIS (BLM 2012), BLM Greater Mooses Tooth Unit EA (e.g., Pp. 38-49 Appendix B *Stipulations and Best Management Practices*, BLM 2016a) and offshore areas (SAExploration Alaska 2016a, 2016b; BOEM 2017).

Considerable advances in state-of-the-art industry practices along with understanding of coastal plain natural and physical resources have occurred since the promulgation of the Final Rule for *Geological and Geophysical Exploration of the Coastal Plain, Arctic National Wildlife Refuge, Alaska* (50 CFR §§ 37), dated 19 April 1983. These advances can be integrated into development, review and processing of new exploration plan applications, BMPs, ROPs, and SUP stipulations.

Technological advancements in equipment and methodology used to conduct exploration activities on the North Slope, particularly the use of ultra-low ground-bearing pressure vehicles, have substantially reduced impacts to land and water habitat compared to surveys conducted in the 1980s (Clough and others 1987; Gliders and Cronin 2000). Winter exploration is designed around narrower temporal and spatial frameworks that do not add to incremental past, present or future cumulative effects.

Potential negative effect might occur if there were a deviation from established BMPs or ROPs but the industry records from NPRA 1999 to 2016 indicate the overall effectiveness of the environmental protections that are applied to winter seismic activities (BLM 2016a).

2.3 ALTERNATIVES CONSIDERED BUT DISMISSED FROM DETAILED ANALYSIS

No other action alternatives were analyzed in detail in this EA.

The Service also considered an alternative that would amend the regulations to extend the deadlines in 50 CFR § 37.21 for submission of exploration plans in lieu of eliminating them. However, the Service determined that doing so would not meet the purpose and need of this proposed action because it would not allow for the ongoing collection of geological and geophysical information intended to keep the Service and other policy makers informed of the oil and gas resource potential of the 1002 area.

3 Affected Environment

Per ANILCA § 1002(c), resource assessment baseline studies within the 1002 area of the coastal plain began shortly after its enactment and, as stipulated in 1002(c), are "continuing." Special emphasis was placed on caribou, wolves, wolverines, grizzly bears, migratory waterfowl, muskox, and polar bears of the coastal plain and their habitats. The purpose of the studies is to "assess the size, range, and distribution of populations of fish and wildlife; determine the extent, location, and carrying capacity of the habitats of the fish and wildlife; assess the impacts of human activities and natural processes on the fish and wildlife and their habitats; analyze the potential impacts of oil and gas exploration, development, and production on such wildlife and habitats; and analyze the potential effects of such activities on the culture and lifestyles (including subsistence) of affected Native and other people."

The environmental setting, flora and fauna, water resources, cultural resources, and rural lifestyles (including subsistence) of the 1002 area of the coastal plain, Arctic Refuge, are generally defined and described in the *Final EIS and Preliminary Final Regulations: Proposed Oil and Gas Exploration within the Coastal Plain of the Arctic NWR* (DOI 1983), and *Coastal Plain Report* (Clough and others 1987).

Additional natural, water and cultural resource data and assessments are provided in the numerous studies conducted under the Arctic Refuge Coastal Plain Resource Assessment over the past 30 years (FWS 1982; Garner and Reynolds 1983, 1984, 1985, 1986, 1987; McCabe and others 1992; Douglas and others 2002; among others). Cumulative effects of oil and gas activities on the Alaska North Slope were reviewed by the National Research Council, as these effects were not adequately integrated into ongoing studies up to that point (NRC 2003).

Since 1988, the natural and cultural resources, water resources, and lifestyles (including subsistence) in the Arctic Refuge, including the 1002 area of the coastal plain, have been minimally affected by human influence or intrusion, and have been administered primarily for their wilderness values and natural processes (FWS 1988a, 1988b, 2015a, 2015b).

The Beaufort Sea coastal plain 1002 area has incurred climate changes since the mid-1980s (e.g., Clough and others 1987), particularly for drying and warming (ACIA 2004; NRC 2008; IPCC 2014). Additionally, polar bear use and denning has increased substantially in the area and this is likely to continue (Amstrup 1993; Durner and others 2006; FWS 2016a). Further, subsistence use practices have changed, adjusting to the availability and stability of subsistence species seasonally, annually and long-term. Finally, tourism has increased both as a factor of wilderness quality but exploring new venues such as polar bear viewing.

Table 3.1. Convenience cross-reference for affected (existing) environment descriptions and factors.

Resource Factor	Page Numbers	
	Coastal Plain Report (Clough and others 1987)	**Arctic Refuge CCP** (FWS 2015a)
	Chapter 2 Existing Environment	Chapter 4 Affected Environment
Soils	13	32-32
Permafrost	11	32-34
Water Resouces, Hydrology and Wetlands	13, 18-20	38-43
Climate		
Vegetation	16-17	45-53
Wetlands	18	
Fish	34	62-78
Eagles and Raptors	33	85
Resident Birds	--	--
Migratory Birds including waterfowl, shorebirds, landbirds	32-33	79-83, 85-89. 92-93
Other Terrestrial Mammals	26-29	112-114
Caribou	21-26	
Polar Bears	30	117-123
Bowhead Whale	--	
Seals	31	
Cultural Resources	45	132
Socioeconomics	35-45	145-173
Environmental Justice		
Subsistence Resources	36-42	174-217
Noise	16	43-44
Visual	--	--
Wilderness Values	46	--

3.1 Physical Environment

3.1.1 Soils

Soils in the coastal plain are described in the 2015 Arctic Refuge CCP as including low terraces and floodplains of streams draining the North Slope of the Brooks Range (FWS 2015a). Materials underlying soils in this region consist of fluvial sands and silts, with increasing amounts of interstratified marine sediments near the coast. Generally, soils thaw less than 18 inches in summer and are poorly drained. Loamy textures are common on terraces and floodplains, and organic soils occur in depressions. Locally, peaty materials are buried beneath windblown sand deposits.

3.1.2 Water Resources and Wetlands (including Riparian Areas)

Hydrology. Water resources on the coastal plain of the Arctic National Wildlife Refuge consist of streams, lakes, and springs. Streams of the Arctic coastal plain flow north, several forming large alluvial fans as they flow into the Beaufort Sea where they contribute substantial volumes of water and sediment to coastal ecosystems (FWS 2015a). Like other areas of the Arctic, the coastal plain is underlain by continuous permafrost limiting infiltration of surface water and limiting groundwater resources (Lyons and Trawicki 1994). Groundwater that may exist below permafrost is thought to be saline or brackish (Williams 1970). While 99 percent of the 1002 area is classified as wetlands, freshwater is limited and confined to the shallow zone above permafrost (Clough and others 1987; FWS 1994). Lakes are not evenly distributed across the coastal plain with concentrations occurring 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 and others 1991). At Barter Island mean annual precipitation which includes the water equivalent of snow averages 6.3 inches per year, in Umiat east of the 1002 area on the North Slope it is 5.7 inches (Searby and Hunter 1971) emphasizing that climate and permafrost are dominant factors that limit water availability. The non-frozen water found on the coastal plain during the winter months is located in small isolated pools beneath ice hummocks associated with stream drainages , lakes with depths greater than 7 feet, and flowing surface waters associated with springs (Lyons and Trawicki 1994).

Streams and Rivers. The 1002 area has a relatively high density of streams and rivers compared to other areas of the North Slope (Brackney 2008). These habitats support thirteen species of fish, including Dolly Varden char, an important subsistence fish. The hydrography of these systems is strongly influenced by the climate which is characterized by extremely low winter temperatures and short, cool summers with low, desert-like levels of precipitation. Streamflow rapidly declines in most systems shortly after freeze up in September and ceases in most streams by December when they are generally frozen to the stream bed resulting in no flow or flow so low as to not be measureable (Lyons and Trawicki 1994). A few exceptions to this occur where springs result in open reaches and aufeis areas that develop providing important fish overwintering habitat (Arcone 1989). Break up on the Arctic coastal plain occurs during a brief period in late May or early June. Snowmelt begins in the mountains and foothills progressing towards the coastal plain. Rapidly melting water runs over the ground as sheetflow with infiltration limited by permafrost (Lyons and Trawicki 1994). Water in drainages rises rapidly, often flowing over ice covered stream channels. More than half of the annual discharge for these streams can occur during a period of several days to a few weeks (Clough and others 1987; Sloan 1987; FWS 1994). Based on origin, hydrologic regime, and chemical and biological characteristics, Craig and McCart (1975) classified North Slope streams into three categories: mountain, spring-fed, and tundra. Mountain streams are typically fast flowing and fed by varying proportions of snowmelt, glacier meltwater, and spring-fed tributaries. Waters are cold (usually less than 50 °F), occasionally turbid, moderately hard, and support low invertebrate densities.

The most common species of fish in mountain streams is Dolly Varden char. Mountain streams that receive glacial inputs are unique to the eastern North Slope, in the Jago, Hulahula, and Okpilak watersheds, discharge from glacial sources is the dominant source of flow when precipitation is low and air temperatures are high and transport large volumes of water, sediment and nutrients to downstream ecosystems (FWS 2015a). Spring-fed streams are often tributaries of mountain streams and have relatively stable flows and temperatures throughout the year. Spring-fed waters are characterized by low levels of dissolved solids and very high densities of macroinvertebrates. Many spring-fed streams provide critical spawning and overwintering habitat for Dolly Varden char. Tundra streams originate in the Brooks Range Foothills and coastal plain ecoregions, are fed by surface runoff, tend to be meandering systems, and have low to moderate invertebrate densities. Waters are typically warmer and exhibit lower pH and conductivity relative to mountain and spring-fed streams (FWS 2015a). Huryn and others (2004) found that gradients in freezing probability, nutrient concentrations, and substratum instability control invertebrate communities in these systems. Some projections indicate that glacial inputs could disappear within the next 50 years altering hydrology by reducing instream connectivity and negatively impacting fish migrating to critical overwintering habitat (Nolan and others 2011). Surface water availability and instream connectivity will potentially be adversely impacted by deepening of the active layer on the coastal plain, increasing duration of the summer season, and increased evapotranspiration rates (FWS 2015a).

Springs and Aufeis Areas. Six springs are located on the Arctic coastal plain identified through reconnaissance investigation by Childers and others (1977): Sadlerochit Spring, Red Hill Spring, Katakturuk River tributary Spring, Hulahula River Spring, Okerokovik River Spring, and Aichilik River Spring. During the winter months pressurized water discharges from a spring pushing up through the ice to the surface where it spreads out and freezes forming aufeis areas that can become extensive. These formations melt more slowly than snow, generally persist into the summer and may provide a temporary source of freshwater (Kane and Slaughter 1973). Open water associated with springs provides important winter habitat particularly once surface water runoff ceases due to freezing (Lyons and Trawicki 1994). Most springs in Arctic Refuge have survived since the last glacial maximum (Yoshikawa and others 2007), suggesting that they will continue to flow and be refugia for aquatic biota in a changing climate.

Lakes. The density of lakes in the Arctic coastal plain is low compared to the rest of the North Slope and as noted earlier their distribution is not uniform, nor is their size and depth (FWS 2015a). Jorgenson and Shur (2007) classified the coastal plain into regions based on lake origin: thaw, depression, riverine, and delta. Depression lake basins are formed in undulating sandy, alluvial marine or eolian deposits, and are the majority found on the coastal plain concentrated in the depression lakes region between the Hulahula and Niguanak rivers. Riverine lakes include oxbow and floodplain lakes along sinuous channels and thaw lakes formed in ice-rich abandoned channels. Riverine lakes are most concentrated along the Jago and Niguanak rivers. Delta lakes include thaw, riverine, and tidal lakes and most are found in deltas of the Hulahula, Jago, Aichilik, and Canning rivers (FWS 2015a, 2015b). The majority of lakes on the coastal plain are shallow lakes with surface areas ranging from 1,500 acres to less than 10 acres (Trawicki and others 1991). Recharge of these systems is generally limited to snow melt and direct precipitation in the immediate vicinity of the lake (Lyons and Trawicki 1994). When not connected to larger drainage networks, evaporation has a strong influence on water chemistry and plays an important role in regulating lake water balance (FWS 2015a). Maximum winter ice thickness on lakes in the Arctic is between 6–7 feet (Bilello and Bates 1969, 1971, 1972, and 1975). Clough and others (1987) reported that most lakes have basins less than 7 feet deep and thus freeze to the substrate. These shallow lakes generally melt from the surface downward in spring. Deeper lakes that do not freeze to substrate may have ice present on the surface well into July. Due to the level of winter freezing, the depth of lakes restricts the presence of fish, Hobbie (1984) found fish present only in lakes with depths greater than 5.6 feet. Shallow lakes generally lack fish because they usually freeze solid but they provide important habitat to emergent vegetation, invertebrates, and migratory birds due to the earlier availability of ice-free areas. Trawicki and others (1991) identified fish presence in lakes on the coastal plain to be more frequent and widespread than previously suspected. Ninespine stickleback (*Pungitius puingitus*) was found in 34 of 52 lakes surveyed (65 percent) in 1989. In the past half a century, the duration of ice cover, thermal regimes, and rates of primary productivity have likely changed. In the future, changes in temperature, active layer depth, fire frequency and severity, and erosion rates could affect lake distribution, water quality, water levels, size, and connectivity to other habitats (FWS 2015a).

<u>Winter-specific Hydrologic Data</u>. Hydrologic data for the 1002 area are limited, the Service collected short-term (less than five years) of data over two decades ago at 11 stream gage sites on five drainage systems across the coastal plain and conducted an inventory of 119 lake basins to create lake contour maps, water volume calculations and estimates of winter water volume beneath ice cover. These lake basins constituted the majority of larger lake basins found in the 1002 area. These data were collected in large part to address questions regarding winter water availability in the 1002 area in the event of exploration activities. The USGS has collected some additional hydrography data on the Canning and Hulahula Rivers. Through Service stream studies, winter water was found to occur over a wide area in most of the major river drainages but it was restricted to small isolated pools beneath ice hummocks scattered throughout the braided portions of these rivers. The volume of water available was estimated to be small, 9 million gallons over the 237 miles of inventoried area (Elliot and Lyons 1990). Total estimated volume of water in the study lakes ranged from 55,382 acre-feet (18 billion gallons) when free of ice to a low of 3,366 acre-feet (1.1 billion gallons) beneath a maximum ice thickness of seven feet. Ninety percent of the available water was contained in just nine of the 119 surveyed lakes, the majority of these were found in the Canning River delta area (up 80 percent of the total volume), and only two of these lakes were located in the region between the Katakturuk and Sadlerochit rivers (Trawicki and others 1991).

Wetlands. Approximately 99 percent of the coastal plain of the Arctic Refuge is classified as wetland. The National Wetlands Inventory (NWI) program uses ecological characteristics to define wetlands (Cowardin and others 1979). The essential attributes of wetlands are the presence of wetland plants (hydrophytes), the presence of wet soils (hydric soils), or soil saturation or flooding. Wetlands in the Arctic fall into five categories: marine, estuarine, riverine, lacustrine, and palustrine which are further divided into a number of subcategories. The vast majority of the coastal plain wetlands are in the palustrine category which is commonly referred to as wet tundra or tussock tundra (NWI data). Arctic wetland areas generally have dense vegetative cover and permafrost occurring at shallow depths due to the insulating layer of the vegetation. The permafrost forms a confining barrier that prevents infiltration of surface water keeping the active layer of soils saturated thus forming large wetlands even in areas of low precipitation. Slow decomposition rates found under the Arctic's environmental conditions cause organic matter to accumulate over the mineral soil parent materials as thick peat layers, particularly in low-lying areas (Nowacki and others 2001).

Net primary production, nutrient export, and food-chain support are important functions of Arctic wetlands. Tundra production is remarkably high—approximately one-half that of temperate grasslands—and supplies the energy (plant biomass) on which animals exist. Nutrient export is an important function of Arctic wetlands. Arctic-tundra wetland supports food chains, both through the herbivore-based trophic system (from living plant tissues to rodents and ungulates and their predators) and through the detritus-based trophic system (from dead plant tissue to invertebrate to shorebirds and their predators) (Post 1990). Brown and others (2007) found that wetland and riparian habitats, particularly in coastal areas and river deltas, are of particularly high value to many shorebird species. Arctic wetlands retain or distribute sediments, nutrients, and toxicants. At breakup, streams flood adjacent tundra creating extensive wetland complexes that provide sites for suspended solids to settle, and sediment is trapped by riparian wetlands along large Arctic rivers with mountain headwaters. Microbes and plants contribute to nutrient and contaminant retention or transformation in tundra wetlands since Arctic-tundra species are adapted to low temperatures and are biologically active even under harsh conditions (Post 1990).

Riordan and others (2006) reported a reduction in wetland extent and the number and surface area of lakes on parts of the Yukon Flats between 1980 and 2002. Many wetlands on the Yukon Flats Refuge that were once aquatic habitats, such as lakes, now are shrub and wet meadow habitats. Historical aerial photographs from the boreal forest part of Arctic Refuge also show lakes shrinking or disappearing in the past 60 years.

The integrity of riparian areas is important for maintenance of water quality and fish populations on the coastal plain, more so at higher elevations where stream meandering during spring snowmelt or summer storm events is less prevalent than at lower elevations (Clough and others 1987).

Climate Change Effects to Water Resources and Wetlands (including riparian areas). Historically, in the nearby NPRA the coastal regions have not thawed until after the second week of June (BLM 2012). By mid-century, these areas are projected to thaw the first week of June. By late century these areas are expected to thaw as early as 1 June. Changes in freeze-up date are predicted to be even greater. Historic data indicates NPRA water bodies freeze by mid-September. Models indicate freeze-up will not occur until late September in southern regions and early October along the coast. By the end of the century, coastal waterbodies may not freeze until the end of October. These changes will result in a six-week increase in the length of the ice-free season.

Landscape drying trends have been observed in northeastern Alaska (ACIA 2004; ICPP 2014. Increased temperatures and an extended growing season could increase the evapotranspiration rate, increasing the water deficit (defined as the amount by which evapotranspiration exceeds precipitation) and potentially affecting the annual water balance. The annual water balance represents the water available for plants and animals, streamflow, and groundwater recharge. Shallow water systems, including lakes and wetlands, could decrease in number and extent as the annual water balance experiences an ongoing deficit. Permafrost loss on the Refuge could also result in draining of many shallow water systems; the thawing of ice wedges and ice lenses could create more connections between surface water and groundwater systems. If wetlands and lakes continue to dry, an increase in vegetative cover can be expected eventually transitioning to dry meadows and shrublands. This would reduce the amount of habitat available for wetland-dependent species, such as waterfowl.

3.1.3 Climate

The North Slope is defined as the area north of the Brooks Range, including the Beaufort Sea Coastal Plain and the Brooks Range Foothills ecoregions. The climate of the North Slope is classified as arctic: summers are short and cool, and winters are long and cold. The growing season lasts from June to August. Subfreezing temperatures and snow may occur at any time during the year.

The Arctic coast experiences more frequent cloudiness and fog with higher winds; inland, clear skies are more common, winds are variable, and summers are warmer and less cloudy with increasing distance from the coast. At Barter Island on the coast, temperatures average 40 °F in July (warmest month) and -20 °F in February (coldest month) (Table 4–2). Temperatures on the coastal plain and in the northern foothills of the Brooks Range are more similar to those measured at weather stations at Kuparuk and Toolik Lake, ranging from means of 47 to 53 °F in July and -18 to -6 °F in February.

North of the Brooks Range, the Refuge receives little precipitation. The average annual water equivalent precipitation is less than 10 inches, most of which falls as summer rainfall, but it includes 32 to 46 in of snowfall. Evaporation rates are low due to low temperatures and a short growing season; the land is underlain by continuously frozen soil, which restricts soil drainage. Therefore, available soil moisture is considerably greater than the low annual precipitation would produce in a more temperate climate, and soils are usually saturated during summer.

Surface winds along the Arctic coast average 9 to 15 miles per hour (mph), with occasional intense storms generating winds exceeding 70 mph. Winds are predominantly from the northeast, although the strongest winds come from the west. September and October are the windiest months on the coast, probably due to maximum amounts of open water (Wendler and others 2010). During winter, winds are a major force affecting the distribution and amount of snow cover on the coastal plain. Higher, rolling terrain is often blown clear, or nearly so, while dense snow drifts accumulate in sheltered areas along stream banks.

The Arctic is particularly sensitive to warming due to the historically extensive snow and ice cover, where the freezing point marks a critical threshold for stability of the landscape and thus both habitat and infrastructure sustainability.   Accelerated melting of multiyear sea ice, reduction of terrestrial snow cover, and permafrost degradation are examples of the observed rapid Arctic-wide response to global warming.

Annual average near-surface air temperatures across Alaska and the Arctic have increased over the last 50 years at a rate more than twice as fast as the global average temperature (Taylor and others 2017). There is limited meteorological monitoring on the North Slope, and no long term, continuous monitoring in the Arctic Refuge. Thus, long term trends are derived primarily from Utqiagvik (formerly Barrow). Especially strong warming has occurred over Alaska's North Slope during autumn. For example, Utqiagvik's warming since 1979 exceeds 7°F (3.8°C) in September, 12°F (6.6°C) in October, and 10°F (5.5°C) in November (Wendler and others 2014).

Our understanding of precipitation trends are limited on the North Slope, in part because the difficulty of collecting rain and snow in windy sites makes historical precipitation data less reliable than temperature data. Overall, the 2016 May Alaska statewide snow coverage was the lowest on record dating back to 1967; the snow coverage of 2015 was the second lowest, and 2014 was the fourth lowest (Taylor and others 2017). The length of the snow season impacts the timing available for winter exploration activities as well as the timing of wildlife activities, including occupancy of migration and birthing habitats. Snowpack in the Brooks Range, and glacier mass, affect water availability in rivers and lakes for fish and wildlife habitat.

Negative trends in precipitation were observed between 1950 and 1988 at Barter Island, on the Beaufort Sea coast in the center of the Arctic Refuge (Curtis and others 1998; L'Heureux and others 2004). Across six decades (1950–2010), researchers also observed a consistent decrease in winter precipitation at Utqiagvik (McAfee and others 2013), which supported earlier analyses (L'Heureux and others 2004). The Barter Island station, however, has not reported continuously since the late 1980s, so it cannot confirm recent trends at Utqiagvik. At Bettles, south of the Brooks Range, there appears to be an increase in winter precipitation, with the difference from the Arctic Coastal Plain resulting from the Brooks Range acting as a barrier to moisture transport.

3.2 BIOLOGICAL ENVIRONMENT

3.2.1 Vegetation

North of the Brooks Range, the coastal plain is treeless tundra, composed mainly of hardy dwarf shrubs, sedges, and mosses. Habitats on the North Slope can be grouped into four broad categories: coastal lagoons, lowland wet tundra and lakes, upland moist tundra, and river floodplains with willow shrub thickets. The geography of the 1002 Area differs from the coastal plain further west in that there is generally less low, flat, wet tundra and a greater proportion of rolling, drier terrain. Detailed biological community descriptions are provided in the Arctic Refuge CCP (FWS 2015a). The following is a summary of the information found there as it pertains to the Refuge coastal plain.

Shrub thicket habitat can be categorized into two types: dry and moist prostrate dwarf shrub. Dry prostrate dwarf shrub occupies dry areas of the coastal plain tundra and on dry, infrequently-flooded river terraces or alluvial fans throughout the refuge. Moist habitats on slightly elevated microsites of the coastal plain are often drier as a result of greater exposure to wind and lack of water from surrounding terrain. Lichen are more common than mosses in these drier habitats. Bare soil as a result of frost action is common in this habitat type. Moist prostrate dwarf shrub contains similar shrub species as dry, but greater winter snow cover and summer soil moisture allows grasses, sedges, and mosses to thrive in the understory.

The riparian shrub type develops on gravels along rivers and is dominated by the willows *Salix planifolia* and *S. alaxensis*. On the North Slope, this is the tallest vegetation type. Species composition and density is controlled by frequency of flooding, water velocity, and the size of particles deposited during flooding

The very wet graminoid vegetation type occurs on aquatic habitats surrounding large, open bodies of fresh water, very wet habitats that contain numerous small bodies of open water; and coastal marshes frequently inundated with salt water. Surface forms include low-centered polygons with abundant standing water, thaw lake basins, edges of lakes, and lowbank coastline. There is usually little shrub, forb, or moss cover, except on drier microsites such as polygon rims.

3.2.3 Fisheries

Two types of fish habitat dominate the Arctic coastal plain: streams and lakes. Lake habitats may be isolated and without upstream or downstream connections, and may be further defined as deep or shallow. Environmental extremes also dominate fish habitats, between freezing, i.e., below 0°C/32°F during the long winter and flowing waters (above 0°C/32°F) during the short summer months. This combination, along with size, location, and morphology, including chemical and physical characteristics of the numerous lakes and tributaries of the Arctic coastal plain determine the distribution, densities and diversity of fish species (see Affected Environment - Hydrology 3.1.2).

Fish species may be categorized into freshwater residents, diadromous (both marine and freshwater) and marine. About 62 marine and diadromous fish occur in in the Beaufort Sea adjacent to the coastal plain and these species include Arctic char, Arctic cisco, Arctic flounder, boreal smelt, Pacific salmon (pink and chum), and fourhorn sculpin (Craig 1984; Clough and others 1987; Gallaway and Fechhelm 2000; Mecklenburg and others 2002; BLM 2012; FWS 2015a). Nearshore marine environments provide important foraging and spawning habitats while the moving waters of river deltas provide overwintering habitat for some species. About 21 species of freshwater fish, including diadromous species that are predominantly freshwater, occur in the coastal plain and include Arctic lamprey, Arctic grayling, round whitefish, broad whitefish, ninespine stickleback, and burbot (Clough and others 1987; Moulton and George 2000; BLM 2012; FWS 2015a).

The 3- to 4-month Arctic summer is a critical period for fish to find quality foraging habitats and food resources and reproduce. It may be safely assumed that any fresh waters deeper than 2–2.5 meters (6-7 feet) deep, or alternatively below the maximum winter ice depth of the coastal plains environs may be suitable wintering habitat for fish (Bilello and Bates 1969, 1971, 1972, 1975 in Lyons and Trawicki 1994; Schmidt and others 1989; Moulton and George 2000). This type of habitat is considered restricted and a limiting factor to overwintering fish survival (Reynolds 1997). Large lakes are generally uncommon in the 1002 area of the coastal plain, and particularly those with overwintering capacity; do not freeze to the bottom during winter months, provide sufficient dissolved oxygen, and/or without salt water intrusion (Clough and others 1987).

Springs are important for spawning, rearing, and overwintering and these sites are generally more abundant and diverse than other waters for aquatic invertebrates as food resources (Glesne and Deschermeier 1984; Clough and others 1987).

Grayling are not as tolerant of brackish waters and occur more in riverine systems than char but are in large concentrations are only a few locations. Grayling make extensive migrations to and from spawning, rearing, foraging, and overwintering locations (West and Wiswar 1985; Mecklenburg and others 2002). Major Arctic grayling populations occur in the Canning, Tamayariak, Sadlerochit, Hulahula, Okpilak, and Aichilik Rivers. Arctic char (Dolley Varden) are primarily anadromous but rely on freshwater habitats for spawning, early rearing, and wintering. Therefore, char also migrate with primary movement corridors in the Canning, Aichilik and Hulahula Rivers. The Canning River has the largest char run and the Hulahula is the most important for subsistence purposes.

Smaller fish species which have little interest for sport or subsistence, are important food resources for birds, mammals and other fish.

Seventeen of the most commonly occurring fish species in the coastal plain are important subsistence resources (NRC 2003). Due to difficulty of access and seasonal restrictions, sport fishing may be considered minimal in the coastal plain (Clough and others 1987; BLM 2012). Arctic char is the most important subsistence freshwater fish species followed by Arctic grayling.

3.2.4 Bald and Golden Eagles

Bald Eagles are considered a casual visitor with the possibility breeding on the coastal plain (FWS 2015a), therefore are not considered further for evaluation. Golden Eaglescommon visitors on the coastal plain and rare breeders on the inland coastal plain (FWS 2015a). Across the Beaufort Sea coastal plain Golden Eagle numbers have increased substantially between 1986 and 2012 at an annual rate of 7 percent, and over the last decade of that period the increase was an annual rate of 37 percent (Stehn and others 2013). The averagefor Golden Eagles over the entire period was 118 birds, but in 2012 the average a high of 522 birds were observed (Stehn and others 2013).

The coast plain 1002 area is important for non-breeding Golden Eagles, particularly subadults, which scavenge and prey upon caribou of the Porcupine herd during the calving and post-calving period (Mauer 1985). Although none of the nest sites visited by Mauer (1985) were within the 1002 area, subsequent observations have confirmed them as a breeding species there, including at nest sites within core calving areas.

Within the Arctic Refuge, Golden Eagles breed north of the crest of the Brooks Range begin nesting early in spring. Based on a three-year study (1988 to 1990), nest initiation dates ranged from 23 March to 11 May, with annual mean nest initiation dates of 22 April, 14 April, and 5 April in 1988, 1989, and 1990, respectively (Young and others 1995). Those dates would include the last part of the operations phase for exploration activities and all of the demobilization phase based on the recently-proposed winter seismic exploration project farther west on the North Slope NPRA Mooses Tooth Unit seismic exploration (BLM 2016a). In studies elsewhere, disturbance and human activities were correlated with reduction in Golden Eagle nesting success (Kochert and others 2002). It may be assumed that winter seismic activity could have similar effects for golden eagles on the coastal plain 1002 area.

3.2.5 Resident Birds

Four species of birds are considered permanent residents of the coastal plain: Willow Ptarmigan, Rock Ptarmigan, Gyrfalcon, and Common Raven (FWS 2015a). Gyrfalcons are an uncommon resident of the inland coastal plain (FWS 2015a); nests are known in the coastal plain 1002 area. Even in the middle of winter, Gyrfalcons may be present on their nesting territories; in the coastal Northwest Territories of Canada (at latitudes comparable to, or greater than, those of the coastal plain 1002 area). Gyrfalcons have been found on territories as early as February (Booms and others 2008). Both species of ptarmigan are important components of the Gyrfalcon diet, particularly in winter and early spring when other prey types are either absent or scarce (Watson and others 2012). Nest initiation dates range from early April to early June annually.

3.2.6 Migratory Birds

In the northern foothills of the Brooks Range, Beaufort Sea coastal plain and adjacent marine waters, 158 species have been recorded, including 79 breeding species and 79 species that are migrants, visitors, or vagrants. Birds that use the Arctic Refuge have distributions that include all 50 U.S. states and six continents. Thirty-five species of waterfowl have been observed on Arctic Refuge. Geese, except Canada Geese, and Tundra Swans primarily breed on the coastal plain wetlands (FWS 2015a).

Red-throated Loons have been identified as a species of Conservation Concern by the Service (FWS 2008), Audubon Alaska (Kirchhoff and Padula 2010) and the ADF&G (ADF&G 2006). The highest densities of Red-necked Loon are found along coastal plain deep-water lakes and adjacent marine areas, but a few also breed in the Brooks Range and on the south side of the Arctic Refuge.

Twenty-six species of shorebirds breed on the Arctic Refuge, of which 22 breed on the coastal plain wetlands and adjacent areas. Another species, the Red Knot, occurs as a migrant only. Of these 27 species, 21 are identified as species of moderate or high conservation Concern by the U.S. Shorebird Conservation Plan (Brown and others 2001), Alaska Shorebird Conservation Plan (Alaska Shorebird Group 2008), Service (FWS 2008), and Audubon Alaska (Kirchhoff and Padula 2010) because of small or declining populations.

3.2.7 Terrestrial Mammals other than Caribou

As established by ANILCA, the first purpose of the Arctic Refuge is to "conserve fish and wildlife populations and habitats in their natural diversity." Among the wildlife species specifically under this purpose are several species of large terrestrial mammals including caribou, Dall sheep, muskox, moose, brown bear, wolf, and wolverine. Dall sheep do not occur on the coastal plain. Among the five species which do occur in that region, both muskox and moose have experienced marked population declines over the last few decades. After muskoxen were reintroduced to the North Slope in the Arctic Refuge in 1969 and 1970, the population grew steadily and rapidly from 1978 to 1985 and then remained relatively stable until nearly the end of the century. Beginning in 1998, however, numbers within the refuge dropped dramatically for the next half decade and have remained very low ever since. The overall muskox population in northeast Alaska and northwest Canada peaked in 1993, declined through 2006, and has remained relatively stable since then. Most of that decline was due to population losses from the Arctic Refuge. Today, most of the muskox in the area are either west or east of the Arctic Refuge (FWS 2015a).

Of the two species, muskox may be more vulnerable to potential disturbance on the coastal plain. Female muskox do not typically breed until they are 4 or 5 years old, most only breed every other year (or less frequently), and produce just a single calf. They subsist on generally low quality forage in the winter time, and to compensate, they conserve energy by reducing their winter activity. In addition, calves are born between mid-April and mid-May, 4 to 6 weeks before snowmelt and subsequent green-up produce nutritious forage. As a result, late winter is a time of high vulnerability, and if any muskox were in the vicinity of seismic exploration camps and activity, disturbance could substantially reduce energy reserves that may affect survival into spring (FWS 2015a).Moose populations in northeast Alaska, including the Arctic Refuge, increased rapidly through the late 1900s. From 1989 to 1994, moose in this region declined by at least 50 percent, leading to harvest closures on State lands. By the early 2000, moose populations west of the refuge had started to increase, and by 2015 there was some indication that moose were beginning to increase within the refuge. However moose continue to occur at low density east of the Canning River on the coastal plain and in the northern foothills of the refuge. Because of concerns about the small population size, harvest restrictions have been implemented (FWS 2015a).

Grizzly bears, wolves, and wolverines all occur on the coastal plain, but are more common inland on the foothills and mountains of the Brooks Range. Among the three, bears may be the most vulnerable to disturbance. Throughout the Arctic, brown bears have low rates of reproduction. They exhibit a delayed age at first reproduction (9 years of age in the Arctic Refuge), mean litter size of 2, high first-year mortality, and an interval between successful litters of greater than 3 years. In addition, they emerge from their dens from late March through May, females with cubs usually emerge later than adult males (FWS 2015a, 2015b). The den emergence period overlaps the late operation and entire demobilization phases of winter exploration activities. Human-bear conflicts would be possible at this time as recently-emerged and hungry bears are ranging widely in search of early spring food.

3.2.8 Caribou

Caribou are the most abundant large mammal in Arctic Refuge and are an important subsistence species for Iñupiat and Athabascan (Gwich'in) hunters. Caribou are also hunted and viewed by other visitors to the Refuge and are prey for brown bears and wolves.

Caribou have been present in northeastern Alaska and the northern Yukon since the early Pleistocene. Human use of caribou in the region may date back thousands of years. Remnants of caribou fences and corral structures used by the Gwich'in people are found throughout the current southern range of the Porcupine caribou herd (Warbelow and others 1975).

Large caribou herds tend to migrate over long distances using seasonally available forage resources that are often widely distributed. Caribou move in response to changing weather conditions, biting and parasitic insect harassment, and predators. In the Arctic, caribou reproduction is highly synchronous and the majority of calving occurs in a two- to three-week period. Most adult females give birth to a single calf. Caribou calves are precocious, being able to stand and nurse within one hour after birth and follow their mothers within a few hours. The first 24 hours of life are critical, when a behavioral bond is formed between the calf and its mother. Disturbance of maternal groups on the calving grounds may interfere with bond formation and can increase calf mortality. After calving, small bands of cows with newborn calves gradually merge into larger groups and are joined by yearlings, barren females, and bulls arriving from wintering areas.

Summer weather conditions promote the emergence of mosquitoes, nose bots, warble flies, and other biting insects. Insect harassment drives caribou into densely packed groups. These post-calving aggregations often move toward the Arctic coast or to higher elevations in the mountains to find relief from insects. The sloped hills with deep ravines of the 1002 area between the Canning and Hulahula Rivers, is the only area that provides any substantial topographic relief along the entire Beaufort Sea coastal plain.

By August, large aggregations gradually disperse into widely interspersed smaller groups that move progressively toward winter ranges. Breeding takes place en route, and by mid-November, caribou arrive in areas where they will spend the winter.

Four caribou herds live in northern Alaska. Two of these, the Porcupine and Central Arctic herds, consistently use Arctic Refuge seasonally or throughout the year. Caribou would be most susceptible to interaction and potential disturbance from winter exploration activities during their spring migration to calving grounds within the 1002 area of the coastal plain and for those that overwinter in that area, including members of the Teshekpuk Herd.

Porcupine Caribou Herd. An iconic symbol of Arctic Refuge, this herd migrates hundreds of miles from wintering grounds to give birth on the coastal plain and northern foothills of Arctic Refuge and nearby Yukon Territory in Canada. Residents of Arctic Village and Kaktovik hunt Porcupine caribou. Many visitors come to Arctic Refuge during early summer with hopes of seeing large numbers of caribou.

During the 1960s and 1970s, the Porcupine caribou herd was relatively stable at about 100,000 animals. Herd numbers have steadily increased after 1978, peaked at 178,000 in 1989, and declined to 123,000 caribou in 2001 (Lenart 2007). Between 2002 and 2009, no estimates of abundance were available. During this period, caribou left the coastal plain and northern foothills of Arctic Refuge earlier and did not form large post-calving aggregations, or weather conditions precluded flights to photograph groups. In 2010, 169,000 caribou were counted in a photo-census of the Porcupine caribou herd (Caikoski 2011). Between 2001 and 2013 the herd increased to levels not seen since monitoring began in 1977, with an estimated population of 197,000 (ADFG 2017b).

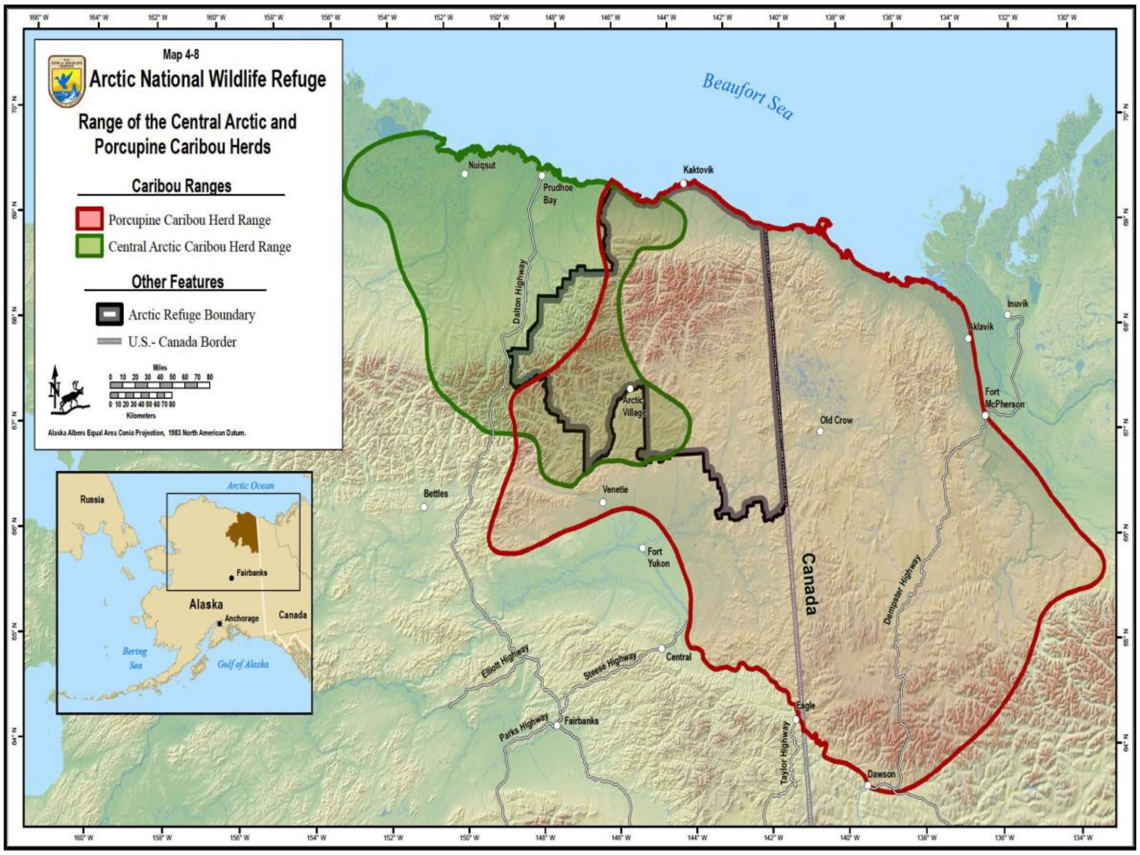
The Porcupine caribou herd ranges over 130,000 square mi (337,000 square km) of wild lands in northeastern Alaska and northwestern Canada (Lenart 2007). The entire Arctic Refuge coastal plain is key calving and post-calving habitat for Porcupine caribou (Griffith and others 2002). Foothills and mountains of Arctic Refuge are also important summer, fall, and winter habitats, as well as spring and fall migration routes. As the summer progresses and willows (*Salix* sp.) emerge, caribou also use riparian habitats. The Porcupine caribou herd generally overwinters south of the Brooks Range in Arctic Refuge and in the Richardson and Ogilvie mountains of the Yukon Territory, Canada. Winter distribution varies by year but is primarily south of the Brooks Range (Caikoski 2011).

Spring migration to calving grounds begins in mid-April and continues through May. Gravid caribou move northward from wintering areas toward calving grounds, where they give birth during the first week in June. Timing and routes of migration vary annually depending on where they overwintered, snow conditions, and timing of the onset of spring weather. Caribou wintering in Alaska often follow a northeasterly route to calving grounds, crossing the southern flanks and valleys of the Brooks Range, and eventually entering Canada near the Firth River. Caribou wintering in Canada also converge in this region. Some caribou wintering in Alaska move in a more northerly direction, crossing the eastern Brooks Range and traveling more directly toward calving grounds. As snowmelt progresses, caribou in the foothills spread northwestward along a broad front, primarily following the major river corridors and associated terraces where snow melt has advanced.

For the past few decades, the Porcupine caribou herd has calved in a region encompassed by the Arctic foothills and the coastal plain from the Canning River in Arctic Refuge to the Babbage River in Canada, an area of nearly 8.9 million ac (Griffith and others 2002). During the calving season in early June, Porcupine caribou selected areas of wet sedge, herbaceous tussock tundra and riparian vegetation types (Griffith and others 2002). Emerging tussock cotton grass (*Eriophorum vaginatum*) flowers were an important source of high quality forage in areas used by calving caribou (Jorgenson and others 2002). This plant species had greater biomass and forage quality in tussock tundra compared with other vegetation types. The distribution of tussock tundra and moist sedge-willow tundra was greater in calving areas in the Arctic Refuge 1002 area of the coastal plain than in areas further south and east (Jorgenson and others 2002).

Central Arctic Caribou Herd. The annual range of the Central Arctic caribou herd overlaps that of the Porcupine caribou herd. Two main calving concentration areas have been identified for the Central Arctic caribou herd: a western area between the Kuparuk and Colville rivers, and an eastern area between the Sagavanirktok and Canning rivers. The eastern area includes the Canning River delta region in northwest Arctic Refuge.

During most winters, scattered groups of animals range throughout the coastal plain west of the Katakturuk River and adjacent uplands to the south. Between 2002 and 2009, the winter distribution of the Central Arctic caribou was north and south of the Brooks Range in Arctic Refuge. In some years, they mixed with Porcupine caribou wintering in the same region. In 2010, almost all Central Arctic caribou wintered on the south side of the Brooks Range in Alaska, as did Porcupine caribou.



Map 4-8
Arctic National Wildlife Refuge
Range of the Central Arctic and Porcupine Caribou Herds
Caribou Ranges
Porcupine Caribou Herd Range
Central Arctic Caribou Herd Range
Other Features
Arctic Refuge Boundary
U.S.- Canada Border
Miles
Kilometers
Alaska Albers Equal Area Conic Projection, 1983 North American Datum.
Beaufort Sea
Nuiqsut
Prudhoe Bay
Kaktovik
Inuvik
Aklavik
Fort McPherson
Old Crow
Arctic Village
Venetie
Bettles
Fort Yukon
Central
Eagle
Dawson
Fairbanks
Canada
Dalton Highway
Dempster Highway
Elliott Highway
Steese Highway
Parks Highway
Taylor Highway
Russia
Arctic Ocean
Alaska
Anchorage
Bering Sea
Gulf of Alaska

This herd had about 5,000 caribou in the mid-1970s when it was first identified as a distinct herd (Cameron and Whitten 1979). By the early 1980s, it had grown to almost 13,000 and by the late 1990s, when net calf production was greater than 70 percent calves per female it increased to over 25,000 (Cameron and others 2002). A photo-census in 2010 counted more than 70,000 caribou in the Central Arctic herd, but a late spring in 2013 resulted in high mortality and the population dropped to 50,000 animals (ADFG 2017a). A 2016 estimate showed further dramatic declines, and the population estimate decreased an additional 50 percent and is at less than 23,000 caribou. The declines are attributed to high adult female mortality and loss of individuals to other herd units during mixing of the Central Arctic, Teshekpuk and Porcupine caribou herds.

3.2.9 Polar Bear

Of the two polar bear subpopulations found in the U.S., polar bears in the Southern Beaufort Sea (SBS) subpopulation are the most likely to occur Arctic Refuge 1002 area (FWS 2009; 2016). Individual bears may primarily use the area within 5 miles of the coast including offshore and barrier islands but may range much farther inland. The subpopulation is shared by the U.S. and Canada and is listed as threatened under the Endangered Species Act. Designated critical habitat for the polar bear occurs along most of the coastal plain 1002 from offshore waters inland (FWS 2010). The boundary of the SBS subpopulation, as recognized by the Polar Bear Specialists Group, is Icy Cape, Alaska to the west and south of Banks Island and east of the Baillie Islands, Canada to the east (Obbard and others 2010). The SBS subpopulation had an estimated population size of approximately 900 bears in 2010 (Bromaghin and others 2015). This estimate represents a significant reduction from previous estimates of approximately 1,800 in 1986 (Amstrup and others 1986), and 1,526 in 2006 (Regehr and others 2006). There is some evidence the 2010 estimate might be indicating the subpopulation may starting to increase (Bromaghin and others 2015). Analyses of over 20 years of data on the size and body condition of this subpopulation demonstrated declines for most sex and age classes (Rode and others 2010, 2014).

Population declines and the size and body condition of bears in the SBS subpopulation have been linked to declining sea ice conditions in the Beaufort Sea (Regehr and others 2006; Rode and others 2010, 2014, In press; Bromaghin and others 2015). Declining sea ice conditions in the Beaufort Sea have also led to an increase in the proportion of the subpopulation coming on shore in summer and autumn (from 5.8 percent during 1986 to 1999 to 20 percent during 2000 to 2014) and a 30 day increase in time spent on land (Atwood and others 2016). While on land, polar bears typically do not feed (Rode and others 2015), although bears in the SBS subpopulation are drawn to bowhead whale remains from subsistence harvesting, particularly adjacent to the community of Kaktovik, Alaska (Wilson and others 2017). These whale remains may be helping offset lost hunting opportunities for bears in the SBS subpopulation due to sea ice loss (Herreman and Peacock 2013, Atwood and others 2016).

In addition to a higher proportion of the SBS subpopulation occurring on shore during summer and autumn, there is also an increasing trend towards more bears denning on land (Olson and others 2017). Denning substrate (i.e., sea ice or mainland) is significantly related to where bears occur in autumn. Pregnant polar bears in the SBS subpopulation that spent more than 25 days on land in autumn all subsequently denned on land (Olson and others 2017). Between 1985 and 2013, the number of bears denning on land in the SBS subpopulation increased from 34 to 55 percent and is linked to sea ice declines. Designated critical denning habitat overlaps with 77 percent of the coastal plain1002 area (FWS 2009, 2010). There are 38 percent more denning habitat available in the coastal plain than in the region immediately to the west (Durner and others 2006). Polar bears have been shown to den in the coastal plain 1002 area with greater frequency than expected based on available habitat (Amstrup 1993). Based on known den locations from 2000 to 2010, 22 percent of dens for bears in the SBS subpopulation occurred within the coastal plain 1002 area (Durner and others 2010). Therefore, the coastal plain 1002 area has been documented to be an important area for denning by polar bears and will likely increase in importance as the percent of bears denning on land increases with sea ice loss (Olson and others 2017).

The mean dates of den entrance and emergence for polar bears that den on land in the SBS subpopulation is 11 November and 3 March, respectively (Rode and others In press). Females observed with cubs in spring emerged 15 days later than females observed without cubs (Rode and others In press). Land-based denning also appears to be important for polar bears, as bears that den on land have significantly higher reproductive success (Rode and others In press).

The Service has worked with the BLM and the oil and gas industry for nearly a decade to develop approaches to polar bear management that will ensure long-term success in achieving Beaufort Sea recovery goals for this species and their designated critical habitat; specifically operation parameters for incidental take regulations (ITR) to cover the period 2016 to 2021 (FWS 2016a, 2016b, 2016c, 2016d). These incidental losses would not affect the larger Beaufort Sea polar bear population but are premised upon the long-term lack of oil and gas activity in the coastal plain 1002 area as managed under the current Arctic Refuge CCP of minimal management (FWS 2015a, 2105b). In effect, the ITR makes the 1002 area a safe-haven for bears and designated critical habitat.

3.2.10 Bowhead Whale

The bowhead whale is classified as endangered under the Endangered Species Act and as depleted under the Marine Mammal Protection Act. It was listed in 1970, but no critical habitat has been designated. A detailed discussion of the bowhead whale migration and population history is included in the NPRA Integrated Activity Plan/EIS (BLM 2012) and Liberty Project (BOEM 2017). The Bering-Chukchi-Beaufort Seas stock of whale is important subsistence resource to the Inupiat peoples. If barging of materials to Kaktovik, is required to support exploration of the eastern coastal plain 1002 area, this population may be affected.

The size of the Bering-Chukchi-Beaufort Seas stock was estimated at 10,400 to 23,000 animals in 1848, before commercial whaling depleted stocks to between 1,000 and 3,000 animals by 1914 (Woodby and Botkin 1993). This stock has slowly increased since 1921 when commercial whaling ended, and in 2001 estimates indicated a population size of about 10,500 whales (George et al. 2004; Zeh and Punt 2005). Separate analyses suggest the mean annual rate of increase from 1978 to 2001 to be between 3.4 and 3.5 percent (George and others 2004, Brandon and Wade 2004).

Bowhead whales migrate through the Beaufort Sea while traveling between wintering areas in the Bering Sea and summer feeding grounds in the Canadian Beaufort Sea, although some animals may remain in areas offshore in the Beaufort and Chukchi seas throughout the summer. The spring migration typically begins in the Bering Sea in mid-March to early April, depending on ice conditions. During the spring migration, bowhead whales follow somewhat predictable leads that form along the coast of western Alaska to Point Barrow. From Point Barrow eastward to Amundsen Gulf, the leads and the migration occur farther from shore based largely on satellite telemetry tracks (ADF&G unpublished data). From April to June, most bowhead whales are distributed along a migration corridor that extends from their Bering Sea wintering grounds to their feeding grounds in the eastern Beaufort Sea (Moore and Reeves 1993). Some bowhead whales migrate westward to feeding grounds in the western Chukchi Sea (Bogoslovskaya and others1982; Mel'nikov and others1997; ADF&G satellite telemetry data). Bowhead whales arrive on their primary summer feeding grounds in the eastern Beaufort Sea from mid-May through June and remain in the Canadian Beaufort Sea and Amundsen Gulf until late August or early September. Some whales may occur regularly in the western Beaufort Sea, particularly near Barrow Canyon, and in the Chukchi Sea along the northwestern Alaskan coast in late summer. These animals may be summer residents but may also be "early autumn" migrants. However, it should be noted that recent telemetry data has suggested that bowhead movements are far more labile within their range than formerly thought (Quakenbush and others 2010) and 'reverse' migratory behavior has been documented.

Bowhead whales that have summered in the eastern (Canadian) Beaufort Sea begin the fall migration in late August to September and are usually out of the Beaufort Sea by late October (Treacy 1988−1997, 2000, 2002a, 2000b; Moore and Reeves 1993). The fall migration route extends from the eastern Beaufort Sea, along the continental shelf across the Chukchi Sea, and down the coast of the Chukotka Peninsula (Moore and Reeves 1993; Quakenbush and others2010b). The extent of ice cover may influence the route, timing, or duration of the fall migration. Moore and others (2000) noted that bowheads in the westeren Beaufort Sea tended to be distributed closer to shore during their westward migration in light ice years. Miller and others (1996) also observed that whales moving from 147° to 150° West longitude in the central

Beaufort Sea, migrated closer to shore in light and moderate ice years (median distance offshore 18 to 25 miles), and farther offshore in heavy ice years (median distance offshore 35 to 45 miles).

3.2.11 Ringed and Bearded Seals

Ringed seals (*Phoca hispida*) are the smallest and most abundant of the Arctic ice seals (seals that use ice to carry out important life history traits) (Smith and Hammill 1981: Kingsley 1986). Ringed seals have a circumpolar distribution, occurring in all areas of the Arctic Ocean north of approximately 65° north latitude (Kelly and others 2010: King 1983). A detailed discussion of the ringed seal population and life history is included in the BLM Integrated Activity Plan/EIS (2012).

Bearded seals (*Erignathus barbatus nauticaus*) are a pagophilic (ice-associated) seal present in the Chukchi and Beaufort seas year round. They are generally considered to inhabit areas of shallow water (less than 200 meters) that are at least seasonally ice covered (Burns 1970, Kelly 1988b, Cameron et al. 2010). A detailed discussion of the bearded seal population and life history is included in the NPRA Integrated Activity Plan/EIS (BLM 2012) and Liberty Project (BOEM 2017).

3.3 SOCIAL ENVIRONMENT

3.3.1 Cultural Resources and Historic Background

The Arctic Refuge CCP (FWS 2015a, 2015b) describes in detail the known cultural and historic context of the Refuge. When considering commercial activities within the Refuge's coastal plain, it is important to note that cultural resources on the North Slope and coastal plain are on or near the surface of the tundra and tend to be oriented along river corridors and coastal beaches. This means that many cultural resource sites on the Refuge are vulnerable to erosion and other natural forces, and to a lesser extent, from public use of Refuge lands and waters. Human use has occurred in the area for more than 10,000 years (Reanier 2003).

Communities surrounding the Arctic coastal plain or that rely on resources, such as caribou, from the coastal plain include Arctic Village, Chalkyitsik, Coldfoot, Deadhorse, Fort Yukon, Kaktovik, Prudhoe Bay,Venetie, and Wiseman. Details of the histories of all communities, except Deadhorse and Prudhoe Bay, are included in the CCP (FWS 2015a, 2015b). Deadhorse and Prudhoe Bay were not included in the CCP because their residents do not generally use Arctic Refuge wildlife resources. These communities fundamentally support infrastructure for the operational oil fields.

Prudhoe Bay and Deadhorse

Prudhoe Bay was named in 1828 for Baron Prudhoe by British explorer Sir John Franklin. In the 1970s the site was extensively developed to support oil drilling operations. The 800-mile Trans Alaska Pipeline, constructed to transport crude oil from Prudhoe Bay to Valdez, has its northern terminus here. At Valdez oil is loaded into marine tankers for shipment throughout to the lower-48 States. Prudhoe Bay is also the unofficial northern terminus of the Pan-American Highway. Deadhorse is a small community which is absorbed into Prudhoe Bay for statistical purposes. Prudhoe Bay is a large work camp for the oil industry. All residents are employees of oil-drilling or oil-production and support companies and work long consecutive shifts. Living quarters and food are provided to the workforce, and there are a number of recreational facilities. There are no permanent residents of Prudhoe Bay.

3.3.2 Socioeconomic

Although the communities of Arctic Village, Chalkyitsik, Coldfoot, Fort Yukon, Kaktovik, Venetie, Wiseman, and Prudhoe Bay surround the Refuge, generally only economies of Kaktovik, Coldfoot, Wiseman, and Prudhoe Bay would be directly affected by oil and gas exploration as they are located either in locations where infrastructure could be staged or along the Haul Road, the only developed land route into the area. All of the communities would be indirectly affected if caribou, a valuable subsistence resource, was affected due to their proximity to and use of the Porcupine caribou herd.

Table 3 – 2: Demographic Characteristics of the Communities near Arctic Refuge.

Demographic Characteristics	**Arctic Village**	**Chalkyitsik**	**Cold-foot**	**Fort Yukon**	**Kaktovik**	**Venetie**	**Wiseman**	**Prudhoe Bay**
Overall 2010 Census Population	152	69	10	583	239	166	14	2174
American Indian and Alaska Native	135	59	1	45	212	152	0	163
White	7	10	9	520	24	3	13	1804

Two or more races	10	0	0	10	3	10	1	41
Other races	0	0	0	8	0	1	0	166
Median age	29	27.5	43	33.7	30.5	30.5	28.5	50
Median household income	$27,250 +/- $9,667	$38,750 +/- $16,617	Not Available	$33,194 +/- $7,432	$58,125 +/- $33,478	$28,333 +/- $21,379	Not Available	94,906 +/- 11,207
Employment in 2016								
Employed (#)	87	48	11	266	125	103	5	1978
Employed in the Private Sector (#)	14	6	9	113	41	23	5	1978
Employed in local and/or state government (#)	73	42	2	153	84	80	0	0
Employed in all 4 Quarters (#)	31	27	9	138	93	40	0	1891

3.3.4 Subsistence

Section 803 of ANILCA defines subsistence uses as: The customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of inedible byproducts of fish and wildlife resources taken for personal or family consumption; for barter or sharing for personal or family consumption; and for customary trade (16 U.S.C. § 3113).

One of the purposes of the Arctic 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 (FWS 2015a, 2015b). With the exception of Prudhoe Bay, each of the affected communities near the 1002 area is characterized by active participation in subsistence fishing, hunting, and trapping on federal, state, and Native corporation lands.

Subsistence Harvest Practices In or Near the Refuge

Arctic Village, Chalkyitsik, Fort Yukon, Kaktovik, Venetie, and Wiseman use the Arctic Refuge for subsistence purposes (FWS 2015a, 2015b). Due to their close proximity Arctic Village, a Gwich'in community, and Kaktovik, a Inupiat community, use the Refuge most frequently. 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).

Not only are subsistence opportunities critical to the cultural identities of these communities, the resources gained provide needed sustenance for residents. There are very few year-round employment opportunities and food costs are high due to the cost of air transportation.

Although both Arctic Village and Kaktovik rely heavily on the Refuge for subsistence resources, the resources used are significantly different. Subsistence harvest in Arctic Village was 10,000 to 21,000 pounds with moose and caribou constituting 90 percent of the harvest in each year, according to the State of Alaska's Community Subsistence Information System (1993–1997) and data collected by the Council of Athabascan Tribal Governments in 2001 and 2002. The harvested caribou from these surveys come primarily from the migrating Porcupine caribou herd. Because of this, the Gwich'in people consider the Porcupine caribou herd's calving grounds on the coastal plain as sacred ground, a birthing place for thousands of caribou each year (Gwich'in National 1988).

Kaktovik is an Inupiat community located on Barter Island on the shore of the Beaufort Sea. The Kaktovikmiut's way of life continues to be heavily dependent on subsistence harvest of marine and terrestrial animals and fish. Caribou hunting occurs throughout most of the year, while bowhead whaling occurs from late August to early October. When the community harvests a whale, marine resources composed 59 to 68 percent of their total subsistence harvest (Minerals Management Service 2003). In addition to whales, Kaktovik residents also harvest a considerable number of Dall's sheep and caribou, contributing 17 to 30 percent of the annual harvest by weight. Hunting of sheep and caribou and fishing during the winter requires snowmachine throughout the coastal plain and as far inland as the Brooks Range footfills. During the summer, Kaktovik residents use boats to access hunting and fishing areas within the coastal plain.

3.3.5 Recreation

The coastal plain is located on lands within ADF&G Game Management Unit (GMU) 26C. ADF&G regulates the seasons, licenses, and bag limits (ADF&G 2015). Access to prime hunting areas is typically by chartered aircraft, boat, or foot. Two guide use areas could be affected by exploration activities. Nonresident brown bear and Dall sheep hunters must be accompanied in the field by a big game guide authorized to operate in the area (FWS 2014).

There are two registration brown bear hunting seasons in GMU 26C. They are held from January 1 to May 31 and August 25 to May 31. In 2016, of the 27 permits issued 12 people reported going hunting (ADF&G website 2017). Caribou hunting is also popular and the hunt is open year round. No permit statistics were available to quantify the extent of caribou hunting

In recent years polar bear viewing is an emerging tourism industry and public use of Arctic Refuge wildlife at Kaktovik and is addressed under the CCP (FWS 20015a, 2015b). NEPA compliance and Refuge compatibility determination are now in progress for this matter.

3.3.6 Noise

Sound is defined as a particular auditory effect produced by a given source, for example the sound of rain on the roof, and is measured in decibels (dB). A-weighted sound level measurements (dBA) are a measure of how the human ear hears sound and is used to characterize sound levels. Table 3–4 shows dBA levels for sounds associated with the area and equipment being proposed for use in the action alternatives.

Table 3 - 4: dBA Levels

Source of Noise	dBA Level
Ambient sound without human influence	20 – 30 dBA
Ground wind 5–10 miles per hour	35 – 45 dBA
Ground wind 20 – 30 miles per hour	55 – 65 dBA
Single engine plane fly over at 1,000 ft	88 dBA
Cessna 206	79 dBA

Bell Huey 204	88 dBA
R-66	82 dBA
Propane generator at 500 ft away	30–35 dBA
(Bolin 2006, Illingworth and Rodkin 2006, Schulten 1997, ICAO Annex 2006, US Coast Guard 2010)	

Currently there is no source of non-ambient noise on the coastal plain, aside from ground wind and the occasional aircraft, high overhead. Generally, noise levels on the Refuge are expected to be between 20 and 30 dBA in calm winds and up to 40 to 50 dBA in moderate to strong winds.

3.3.8 Wilderness Values

The Arctic Refuge, including the coastal plain, was initially proposed as "The Last Great Wilderness" and wilderness values were highly prominent in its initial establishment as the Arctic National Wildlife Range. The CCP recommended the 1002 area for Wilderness designation because it exemplifies the wilderness qualities of natural condition, natural quiet, scenery, wild character, and ecological wholeness (FWS 2015a, 2015b). The area's diverse wildlife species are particularly valued because they exist in a wilderness context, with their natural behaviors, interactions, movements, and cycles continuing. To date Congress has not acted on the recommendation.

The area offers exceptional opportunities for wilderness oriented recreation—adventure, exploration, solitude, and emersion in the natural world. As well, the area holds high symbolic and existence value for millions of people who do not visit, but find satisfaction, inspiration, even hope in just knowing it exists.

4 Environmental Consequences

NEPA requires the disclosure of environmental impacts associated with the alternatives including the No Action Alternative. This chapter presents the anticipated environmental effects of Alternative 1 (No Action) and Alternative 2 (Proposed Action). These analyses provide the basis for comparing the effects of the alternatives on the Affected Environment. The exploration activities described in Alternative 2 are general in nature. If Alternative 2 is selected, the regulations are updated, and applications are received, additional NEPA compliance would be necessary in included with exploration plan applications based on the specifics of each proposal at that time.

4.1 Definitions of Terms

Direct Effects – Direct effects are impacts that are caused by the alternatives at the same time and in the same place as the action.

Indirect Effects – Indirect effects are impacts caused by the alternatives that occur later in time or farther in distance than the action.

Long-term Effects – Long-term effects are impacts that would occur or persist more than three years after exploratory activities are conducted.

Short-term Effects- Short-term effects are impacts that would occur or persist up to three years after exploratory activities are conducted.

Cumulative Effects - The CEQ defines cumulative effects as impacts on the environment which result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative effects can result from individually minor, but collectively significant actions taking place over a period of time (40 CFR 1508.7). Informed decision making is served by consideration of cumulative effects resulting from actions that are proposed, under construction, recently completed, or anticipated to be implemented in the reasonably foreseeable future.

CEQ guidance in considering cumulative effects states that the first steps in assessing cumulative effects involve defining the scope of the other actions and their interrelationship with a proposed action. The scope must consider other actions whose effects coincide with the location and timetable of a proposed action and other actions. Cumulative effects analyses must also evaluate the nature of interactions among these actions (CEQ 1997). The cumulative effects assessment is based on available information at the time of development of this EA.

To identify cumulative effects, the analysis needs to address two fundamental questions.

1. Does a relationship exist such that affected resource areas of the Proposed Action or alternatives might interact with the affected resource areas of past, present, or reasonably foreseeable future actions?

2. If such a relationship exists, then does an EA reveal any potentially significant effects not identified when the Proposed Action is considered alone?

Mitigation — Mitigation includes special procedures and minimization measures that are implemented to avoid, reduce, or compensate for effects caused by an action. Some mitigation measures are already incorporated into the Proposed Action to avoid and reduce the potential for adverse effects. Other mitigation measures could be characterized as BMPs or ROPs that further reduce or minimize adverse effects.

4.2 SIGNIFICANCE CRITERIA

Summaries of the effects on the resources synthesize information about context, intensity, and duration, which are weighed against each other to produce a final assessment. While each summary reflects a determination using best professional judgment regarding the relative importance of the various factors involved, Table 4–1 provides a general guide for how summaries are reached.

Table 4 - 1: Descriptions of Final Assessment Categories

Assessment	**Description**
Beneficial	Resource improvements or enhancement would occur and would have a perceptible change to the resource(s).
Adverse: Negligible	Effects are generally extremely low in intensity (often they cannot be measured or observed), are temporary, and do not affect unique resources.
Adverse: Minor	Effects tend to be low intensity or of short duration, although common resources may have more intense, longer-term impacts.
Adverse: Moderate	Effects can be of any intensity or duration, although common resources are affected by higher intensity, longer impacts while unique resources are affected by medium or low intensity, shorter-duration impacts. Moderate effects may encumber Arctic Refuge purposes under ANILCA regarding fish and wildlife populations and their habitats in their natural diversity; fulfill international treaty obligations; subsistence opportunities; and, water quality and quantity.
Adverse: Significant	Impacts that in their context and due to their intensity (severity) have the potential

	to meet the thresholds for significance set forth in CEQ regulations and therefore, warrant heightened attention and examination for potential mitigation in order to fulfill the policies set forth in NEPA. Significant effects would seriously degrade, and in some instances may preclude, Arctic Refuge purposes under ANILCA regarding fish and wildlife populations and their habitats in their natural diversity; fulfill international treaty obligations; subsistence opportunities; and, water quality and quantity.

4.4 ALTERNATIVE 1 – NO ACTION-STATUS QUO

Direct and Indirect Effects: Implementation of the No Action Alternative would result in no direct or indirect impacts to any of the considered resources. There would be no new exploration activities allowed on the coastal plain; and therefore no effects due to exploratory activities would occur.

Cumulative Effects: No direct or indirect effects to the existing condition of the resources considered would occur under the No Action Alternative; therefore, no cumulative effects would occur on the resources.

4.5 ALTERNATIVE 2 – PREFERRED ACTION

No on-the-ground activities will be directly authorized by the proposed revision to the regulation. However, the following is an analysis of the types of impacts that could occur if specific exploratory activity proposals are authorized in the future after plan-specific assessment.

Table 4.2. Summary of Environmental Factors Considered for Evaluation and Environmental Consequences

ENVIRONMENTAL FACTOR	ENVIRONMENTAL CONSEQUENCES
Soils (closely allied with vegetation)	Overall, minor direct effects short- and long-term; potential for locally moderate indirect long-term impacts to soils may occur with thermokarsting due principally to topographic relief of the 1002 area with higher potential for soil erosion or slumping.
Water Resources, Hydrology and Wetlands	Overall, minor direct effects short- and long-term; potential moderate effects due to the water-limited characteristics of 1002 area additive with climate change (warming and drying). Some effects and their significance may be determined long after the disturbance has occurred.
Climate	Overall, climate will not be affected by exploration activities. Climate change will occur independently of the proposed action, specifically long-term warming and drying. As a consequence this may affect surface and exploratory activities, and may add incrementally effects to fish, wildlife and their habitats, and water resources of the coastal plain 1002 area.
Vegetation (closely allied with soils)	Overall, minor direct and indirect effects short- and long-term; potential for locally moderate impacts if natural recovery is prolonged or requires decades to

	recover due principally to topographic relief of the 1002 area and higher potential for soil erosion or slumping.
Fish	Overall, minor to moderate direct effects short- and long-term; potential for moderate effects locally.
Golden Eagles (Bald Eagles dropped for further analysis)	Overall, minor direct and indirect effects short- and long-term; generally negligible to minor, but there may be moderate localized impacts. Early nesting birds may be affected by exploration activities if close to nest sites or occupied territories.
Resident Birds	Overall, minor direct and indirect effect short- and long-term; potential for moderate localized impacts with risk to disturbance or displace individual Gryfalcon nesting pairs or territory holders in close proximity to exploration activities in April to May, late spring exploration activities or seasonal demobilization.
Migratory Waterfowl, Shorebirds and Landbirds	Overall, negligible to minor direct and indirect effect short- and long-term; if there is an effect it will most likely be connected with water resources or wetlands therefore limiting to waterfowl and/or shorebirds.
Caribou	Overall, minor to moderate direct and indirect effects short- and long-term.
Other Terrestrial Mammals	Overall, minor direct and indirect effects short- and long-term.
Polar Bears	Moderate to significant: due to the higher density and habitat preference of polar bears for the coastal plain 1002 area, assuming a proportionate increase for bear-human conflict at all seasons and uncertainty regarding extent and type of proposed activities and effectiveness of potential mitigation measures.
Bowhead Whale	Overall, negligible to minor direct and indirect effects short- and long-term; potential for effects due to exploration activity staging of personnel or materiel via barge traffic in the Chukchi and Beaufort Seas when whales are present (and may affect subsistence use).
Ringed and Bearded Seals	Overall, negligible to minor direct and indirect effects short- and long-term; potential for moderate effects due to exploration activity staging of personnel or materiel via barge traffic in the Chukchi and Beaufort Seas when whales are present (and may affect subsistence use).
Cultural Resources	Overall, negligible to minor direct and indirect effects short- and long-term; requires coordination and consultation under NHPA with SHPO.
Socioeconomic	Overall, minor direct and indirect effects short- and long-term; potential for locally moderate to significant effects to developing tourism industry at Kaktovik with staging and pre-survey activities.
Subsistence	Minor; no significant restriction on subsistence uses.
Noise	Overall, negligible to minor direct and indirect effects short- and long-term; some localized high intensity, short-duration noise may occur; potential effects to caribou, muskox and polar bears depending on noise duration, intensity, frequency and reaction of individual or herd animals (includes winter exploration and/or staging and pre-survey activities).
Wilderness Values	Overall, negligible to minor direct and indirect effects short- and long-term; temporary moderate effects may occur.

PHYSICAL ENVIRONMENT

4.5.1 Soils

The NPRA Integrated Activity Plan/EIS (BLM 2012) for the NPRA describes general consequences to soils as a result of seismic exploration activities.

Seismic surveys to collect geological data would occur during the winter months. Frozen ground and sufficient snow cover, along with the requirement for low-pressure ground vehicles, would prevent most disturbances to vegetation or compaction of the soils. A majority of seismic surveys create minor, short-term disturbance to soils and vegetation (Kevan and others 1995; Kemper and MacDonald 2009a, 2009b; Jorgenson and others 2010). However, even with protective measures in place, some small areas of disturbance to soils and vegetation would be expected to occur from seismic surveys and overland moves. In some instances, past overland moves and seismic surveys have disturbed vegetation (the insulating layer), altered the thermal balance, and increased the risk of thermokarsting, causing the permafrost to melt and creating surface subsidence (Jorgenson and others 2010; Jones and others 2013). Areas of soil disturbance could be caused at streambank crossings from damage to the vegetative mat, which could be scraped away, leaving exposed soil. Disturbance could also be caused, damaging the tops of tussocks in dryer areas, reducing the insulating abilities, and hastening loss of permafrost. Water-saturated areas show less damage to vegetation and soils from large-tired vehicles (Becker and Pollard 2016). The potential for soil erosion would increase with an increase in disturbance to soil and vegetation. Best management practices and other measures, including required use of low ground-bearing pressure vehicles, are designed to keep areas and severity of disturbance as small as possible.

Soil and plant community impacts may occur even with the use of winter surveys and new technology including low ground-bearing pressure vehicles and seismic lines in lieu of charges. Where soils are exposed without snow cover or shallow snow cover, thermokarst may develop long after seismic surveys due to that initial disturbance (Kemper and MacDonald 2009a, 2009b; Jorgenson and others 2010). In some instances, severe impacts to tundra vegetation persisted for decades after disturbance from exploratory activities (Jorgenson and others 2010; Becker and Pollard 2016; Jones and others 2013; McCarter and others 2017).

Impact Summary: Overall minor, with potential for locally moderate due to the time required for natural recovery and thermokarsting.

4.5.2 Water Resources and Wetlands

This section analyzes the impacts of using temporary water-based infrastructure such as ice roads and ice pads to support winter seismic exploration. It is clear that because unfrozen water is limited in winter on the Arctic coastal plain, negative effects of water withdrawals on overwintering fish populations, benthic invertebrates, and birds and mammals that feed on those organisms seem likely (West and others 1992). Water withdrawal and its direct influence on reducing available habitat (wetted space) probably impacts fish populations more than any other winter alteration (Cunjak 1996). Since the distribution of adult and juvenile fish is extremely restricted during the long arctic winter when most of a drainage is frozen solid (Craig and Poulin 1975), water removal , leading to reduced groundwater flow or altering baseflow, ice and temperature regimes has the potential to affect all life stages of some populations. Seismic activity could potentially reduce fish populations, divert fish from their normal locations, or adversely affect fish populations and habitat. Exploration activities bring the potential for fuel spills or other releases of contaminants that could affect water quality.

Seismic exploration and thermokarst activity. Seismic exploration can cause thermokarst, especially when snow is insufficient to protect soil and vegetation (WesternGeco 2003). Removal or damage of the organic mat exposes soils to erosion by wind and water, which could deposit sediment into water bodies resulting in higher turbidity and concentrations of suspended sediment. To cause high turbidity, the peat mat must be sufficiently eroded to expose underlying mineral soils, and the mineral soils must be fine grained (BLM 2012).

Use of Explosives. Use of explosives is a major disturbance to fish and wildlife. These are particularly stressful to fish that are captive in overwintering habitats and would likely have a negative impact on terrestrial and aquatic animals that congregate near spring-fed oases during winter as well as presenting potential contamination issues.

Effects of Water Withdrawal from Lakes. In other areas of the North Slope the primary source of water during the winter months for exploration activities is unfrozen water that lies beneath the ice cover of both shallow and deep lakes. This water is somewhat saline because of the exclusion of ions during the freezing of the upper part of the lake. Water from lakes may be used for ice roads, pads and airstrips, and potable water for field crews. Typically the volume of water taken from an individual lake depends on the depth of the lake, volume of unfrozen water in the lake, and the presence and type of fish documented (BLM 2012).

Water withdrawal affects the available habitat for fish species if they are present, macroinvertebrates and can otherwise impact aquatic habitat by further altering water quality and reducing the water available when breakup occurs potentially affecting spring recharge and lake levels.

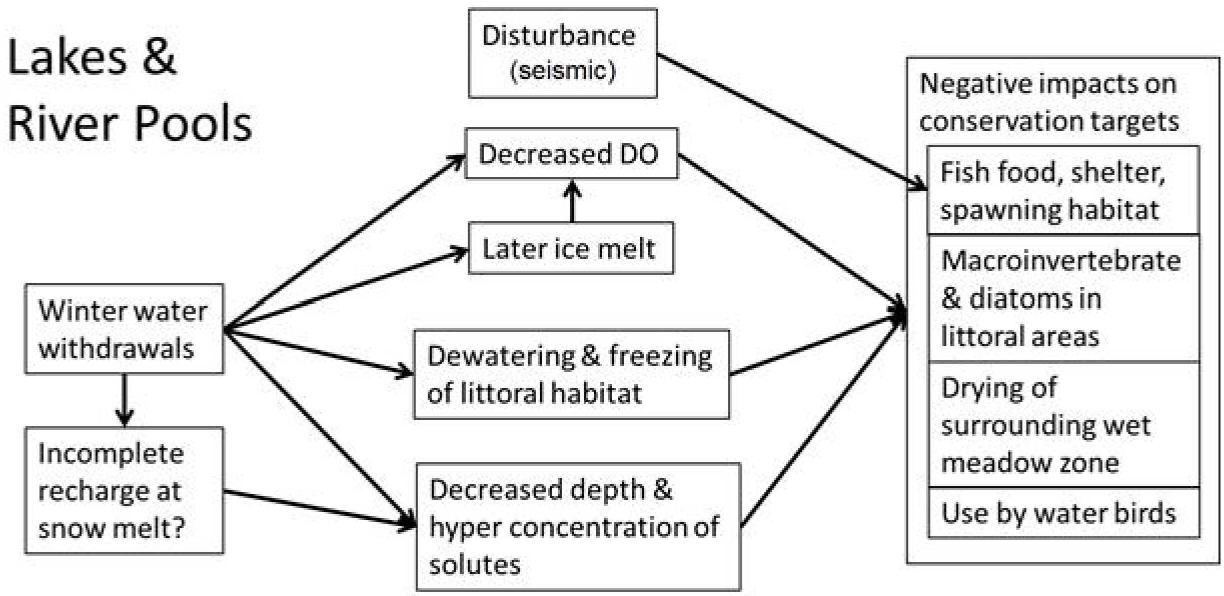


Figure 4.1 Potential impacts of seismic exploration on lakes and rivers

Removal or compaction of snow can increase the depth of freezing on lakes, sometimes by one foot or more. As a result, the water quantity available in a lake during the winter months can be greatly reduced, and the salinity of the water beneath the ice can be increased further. Maintaining the natural hydrologic regime may not be possible under various pumping scenarios. To reduce impacts to the natural hydrologic regime, regulations typically prohibit snow compaction on fish-bearing lakes, but snow compaction is unavoidable when ice aggregates are removed from lakes (BLM 2012).

There are no studies assessing the effects of permitted withdrawals on lake water chemistry on the North Slope of Alaska. Hinzman and others (2006) conducted a study to assess the effects of what turned out to be relatively small water withdrawals on water chemistry and lake-recharge. This work was funded by the Department of Energy (DOE) and oil field companies, and did not undergo a standard peer-review process, yet it is widely cited by the BLM and DOE. Unfortunately, only a small fraction of the permitted withdrawal volume was actually pumped from the study lakes, the study design had almost no ability to detect change, and the researchers were unable to get their dissolved oxygen sensors functioning to conduct any relevant measurements in pumped lakes. Thus, we have no information on potential impacts of heavy pumping that is currently allowed by water withdrawal permits on the North Slope of Alaska (i.e., State of Alaska water rights, EPA/USACE 404 permits). Despite the poor capacity to detect change, Hinzman and others (2006) did find that 1 of 4 pumped lakes did not fully recharge at snow melt. This suggests that water withdrawals far below requested permitted volumes can have substantial impacts on lake hydrology and the availability of “wetted” habitat, or those habitats wet during the growing season with saturated soils and supporting hydric vegetation. Canadian studies on ice-covered lakes have found that water withdrawals have a substantial and wide range of negative impacts on aquatic ecosystems (Cott and others 2008). These include reduction of habitat for fish, waterfowl, and furbearers; reduction in oxygen available to overwintering fish; and dewatering and freezing of littoral habitats which kills plants, invertebrates, and fish eggs. Isolated lakes may be particularly vulnerable as they may not recharge at snowmelt. Organisms in small isolated lakes are particularly sensitive to water withdrawals. The effects of water withdrawals on wet meadow zones surrounding lakes are unknown, but would likely be great if lakes are not fully recharged at snowmelt. This would result in a reduction in habitat for waterfowl and shorebirds that use these lakes during the summer. The ADNR regulates the winter withdrawal of water from lakes for ice construction, and limits the amount of allowable withdrawal to such amounts that are unlikely to substantially affect overwintering fish populations or the ability of the lakes to recharge.

Effects during exploration on water chemistry from water withdrawals could be short term if lakes are fully recharged during spring. Impacts to overwintering fish and littoral zone communities will likely be more substantial and longer-term, especially in isolated lakes.

<u>Effects on Wetlands</u>. Impacts to wetlands associated with vehicles depend on the type of vehicle, the vegetation type, and the snow conditions. Vehicle traffic may affect wetlands, soil chemistry, soil invertebrates, soil thaw characteristics, and cause small-scale hydrologic changes (Kevan and others 1995). Overlying vegetation serves as an insulating layer that prevents thawing of permafrost near the surface. Any disturbance that removes the overlying vegetation, or otherwise decreases its insulating capacity such as vegetative compression from ice road and pad construction, can initiate melting of ice-rich permafrost and result in surface subsidence, termed thermokarst. This disturbance can drastically alter the surface topography, hydrological regime, and temperature of the underlying soils. In wet tundra, this disruption can result in water accumulation and thermokarst. In drier tundra, travel over low shrubs can cause breakage and tussocks may be broken or crushed. The later melting of ice roads and pads could affect surface water movement during breakup that is essential to water recharge and movement across the landscape. Severity of impacts would depend upon the actual location and type of habitat, but impacts could range from temporary to longer-term.

<u>Effects of Ice Roads, Ice Pads and Ice Bridges</u>. Ice roads and ice pads are used extensively during the winter season for access and for seismic exploration. Ice roads require about 1 million to 1.5 million gallons of water per linear mile and generally can be built at a rate of about 1.5 inches of thickness per day (BLM 2012). Ice pads can require up to 5 million gallons of water to build and range in size from 3 to 10 acres. Floating ice bridges may be necessary to cross large rivers and must be of sufficient thickness to handle heavy truck traffic. Smaller rivers require ice bridges, which are often constructed of aggregate chips and water and placed on grounded ice. Ice roads and bridges can cause additional freeze-down, reducing the already limited overwinter

water volume available for fish habitat and affecting water quality. During snow melt ice bridges can create ice dam flooding if not removed properly.

The NPRA Integrated Activity Plan/EIS (BLM 2012) describes general consequences to wetlands and such seismic exploration activities of the coastal plain 1002 area may be similar. The majority of the coastal plain 1002 area is considered wetlands, according to the NWI database. It may be assumed that any ground-disturbing actions to vegetation from construction and use of temporary ice facilities will also be impact wetlands.

Impact Summary: Effects to water resources and wetlands may be minor locally, with the potential for moderate effects at specific locations due to the nature of the water-limited ecosystem. Some effects and their significance may be determined long after the disturbance has occurred. Exploration would affect the annual and seasonal water budgets and water quality, including wetlands, with the result that any species dependent of those aquatic habitats and wetlands could be affected, specifically fish, waterfowl and shorebirds.

4.5.3 Climate

Climate will not be affected by the proposed action or any exploration activities. Exploration activities will be additive to climate factors, including continuing and accelerated warming and drying of the Beaufort Sea coastal plain 1002 area, specifically as an added stressor to natural and physical resources present. Additionally, climate may affect the conduct of exploration activities such as winter exploration that is premised upon the presence of adequate snow cover to protect soils and vegetation during seismic surveys, which may be greatly reduced or absent in the future. Permafrost degradation will likely continue and accelerate, increasing the potential for soil and vegetation impacts. Reduced availability of water seasonally and annually may affect water quantities needed for ice road construction.

Impact Summary: Overall, climate will not be affected by exploration activities. Climate change will occur independently of the proposed action, specifically long-term warming and drying. As a consequence this may affect surface and exploratory activities, and may add incrementally effects to fish, wildlife and their habitats, and water resources of the coastal plain 1002 area.

4.6 ALTERNATIVE 2 - PREFERRED ACTION

BIOLOGICAL ENVIRONMENT

4.6.1 Vegetation

Closely allied with the effects to soils, exploratory activities are anticipated to be overall minor, short-term disturbances. Vegetation along stream banks may be particularly at risk to slumping or soil erosion disturbances as equipment uncross uneven ground but these sites are more resilent and recover quicker (Jorgenson and others 2010). The NPRA Integrated Activity Plan/EIS (BLM 2012) indicates that in general, construction of ice roads, pads, and airstrips, occasionally substituting gravel to insulate permafrost in some circumstances, would have only localized impacts on vegetation, usually limited in wetter areas to compression of the tundra vegetation under the roads and pads and a shortened growing season for the plants in the following summer due to delayed melting of the ice in the spring. Construction of ice roads and pads could also cause breakage of shrubs and scuffing and crushing of tussocks in moist or drier habitats, and localized areas of plant death (Jorgenson 1999; Pullman and others 2005; Yokel and others 2007). Recovery from most impacts to vegetation would be expected within a few years.

Plant community impacts may occur even BMPs and ROPs including use of low ground-bearing pressure vehicles and seismic lines in lieu of charges. Where soils are exposed or shallow snow cover, thermokarst may develop long after seismic surveys due to that initial disturbance (Kevan and others 1995; Kemper and MacDonald 2009a, 2009b; Jorgenson and others 2010). The greatest potential risk for vegetation impacts does not occur during the seismic surveys but the supporting infrastructure to support exploratory activities, i.e., the man-camps and their movement on heavy skids. In some instances, severe impacts to tundra vegetation persisted for decades after disturbance from exploratory activities (Jorgenson and others 2010; McCarter and others 2017).
Impact Summary: Overall, minor direct and indirect effects short- and long-term; potential for locally moderate impacts if natural recovery is prolonged or requires decades to recover due principally to topographic relief of the 1002 area and higher potential for soil erosion or slumping.

4.6.3 Fisheries

Direct impacts would include mortality to fish or alterations to habitat by geophysical exploration that make these unacceptable or suboptimal for life history requirements and/or long-term survival, including contaminant spills, failure of sewage or waste-water disposal, blasting, channelization, culverts or barriers to movement, increased turbidity from construction, toxic effects of drilling muds or depletion of dissolved oxygen levels.

Effects of seismic exploration on water resources and aquatic habitats. Seismic surveys can be conducted using dynamite (or other explosives), air guns, or vibroseis to generate acoustical energy pulses necessary to locate subsurface geological formations that might contain oil or gas (BLM 2012). Research has demonstrated that high-intensity acoustic energy can lead to damaged auditory sensory hair cells in fish, effectively reducing the ability to hear (McCauley and others 2003; Popper 2003; Smith and others 2004; Popper and others 2005). The extent of damage and the ability to regenerate these cells is dependent on the intensity and duration of noise and the species of fish. Underwater shock waves can also cause injury to the swim bladder and other organs and tissue (Wright 1982), which could result in a sub-lethal or lethal effects. Fleeing behavior is also a well-documented response by fish to anthropogenic sounds (Popper 2003; Popper and others 2004). Because of a lack of information regarding the impacts on fish from vibroseis specifically, winter field tests on the North Slope were conducted in 2000, to measure the sound pressure levels in water that were generated by vibroseis rigs operating on the ice overhead (Greene 2000; Nyland 2002). The results indicated that these sound pressures were great enough 10 meters from the source to cause avoidance behavior, but no measurements were made directly below the vibroseis equipment. Fish fleeing behavior was the most obvious effect of vibroseis during the 2003 ADNR/BLM study (Morris and Winters 2005). Because exploration using vibroseis occurs in the winter when physiological stress is the greatest for most fish species, a flight response could potentially be detrimental (BLM 2012).

Direct, indirect, and cumulative effects of geophysical exploration pose little risks to freshwater fisheries and their habitats based on recent evaluations and using BMPs that have evolved since the late 1970s to late 1980s (Moulton and George 2000; NRC 2003; BLM 2012). The use of vibration equipment in lieu of blasting has reduced overpressure mortalities in fish and less intrusive to habitats. Low ground-bearing pressure vehicles reduce soil disturbances and potential for sediment mobilization and associated accumulation to lakes and streams. Capping the amount of water withdrawal from any natural waters may minimize overwinter mortalities or reduction of overwintering habitat for fish.

Impact Summary: minor to moderate

4.6.4 Golden Eagles

Exploratory activities are not anticipated to effect Bald Eagles as these are unlikely to be encountered during winter months. Golden Eagles due to their more ubiquitous presence and tendency to remain on or near nesting territories through the winter, will require further evaluation under specific exploration plan applications with BMPs, ROPs, and SUP stipulation as warranted.. Golden Eagles are known to be present and feed on caribou calving groundsthe coastal plain 1002 area. Elsewhere, disturbances connected with human activities are correlated with reduction in golden eagle nest success (Kochert and others 2002; Watson 2010) and late spring exploration activities in April and May may have similar results.

Impact Summary: Generally negligible to minor, but there may be moderate localized impacts. Early nesting birds may be affected by exploration activities if close to nest sites.

4.6.5 Resident Birds

Ptarmigan and gyrfalcon are known to be present within the coatal plain1002 areaduring the winter (Platt 1976). Gyrfalcon, like Golden Eagles, are early-nesting birds that could be disturbed by winter seismic exploration on close proximity during late operation and demobilization phases, April and May. Gyrfalcons are known to elicite strong defensive behavioral responses to fixed- and rotary-winged aircraft especially near occupied breeding sites (Booms and others 2008).. Disturbed birds are less likely to reuse the same site in subsequent year (Booms and others 2008). Further analysis of project specific plans will analyze possible effects and potential mitigation measures for bird species present during any proposed seismic activities. Gyrfalcons and their primary prey species, Willow and Rock Ptarmigan, have all demonstrated global declines in recent years which may be associated with climate change (Watson and others 2011). Incremental disturbances due to exploration activities could impose additional stressors to these species in the long term.

Impact Summary: overall minor, with the potential to disturb or displace individuals nesting pairs territories or nesting efforts in close proximity to late spring exploration activities or seasonal demobilizations.

4.6.6 Migratory Birds

Many species of migratory birds use the coastal plain for nesting or for feeding in preparation for fall migration. These include a variety of waterfowl and shorebirds that are dependent on aquatic and lakeshore habitats for nesting or feeding. If winter water withdrawals impact shoreline vegetation and/or aquatic plants, fish, and invertebrates, these effects could negatively impact waterfowl and shorebirds.

Impact Summary: Negligible to minor.

4.6.7 Other Terrestrial Mammals - (Muskox, Wolverine, Grizzly Bear)

Impacts to habitat used by terrestrial mammals would be minor, as most seismic activities would occur during the winter on frozen tundra or ice. Potential causes of disturbance to terrestrial mammals from exploration 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. Where seismic exploration survey lines are located only 660 to 1,200 feet apart, localized displacement of terrestrial mammals could last for several days or lead to complete abandonment of localized habitat.

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 1985). Responses varied from no change in behavior to becoming alert, forming defense formations, or running away (Winters and Shideler 1990). The movements of muskoxen away from the seismic operations did not exceed 3 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 (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 even 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 upon the location of the seismic exploration, impacts on muskox populations would be non-existent to minor.

Seismic camps could result in localized disturbance and/or displacement of terrestrial mammals for up to a few days. Bears and foxes could also be attracted to camps and conflict could result. Since seismic camps generally move at least once a week and proper handling of wastes would be regulated through permitting, the potential for bears or foxes to be attracted to human food sources would be minor. In addition, most seismic activity would occur when bears were hibernating and not attracted to scents. However, grizzly bears denning on the coastal plain, including females with dependent cubs, would be exposed to disturbance from seismic activities. Disturbance during winter can cause bears to abandon their dens, which increases winter mortality. Mitigations measures, such as those employed in existing oil fields west of the refuge will be required to minimize this disturbance.

The potential effects of seismic activities on wolverines would include disturbance from air and surface vehicle traffic, and increased human presence. Wolverines are considered a shy and secretive species that is present at very low densities and may be sensitive to disturbance.

Impact Summary: minor.

4.6.8 Caribou

Caribou of the Central Arctic, Teshekpuk and Porcupine herds may be present in the coastal plain 1002 area throughout the year depending upon snow cover precluding access for forage, but would be primarily limited to wintering grounds during the winter exploration activity period, December to May.

Exploration activity effects on caribou may include temporary habitat displacement and increased individual energy-reserve expenditure associated with behavioral response. Caribou overwintering on the coastal plain would likely be encountered during exploration surveys. It is possible that displacement of caribou by exploration activities during winter could have a negative effect on individual energy-reserves (intake versus expenditure). Because these animals are mobile and the activity is expected to short in duration (i.e., lasting only 2 to 3 days at any location), it is not anticipated that any lasting adverse impacts to caribou individuals or herd integrity in most circumstances. However, due to annual variations in environmental conditions, nutrition values of forage, or other natural or externally caused stressors, thresholds for winter survival vary from year to year. It is possible that exploration activities may have an additive effect on natural winter mortality and could disproportionately impact young of the year and gravid cows. Caribou have been shown to exhibit panic or violent, running reactions to aircraft flying at elevations of approximately 160 feet and to exhibit strong escape responses (animals trotting or running) to aircraft flying at 150 to 1,000 feet (Calef and others 1976). Additional effects on caribou nutrition during the calving and post calving periods could occur as a result of delayed green up of vegetation underlying ice roads and pads or areas of compacted snow. Rain-on-snow events are likely to increase in a warming Arctic and severely limit nutrient uptake for caribou and can greatly affect herd survival (Hansen and others 2011; Wilson and others 2012). The severity of these impacts would be dependent on the extent of the affected areas and by timing of snowmelt during a particular year.

BMPs or ROPs may be attached to SUPs for general wildlife and habitat protections, such as for the NPRA integrated activity plan/EIS and associated seismic activities (BLM 2012, 2016). These permit conditions have proven utilitarian but are primarily oriented towards minimizing conflicts when caribou are present during summer months. What is unknown is the response of individuals and herd to an increased human presence in an area that has been managed for its wilderness values with minimal management since the mid-1980s (FWS 1988a, 1988b, 2015a, 2015b). Further, it is unknown what related activities are necessary to prepare and stage for winter exploration activities, including increased fixed- and rotary-winged aircraft that may occur outside of the December to May timeframe, and possibly when caribou are present in the 1002 area. Low flying aircraft have been demonstrated as eliciting strong responses in some instances (Calef and others 1976). This is pertinent as there are implications that caribou (including free-ranging reindeer) declines globally are related to stressors caused by increasing human activity and industrial development (Vors and Boyce 2009; CAFF 2010).

While caribou may tolerate human presence and human activity and oilfield development, as noted above, behavioral responses may be individual or herd specific, and appear not to have affected overall health of Beaufort Sea coastal plain caribou at this time (Ballard and others 2000; Cameron and others 1979, 1989, 2005; Cronin and others 2000; among others), However, repeated disturbance, even if below the threshold of observable response, may displace individuals or groups, and if persistent may result in displacement or abandonment of these areas, thereby forcing caribou to move farther distances (Webster 1997; Wolfe and others 2000; Cameron and others 2005). With projected environmental change plus the addition of exploration activities, a threshold may be crossed at some point in the future where wildlife resource requirements may come in direct conflict with industry.

Impact Summary: minor to moderate.

4.6.9 Polar Bears

Compared with other areas of the Beaufort Sea coastal plain from Point Barrow to Demarcation Point (U.S.-Canada boundary), the 1002 area has a higher presence of polar bears and polar bear denning habitat (Amstrup 1993; Durner and others. 2006). This is likely to increase in the foreseeable future as human presence and development are projected to continue along with climate driven changes degrading polar bear foraging opportunities and habitat quality (FWS 2016). This has the likely potential to place polar bears and human activities in conflict.

Polar bears present in the coastal plain 1002 area may be affected by exploration through a variety of ways. Noise, vibrations, sights, and smells produced by seismic survey activities may elicit a wide range of responses from polar bears, even with exploration activities purposely designed to occur during winter months to minimize conflicts with wildlife (BLM 2016; FWS 2016).

Polar bears respond to the sights and sound of snowmachines, vehicles, vessels, and aircraft; especially helicopters (Watts and Ratson 1989; Dyck 2001; Dyck and Baydack 2004; Andersen and Aars 2005). Polar bear responses to disturbance are highly variable and are influenced by an individual bear's previous experiences and tolerance humans and human activities. Polar bears are most likely to respond to exploration activities with short-term behavioral and physiological responses such as avoidance, increased vigilance, increased heart rate, and other stress responses. Disturbance during resting may result in increased energy expenditure or adverse physiological responses (Watts and others 1991). Short-term reactions rarely affect the health or survival of individual animals or at the population level, although disturbance studies of wildlife indicate that repeated intrusion may result in the individual(s) abandoning the site of the disturbance. The effects of fleeing from aircraft may be minimal if the event is high-intensity, short-duration and the animal is otherwise healthy and unstressed. However, on a relatively warmer day (an increasing phenomenon in a warming Arctic), a short run may be enough to overheat a well-insulated polar bear. The effect of fleeing an aircraft or ground vehicle on polar bear cubs, particularly cubs of the year, would likely be the use of energy that otherwise would be needed for survival during a critical time in the life history of a polar bear, and with a survival potential should a female and cub be separated during such an event. If the exposure and separation, or both, were brief and singular then the effect would most likely be minimal. Chronic (repeated) disturbances, extreme reactions, disruption in key behaviors such as feeding or denning, or separation of dependent cubs from the female are more likely to affect health of individuals in in some instances, effects for the population. Polar bears directly interacting with seismic survey activities increase the risk of human-bear encounters, conflicts, and injury or death of polar bears.

Exploration activities with the potential to disturb female polar bears at maternal den sites are of great concern. Minimizing disturbance while bears are in dens is important because timing of den emergence is significantly related to cub survival (Rode and others In press). Female polar bears entering dens, and females in dens with cubs, are more sensitive to noises than other age and sex groups. Disturbance during the early stages of denning may cause a female polar bear to abandon the den site in search of another. Such a displaced female polar bear may locate another suitable den site and continue the reproductive process. Denning female bears may abandon their dens early in response to stress (Amstrup 1993). Most denning polar bears continue to occupy the dens after close approaches by aircraft (Amstrup 1993). Although the snow attenuates some aircraft noise (Blix and Lentfer 1992), repeated overflights may cause polar bears to abandon or leave dens temporarily. Premature den site abandonment after the birth of cubs or if the female abandons the cubs after they emerge from the den, will result in cub mortality. The potential for additional disturbance increases once the female emerges from the den. She is more vigilant against perceived threats and easier to disturb.

Although projected future human activity, such as development or subsistence use are anticipated to have a smaller effect on polar bear populations than the loss of sea ice habitat, the cumulative effects of exploration activities would be incremental and additive, even if not fully understood due to uncertainty (Fuller and others 2008; Wilson and others 2013; Regehr and others 2015; Atwood and others 2016). Habitat loss due to changes in Arctic sea ice is the primary cause of decline in polar bear populations, and the decline of sea ice is expected to continue throughout the polar bear's range for the foreseeable future (FWS 2016). Climate change projections for polar bears are expected to have greatly decreased persistence throughout the Arctic with distribution occurring in the most favorable remaining habitats (Atwood and others 2015). The 1002 area is a location already documented as possessing higher polar bear occurrence and denning sites in the larger Beaufort Sea coastal plain landscape. Therefore, there is a potential risk for bear-human conflicts that will need to be addressed through consultation under the MMPA and Endangered Species Act to avoid negative effects of exploration activities for SBS population of polar bears.

The requirements of incidental take authorizations under the MMPA, such as polar bear interaction plans, training, monitoring, and mitigation measures have proven effective at reducing the effects of oil and gas industry activities, including seismic surveys, on polar bears in other areas of northern Alaska. Mitigation measures, including a pre-activity den survey and 1-mile operational exclusion zones around known dens, aid in limiting disturbance of denning female polar bears. The current incidental take regulations for oil and gas industry activity in the Beaufort Sea and adjacent areas of northern Alaska, include a comprehensive analysis of the effects of oil and gas industry activity to polar bears, as well as mitigation, monitoring, and reporting requirements (FWS 2013, 2016). A detailed description of mitigation measures on polar bears is available for integration into exploration plan applications (50 CFR Subpart J § 18.128).

While the consultation and regulatory processes of the Endangered Species Act and MMPA have proven effective at reducing the effects of oil and gas industry activities on polar bears in other areas of northern Alaska, it is important to note that exploration plans, interaction plans, training, monitoring, and mitigation measures are specifically designed and implemented for specified areas and activities. Some measures used in other areas could generally apply to activities in the coastal plain 1002 area, but others will likely be ineffective or inappropriate. Because of the distinct habitat characteristics of the 1002 area and because polar bears use preferred habitat more frequently and in higher densities in the 1002 area, the effectiveness of existing measures in the 1002 area is currently uncertain. Plans and measures will need to be designed and implemented specifically for exploration activities in the coastal plain1002 area to ensure their effectiveness at reducing the effects of exploration activities.

Impacts to polar bears from exploratory activity would be limited by the environmental protection requirements in 50 C.F.R. 37.31, which require permittees to conduct operations in a manner which avoids significant adverse effects on the Refuge's wildlife, its habitat, and environment. Such requirements include several measures specifically intended to avoid or limit impacts to polar bears and other wildlife, including for example prohibition of the harassment of wildlife (37.31(b)(10)) and the prohibition on the use of explosives within 1/2 mile of any denning polar bears (37.31(b)(11)). Additionally, 37.31(a) provides the Service authority to impose additional stipulations to ensure that permittees' activities are conducted in a manner which avoids significant adverse impacts, such as pre-operational thermal surveys for denning polar bears.

Impact Summary: Moderate to significant: due to the higher density and habitat preference of polar bears for the coastal plain 1002 area, assuming a proportionate increase for bear-human conflict at all seasons and uncertainty regarding extent and type of proposed activities and effectiveness of potential mitigation measures.

Consultation will be required to identify and resolve issues specific to the coastal plain 1002 area and develop conservation measures to preclude jeopardizing the polar bear and its designated habitat. Per 1002(d)(1), the Service may not legally approve plans that will result in significant impacts to fish and wildlife, and must condition such approvals to avoid such significant impacts.

4.6.10 Bowhead Whale

Bowhead whales would generally only be affected if exploration activity includes shippingvia barge through the Beaufort and Chukchi Sea. Vessel traffic, including barging, has the potential to disturb bowhead whales and affect their migration routes. Vessel strikes have been documented to occur, albeit infrequently. Further analysis, in conjunction with the National Marine Fisheries Service, of project specific plans will analyze possible effects and potential mitigation measures for bowhead whales.

Impact Summary: Negligible to minor.

4.6.11 Bearded and Ringed Seals

Similar to bowhead whales, bearded and ringed seals would generally only be affected if project infrastructure will be shipped to the project site via barge through the Beaufort and Chukchi Sea. Vessel traffic, including barging, has the potential to disturb seals. Further analysis, in conjunction with the NMFS of exploration activities will analyze possible effects and potential mitigation measures for these ice seals.

Impact Summary: Negligible to minor.

4.7 ALTERNATIVE 2 - SOCIAL ENVIRONMENT

4.7.1 Cultural Resources

Very little cultural resource investigations or inventories have occurred within the 1002 area. Therefore, pursuant to Section 106 of the National Historic Preservation Act, applications for exploration within the 1002 would be required to include sufficient identification and evaluation of cultural resources to ensure that potential adverse effects could be avoided, minimized or mitigated. Winter seismic activities are conducted when the ground is frozen and there is sufficient frost and snow depth to minimize impacts to vegetation. This tends to also minimize impacts to cultural resources.

Impact Summary: Negligible to Minor.

4.7.2 Socioeconomic

Impacts to socioeconomic resources would be considered to be significant if an action resulted in a substantial change in the local or regional population; and housing, community general services, or social conditions from the demands of additional population/population shifts. Impacts would also be considered major if there were a substantial change in the local or regional economy, employment, or spending or earning patterns.

We would expect minor direct and indirect effects in Coldfoot and Wiseman during transport of equipment and personnel. Communities used for staging, likely Prudhoe Bay and/or Kaktovik could expect to see increases in activity during the project. They would see increases in air traffic as equipment and personnel are transshipped to the field. Staging communities would also experience increased activity in hoteling and restaurants to support personnel. Exploration activity personnel would be experienced operators from outside the area.

Impact Summary: Minor.

4.7.4 Subsistence

The ANILCA Section 810 requires an evaluation of the effects on subsistence uses for any action to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of public lands. An analysis was completed and is included as an appendix to this document. In summary, we do not expect that winter seismic operations will cause observable direct effects to subsistence activities, but we do anticipate that the hardened tracks created by the mobile seismic camps will have the potential to damage snowmachines used by local subsistence users who are traveling though out the area hunting and fishing. The winter exploration activities may also force some hunters to travel farther and/or into less familiar territory.

Summer surface geological exploration activity (e.g., helicopter supported sample collection) could disturb caribou, an important subsistence resource, and could disturb subsistence hunting. However in accordance with the requirements of ANILCA § 1002(c)(1) permittees would be subject to conditions that minimize impacts to caribou, such as avoiding calving areas with helicopter use, and that minimize impacts to subsistence uses in general.

Impact Summary: Minor; no significant restriction on subsistence uses.

4.7.5 Recreation and sport hunting

On-shore seismic surveys in the winter would likely be conducted using mobile seismic camps comprised of ski-mounted trailers that are moved every few days to once a week (BLM 2012). Such activities could displace species being sought by hunters in the area, having an impact on their success if they were unable to locate animals due to the disturbance. However, sport hunting and recreational use of the Coastal Plain is very low in the winter. Any ice roads, ice pads or snow trails would be temporary. Disturbance lasts only while the survey or camp train is passing through. Lighting at the facilities would be visible to any hunters or recreationalists passing nearby. Persistence of compacted snow or ice structures may be encountered by recreationalists in the spring and are unlikely to be a barrier to recreation by foot or boat travel.

Staging of personnel and materiel for exploratory activities before December and after May, specifically summer months, may affect a growing tourism industry for polar bear viewing in Kaktovik.

Impact Summary: Negligible to Minor.

4.7.6 Noise/Soundscape

Noise from vehicles, generators, aircraft and human presence has the potential to affect both humans and wildlife within the vicinity of seismic survey activities. The disturbance distance depends on the source and strength of noise, but should be negligible outside the immediate vicinity and is only temporary in nature.

Noise duration, intensity, frequency and the reaction of polar bears may have a significant effect for individuals near seismic survey lines or other activities. This may include staging personnel and materiel for exploratory activities before December and after May, specifically summer months for a wide variety of wildlife but specifically caribou, muskox, and polar bears.Impact Summary: Generally negligible, but localized minor impacts may occur. Noise may have a effect for individuals near exploration activities, particularly caribou, muskox and polar bears.

4.7.8 Wilderness Values

Wilderness characteristics consist of size, naturalness, wildness, and outstanding opportunities for solitude or primitive and unconfined recreation. They may also include supplemental and symbolic values.

Seismic surveys would be conducted in winter, when there are fewer visitors seeking a wilderness experience come to the Arctic Coastal Plain. Ice roads, ice pads, airstrips, and snow trails would be used for staging winter seismic activities and are temporary in nature. The NPRA EIS describes seismic activity as consisting of low-ground-pressure vehicles to minimize potential impacts to the tundra (BLM 2012). The typical survey lasts about 100 days. Seismic camps, which generally consist of six camp strings of five ski-mounted trailers, are typically moved every few days to once a week. The presence of this equipment on the Arctic Refuge coastal plain would have a substantial localized but temporary impact on the wilderness value of the area where seismic surveys are being conducted during the time period of the activity. Temporary impacted wilderness values would include naturalness, outstanding opportunities for solitude or primitive and unconfined recreation, and scenic values resulting from moving camps and associated noise from generators, aircraft, vehicles/trailers and human presence (BLM 2012). Impacts to wilderness values should be negligible once the activity is completed.

Longer lasting impacts to vegetation could result from seismic surveys, which could impact wilderness values of naturalness and scenic values. The color contrast would be minimal from ground view and almost nonexistent from more than a few hundred feet away (BLM 2012). After 8 to 9 years, the evidence of use would be minimal (BLM 2012). Seismic operations by their nature do not follow the same routes every year and the number of miles of survey line run can vary greatly from year to year.

Impact Summary: Generally negligible to minor long-term impacts, but temporary moderate impacts may occur.

5 Cumulative Effects

In addition to short- and long-term direct and indirect effects of the proposed regulatory language change and associated surface geological seismic exploration in the coastal plain 1002 area, are cumulative effects. Alternatively stated cumulative effects are the sum total of past, present or reasonably foreseeable actions on the environment that result from separate, individual actions that, collectively, become significant over time. As defined by 40 CFR § 1508.7: cumulative effects are: *...the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.*

This Draft EA addresses the promulgation of new regulatory language that would reopen the coastal plain 1002 of the Arctic Refuge for surface geological and seismic exploration. The proposed regulatory change does not itself authorize any on-the-ground activities; it merely establishes a mechanism by which an applicant can seek authorization for such activities from the Service. As such, this Draft EA is necessarily general in scope and lacking many details that will be generated through formal exploration plan application review and processing by the Service.

It is important to note that due to the requirement for Federal agencies to comply with NEPA for approval of actions affecting Federally-administered lands and/or resources, additional environmental review prepared by the applicant is required for each exploration plan application for the coastal plain 1002 area submitted to the Service for review and processing. Through the application processing including NEPA compliance, additional clarification for environmental protections or mitigation measures to avoid, minimize, rectify, reduce, or compensate direct, indirect, and cumulative impacts may be considered for their significance in both context and intensity.

At such time as exploration plans are received, a thorough review of the proposed activity and actual or potential environmental effects may be initiated across multiple disciplines. Among such would be a cumulative effects analysis, following the tenets contained in *Considering Cumulative Effects under the National Environmental Policy Act* (CEQ 1997).

Specifically this will include an exhaustive review of advances in state-of-the-industry for oil and gas or other technological improvements plus advances in understanding biological and physical resources of the Arctic region and Beaufort Sea coastal plain in particular, since the publication of 50 CFR §§ 37 *Geological and Geophysical Exploration of the Coastal Plain, Arctic National Wildlife Refuge, Alaska* (FWS 1983) and the *Coastal Plain Report/EIS* (Clough and others 1987).

Cumulative effects that should be addressed include discipline-specific consideration of:

- Past, present or reasonably foreseeable actions
- Climate change
- Habitat fragmentation in landscape context, i.e., the entire Beaufort Sea coastal plain from western Canada to Barrow, AK
- Management decisions under conditions of uncertainty
- Polar bears in the future
- Exploration, development and production relationships

6 Agency Consultation and Coordination

NEPA requires the integration of other required planning and environmental permitting so that all procedures occur concurrently rather than consecutively (40 CFR § 1500.2(c).

6.1 NATIONAL HISTORIC PRESERVATION ACT

Through 50 CFR § 37 and Section 106 of the NHPA, during the exploration plan application process the Service will either conduct or direct applicants to conduct appropriate cultural resources investigations and will consult with the Alaska State Historic Preservation Office (SHPO) and interested or affected parties to identify the presence of, and potential adverse effects to, historic properties. If the Service determines that historic properties would be adversely effect, in consultation with Section 106 parties, including exploration applicants, the Service may require modifications to avoid or mitigate adverse effects to historic properties caused by exploration.

6.2 MARINE MAMMALS PROTECTION ACT AND ENDANGERED SPECIES ACT (SECTION 7) CONSULTATION PROCESS

The coastal plain 1002 area is inhabited by plants, animals, or their habitats determined to be threatened, endangered, or to have some other special status, particularly under the MMPA and Endangered Species Act (ESA). Through the exploration plan application process, including annual plan of operations and issuance of SUP, under Section 7 of the ESA and the MMPA, the Service will consult regarding threatened and endangered species, and any designated critical habitats, once specific plans are known to ensure the continued conservation of these species. The Service may require modifications to or disapprove exploration plan or plan of operations that is likely to adversely affect a proposed or listed endangered species, threatened species, or critical habitat. The BLM will not approve any activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act including completion of any required procedure for conference or consultation.

6.3 WATER RESOURCES PERMITTING

USACE 404 permit under Clean Water Act

Under Section 404 provisions of the Clean Water Act the U.S. Army Corp of Engineers issues permits regulating the discharge of dredge or fill material into wetlands. The U.S. Fish and Wildlife Service has a review and advisory role in this process. Section 401 of the Clean Water Act grants to States and eligible Indian Tribes the authority to approve, apply conditions to, or deny Section 404 permit applications based on a proposed activity's probable effects on the water quality of a wetland.

The Section 404(b)(1) guidelines are the criteria used to evaluate discharges of dredged or fill material into waters of the United States, including jurisdictional wetlands, under Section 404 of the Clean Water Act. A fundamental principle of the Section 404(b)(1) guidelines is that dredged or fill material should not be discharged into wetlands and other waters, unless it can be demonstrated that the discharge will not have unacceptable adverse impacts on those waters. The Section 404(b)(1) guidelines also require the following determinations: (1) the project is the least environmentally damaging practicable alternative, (2) the project will not cause or contribute to the violation of applicable state or Federal laws, such as water quality standards or the Endangered Species Act, (3) the project will not result in significant degradation of waters of the United States, and (4) any appropriate and practicable steps have been taken to minimize the adverse impacts of the project on wetlands and other waters.

Under Alaska law, the ADNR manages water rights regardless of land ownership. The State administers three types of water rights (subsurface water rights, consumptive surface water rights, and reservations of instream flow) and grants temporary water use authorizations.

Title 11-Chapter 93 of the Alaska Administrative Code prohibits the withdraw of significant volumes of surface water or groundwater from lakes, ponds, rivers, streams, springs, and wells without a water right or a temporary water use authorization. To withdraw water, the water user must receive authorization for temporary water use from ADNR through the temporary water use authorization process (11 AAC 93.220). An applicant must apply for the right to withdraw water through a temporary water use permit (TWUP) according to the *Procedure for Temporary Water Use* outlined in 11 AAC 93.220. The ADEC, ADF&G and the land owner review the applications and may stipulate permitting requirements.

A temporary water use authorization does not establish a water right and can only be granted when the water used does not conflict with existing water right holders and fisheries (11 AAC 93.035(b)). An authorized temporary water use is subject to amendment, modification, or revocation by ADNR if it interferes with the supply of water to lawful appropriators of record. In other words, if an instream flow reservation application or water right exists on a river or in a body of water, the TWUP applicant/TWUP holder must meet the minimum flow requirements of the reservation (11 AAC 93.035(c)). This is pertinent, since the Service maintains unadjudicated instream flow water rights (instream reservations of water) on a number of rivers and lakes of the Arctic National Wildlife Refuge under the Alaska Statute (AS) 46.15.145.

7 List of Preparers, Contributors, and Advisors

This Draft EA was developed by U.S. Fish and Wildlife Service (Service) staff. The Service holds final responsibility for all content. Personnel for each contributing party are listed in Table 6-1.

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Appendix A. ANILCA Section 810 Subsistence Analysis for the Proposed Amendment to Regulations for Geological Exploration of the Coastal Plain 1002 Area

Introduction.

The Service is required by ANILCA §810, to evaluate the effects on subsistence uses and needs in determining whether to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of public lands on National Wildlife Refuges in Alaska. The evaluation of the effects on subsistence uses and needs of a proposed amendment to regulations for geological exploration of the coastal plain "1002" area of Arctic National Wildlife Refuge (Arctic Refuge) is documented below. According to ANILCA §803, "'subsistence uses' means the customary and traditional uses by rural Alaskan residents of wild renewable resources for direct personal or family consumption as food, shelter, clothing, tools, or transportation; for the making and selling of handicraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption; and for customary trade." This §810 analysis focuses on the subsistence uses and needs on federal lands.

If this evaluation concluded with a finding that the proposed amendment to the regulations would result in a significant restriction to subsistence uses and needs, and we wished to proceed with the amended regulations, then the Service would be required to conduct hearings and to meet additional procedural requirements of §810. This analysis concludes, however, that the proposed amendment will not result in a significant restriction of subsistence uses on federal lands.

Description of Proposed Amendment and Consequences

The Service proposes to allow opportunities for the submission of applications for permits for surface geological and geophysical and/or seismic exploration on the Arctic Refuge 1002 lands described in ANILCA. Specifically, the Service proposes to amend and update the regulations at 50 CFR §§ 37 - *Geological and Geophysical Exploration of the Coastal Plain, Arctic National Wildlife Refuge, Alaska* regarding the dates when such applications may be submitted.

Direct consequences of the proposed amendment are primarily administrative in nature related to the review, permitting, and oversight of any approved proposals for exploration of the 1002 lands. As such, these consequences would have no direct bearing on subsistence opportunities. An indirect consequence of the proposed amendment to the regulations, however, would be an increased human development presence in the 1002 area by those entities who receive a special use permit for exploration. These exploratory activities could have an impact on subsistence uses and needs.

Current technology for geophysical exploration use methods and means that minimize surface disturbances during winter months when most wildlife resources are absent or otherwise less active. Best management practices (BMPs) or required operating procedures (ROPs) avoid, minimize, rectify, reduce, or compensate direct and indirect effects of exploration on the environment (e.g., Pp. 38-49 Appendix B *Stipulations and Best Management Practices*, BLM 2016). These exploration methods and means are described in detail in recent 3-dimensional (3-D) seismic exploration plans of the National Petroleum Reserve-Alaska (NPRA) as analyzed in the BLM EA for the Greater Mooses Tooth Unit (BLM 2016) and NPRA Integrated Activity Plan/EIS (BLM 2012), and adjacent offshore areas (SAExploration Alaska 2016a, 2016b; BOEM 2017).

The timing (December to early May) and magnitude of the exploratory program for NPR-A's Mooses Tooth Unit (BLM 2016) serves as the basis for this §810 analysis of the impacts of 1002 exploration on subsistence opportunities. Exploration activities generally occur in the winter with crews beginning to mobilize and build ice roads and pads in December. Full crews (40 to 60 people working in 12-hour shifts, 24 hours per day) arrive in January and commence seismic operations if the ice infrastructure has been completed. Seismic operations often involve using truck-mounted vibrators that systematically put variable frequency energy into the earth. Several of these truck-mounted vibrators are located along a line and vibrate in synchrony in order to record energy along a linear transect. The reflected energy image is recorded and the whole line moves ahead. Operations would continue through most of April, with demobilization finishing by the first part of May. Staging activities may extend beyond the December to May timeframe. The camp facility often includes sled-mounted units for preparing and eating meals, sleeping areas, washrooms, offices, shops, medical facilities, generator rooms, and any other support needed. The camp moves along with the exploration work, moving up to 2 miles every 2 to 3 days. Any ice roads or pads built during this time are left to melt in place. Any ice bridges built across rivers are removed in order to decrease the chance of ice damming during the melt season. Frozen lakes are often used for landing strips.

Annual Timeframe Work Period	Proposed Activity
10 December	Scouting and early crew mobilization
10 January	Full crew mobilization
15 January	Begin seismic operations
25 April	Complete seismic operations
25 April-1 May	Seasonal demobilization

Current use in the affected area:

The use of traditional food in the subsistence lifestyle provides important benefits to users. Subsistence foods are often preferable as they are rich in many nutrients, lower in fat, and considered healthier than purchased food. Subsistence harvesting of traditional foods, including preparing, eating, and sharing resources, contributes to the social, cultural, and spiritual well-being of users and their communities (ISER 2010). Subsistence foods make up a major component of the annual diet of rural people in Alaska. For example, based on multiple subsistence surveys in the late 1900s, residents of the village of Kaktovik harvested, on average, over 100,000 pounds of subsistence foods (FWS 2015a, 2015b).

Subsistence resources in the 1002 area of the Arctic Refuge are of potential importance to residents of three villages near or within the refuge boundaries: Nuiqsut, Arctic Village and Kaktovik. Although Nuiqsut is located roughly 120 miles west of the 1002 area, the community's traditional subsistence lands and waters stretch from Barrow in the west to Kaktovik in the east (BLM 2014a). Subsistence activities by Nuiqsut residents are concentrated much nearer the village, however, and neither contemporary nor historic subsistence use patterns reveal much use of the coastal plain within the 1002 area (BLM 2014a).

Arctic Village is situated along the East Fork of the Chandalar River on the south side of the Brooks Range, just outside the southern boundary of the Arctic Refuge. Historically, the Gwich'in people of this region led a nomadic life which included travels to the arctic coast. Just over a century ago, however, the first people settled permanently at the present site of Arctic Village. Subsistence use areas later in the 1900s were roughly centered on the village and concentrated south of the crest of the Brooks Range; contemporary subsistence users may range more broadly (FWS 2015a). Although the residents of Arctic Village do not generally rely on harvesting subsistence resources within the 1002 area, they are critically dependent upon, and inextricably linked with, the caribou of the Porcupine Herd which regularly calve within the 1002 area. Caribou can provide as much as 80 percent of the diet (by weight) of the northern Gwich'in people. They consider the caribou to be "the source of life" and their intimate spiritual connection with the caribou is reflected in their name for the caribou calving grounds on the coastal plain of the 1002 area "*Izhik Gwats'an Gwandaii Goodlit,*" which means, "the sacred place where life begins" (Gwich'in Steering Committee home page, http://www.gwichinsteeringcommittee.org). Similarly, *Gwich'in Niintsyaa*, the Gwich'in people's *Resolution to Prohibit Development in the Calving and Post-calving Grounds of the Porcupine Caribou Herd*, states clearly that "the Porcupine Caribou Herd…is essential to meet the nutritional, cultural, and spiritual needs of our people."

Kaktovik, the only village within the boundaries of the Arctic Refuge, is an Iñupiat village on Barter Island along the shore of the Beaufort Sea. The subsistence harvest includes both marine and terrestrial food sources, and over 90 percent of the residents participate in the subsistence economy. The harvest of marine mammals extends from Prudhoe Bay in the west to the Canadian border in the east, and up to 40 to 50 miles offshore. Fishing occurs along the entire coastline of the 1002 area, in the Canning River Delta, and along major rivers well up into the foothills of the Brooks Range; an isolated fishing site along the Hulahula River is in the middle of the 1002 area. Caribou harvest occurs throughout the 1002 area, west of the refuge to the

Sagavanirktok River, and south into the foothills and mountains of the Brooks Range. A significant portion of the primary harvest area occurs along the coast and in the central section of the 1002 area, and three-fourths of specifically identified caribou harvest sites are within or immediately adjacent to the 1002 area. By weight, caribou and bowhead whales are the most important subsistence resources for the people of Kaktovik (FWS 2015a, 2015b).

The exploration resulting from the proposed change in regulations would occur in the 1002 area during the winter and early spring (December to May). Such exploration would overlap the harvest seasons for polar bear, birds, caribou, moose, muskox, furbearers, small mammals (e.g., squirrels), sheep and freshwater fish. Some of these resources are harvested by the people of Kaktovik within the 1002 area; other resources occur outside the area, but the harvest of such resources requires travel across the coastal plain to reach harvest areas (e.g., sheep in the mountains south of the 1002 area). The seismic exploration period overlaps the annual peak of harvest effort for a subset of resources, including polar bears, birds, moose, furbearers, small mammals, and freshwater fish (FWS 2015s, 2015b).

Evaluation

Potential Impacts

There are several potential impacts to subsistence activity caused by winter exploration (e.g., seismic surveys). Exploration might disturb mobile terrestrial subsistence resources such as caribou, moose, muskox, wolves, wolverines, and birds; non-mobile wildlife such as denning bears; and aquatic species using limited patches of unfrozen water. Depending on the extent of disturbance (in space and time), the condition of the animals, and the specific season of disturbance, the health, reproductive status, and potentially even survival of disturbed animals could be compromised. Given the temporary and mobile nature of seismic exploration, however, most disturbances to mobile terrestrial wildlife will probably be temporary and not result in permanent changes in the home range of individual animals or in the distribution of a local population. Disturbance to denning mammals and aquatic organisms have a greater potential for longer-lasting effects. Concerns about wildlife disturbance have been expressed consistently by subsistence hunters relative to seismic activity west of the Arctic Refuge (BLM 2014b). A second potential impact involves subsistence hunters themselves. Elsewhere on Alaska's North Slope, subsistence hunters are known to avoid permanent infrastructure and activity, and it is likely that hunters would also avoid areas where active seismic work is being undertaken. This could force hunters to travel farther and/or into less familiar harvest areas; such changes could result in increases in travel time, travel costs, and travel risks (BLM 2016), as well as a decrease in harvest success. Winter subsistence users would also experience a third impact—the rutted and hardened tracks left in the wake of mobile seismic camps. These hardened ruts in the snow are often too large to be avoided, and they have the potential to incrementally damage the snow machines used by subsistence practitioners during the winter period (BLM 2016). These concerns will be particularly acute for subsistence hunters traveling long distances across the 1002 area to reach harvest sites beyond its borders.

Exploration will also cause impacts to habitats which support subsistence species. Damage to at least two types of habitats can result from winter seismic work. Moving camps can decrease vegetative cover on the tundra and specifically damage tussocks—the flowers of which provide an important food source for caribou on the calving grounds (FWS 2015a, 2015b). BLM studies have indicated that "most of that damage is gone" in just under a decade (BLM 2016), although recovery rates may vary in the future as rates of revegetation and thermokarst erosion both change. The consequences of damage to aquatic habitats within the 1002 are potentially more severe because the coastal plain of the Arctic Refuge is a "water-limited ecosystem." Relative to the rest of the North Slope's coastal plain, the 1002 area has a very low density of lakes (FWS 2015, 2015b) and springs (Childers and others 1977); during winter, non-frozen water is limited to isolated pools beneath ice hummocks associated with streams, lakes greater than seven feet deep, and the outflow of springs (Lyons and Trawicki 1994). Water withdrawal for ice roads and ice pads from these limited sources could have negative impacts on populations of fresh-water fish which are valued by subsistence users.

Components of the 810 Evaluation

The Service's Region 7 *Recommended Guidelines for Compliance with ANILCA Section 810* specify that a §810 document shall include at least two components: an evaluation section and a finding. The evaluation section must include the following three sub-components:

1. An evaluation of the effect of the proposed action(s) on subsistence uses and needs.

2. An evaluation of other lands for the purpose sought to be achieved.

3. An evaluation of other alternatives which would reduce or eliminate the proposed action(s) from lands needed for subsistence purposes.

Sub-component 1

The first sub-component "shall, as a minimum, address whether or not there is likely to be:

a) A reduction in subsistence uses due to factors such as direct impacts on the resource, adverse impacts on the habitat, or increased competition for the resources.

b) A reduction in the subsistence uses due to changes in availability of resources caused by alteration in their distribution, migration, or location.

c) A reduction in subsistence uses due to limitations on the access to harvestable resources, such as physical or legal barriers."

These three classes of reductions in subsistence uses can be succinctly described as reductions due to resource diminishment, distributional changes, and access limitations. These three will be considered in order below. The final element of sub-component 1 will consider the distinction between subsistence uses and subsistence needs, and the implications of that distinction for this §810 analysis.

Is it likely that there will be reductions in subsistence uses due to resource diminishment?

Neither direct impacts on the resources nor adverse impacts on habitats by seismic surveys should result in reductions in subsistence use of mobile terrestrial animals such as ungulates, furbearers, or birds. Winter exploration is unlikely to cause discernible reductions in the overall populations of mobile terrestrial animals occurring on the 1002 area in the winter time, either from increased mortality or decreased habitat quality. Depending on the spatial extent of the exploration and the behavioral response of wildlife to seismic activity (e.g., avoidance), harvestable wildlife might occupy a somewhat smaller portion of the 1002 area than they would in the absence of disturbance. Because winter densities of all large mammals are quite low in the 1002 area, however, changes in local density resulting from avoidance of seismic activity are unlikely to sufficiently concentrate either animals or subsistence hunters to the point where competition for the resources would change.

Polar bears in, or emerging from, maternal winter dens and freshwater fishes occupying the relatively rare unfrozen winter refugia are more likely to be either directly or indirectly (i.e., via habitat modification/degradation) impacted by winter seismic survey efforts. Denning habitat and the number of denning polar bears within the 1002 area are disproportionately abundant relative to the rest of the range of the Southern Beaufort Sea population. This high density of denning polar bears increases the probability of conflict resulting from seismic exploration. If denning or recently emerged bear families are displaced from dens prematurely, cub survival may be reduced. Given the scarcity of liquid water sources in the winter in the 1002 areas, water withdrawals for the construction of ice roads, ice pads, and ice bridges may very well negatively impact the abundance of aquatic resources dependent upon vulnerable lakes and springs. Even with well-designed mitigation measures to reduce conflicts with bears and to protect fragile aquatic habitats, these resources may be diminished as a result of winter exploration with a resulting reduction in subsistence use of those resources.

Conclusion: Unlikely to result in reductions in subsistence uses for most terrestrial animals; potential reductions due to possible impacts to denning bears and aquatic resources

Is it likely that there will be reductions in subsistence uses due to distributional changes?

Mobile terrestrial mammals such as ungulates (caribou, moose, muskox), furbearers (wolves, wolverines, foxes), and birds (e.g., ptarmigan) may be temporarily displaced by activities associated with winter seismic exploration. Because seismic surveys proceed progressively across the landscape, however, no one site will be a locus of continual activity or disruption. As a result, even though subsistence hunters may have to travel farther than normal or explore new areas to find such displaced wildlife, those animals could potentially be displaced into areas *more* accessible to subsistence hunters as well. There is no reason to assume either that a) winter seismic activity will result in long-term distributional changes and/or b) short-term within-season changes in distribution will result in a net decrease in subsistence hunters' encounter rates with potential resources. Therefore, there should be no net reduction in subsistence use due to distributional changes in these species.

If seismic survey activity disturbs denning or recently emerged bears, sows may move away from den sites prematurely and/or seek different denning sites in subsequent years. Although the seasonal and/or annual home range of these individual bears may change, such changes are unlikely to result in a change in the overall distribution of polar bears within the 1002 area. Disturbance of aquatic communities as a result of winter exploration are unlikely to cause active changes in distribution of organisms such as fresh-water fish. Available habitat is rare and linkages (and therefore opportunities to move) between patches of unfrozen winter waters in response to disturbance are limited. Distributional changes resulting from disturbance are most likely to be a function of populations becoming extirpated, creating gaps in the current distribution. If such populations were traditionally targeted by subsistence users, there could be reductions in subsistence use resulting from the disappearance of those populations.

> Conclusion: Unlikely to result in reductions in subsistence uses for terrestrial animals, including polar bears; potential reductions in subsistence use due to possible degradation of aquatic habitats and resulting changes to the distribution of aquatic organisms.

Is it likely that there will be reductions in subsistence uses due to access limitations?

The presence of seismic exploration crews and camps as well as the hardened ruts left in the wake of mobile survey crews will combine to alter access to subsistence resources. Hunters are likely to avoid areas of active surveying, camps, and camp "trains" as mobile facilities are moved between sites. Hunters may also attempt to avoid rutted trails, where such avoidance is possible; in some cases, however, reaching traditional harvest destinations will almost certainly require crossing rutted trails and accepting the increased wear-and-tear on subsistence users' snow machines. Thus, access to some areas may be temporally limited during surveying; access to others may involve higher costs in time, money (e.g., fuel costs), and impacts to snow machines. Given the distribution of most winter resources on the coastal plain of the 1002 area, however, these restrictions on access are unlikely to result in a reduction in subsistence uses. Subsistence hunters will almost certainly adjust their schedules and travel plans so as to still take advantage of the opportunity to seek out and locate harvestable resources while avoiding as much as possible areas impacted by survey activities.

Conclusion: Unlikely to result in reductions in subsistence uses.

The Distinction between "Subsistence Uses" and "Needs"

ANILCA §810(a) requires the Service to "evaluate the effect of [this proposal] on subsistence uses and needs," and to evaluate "other alternatives which would reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence purposes." Although ANILCA (§ 803) defines "subsistence uses" (see Introduction, above), it does not define either subsistence "needs" or "public lands needed for subsistence purposes." §810 analyses typically either ignore or conflate "subsistence uses" and "needs," and evaluate only subsistence uses. Congress explicitly used the two terms, however, so a distinction should be inferred.

Needs and *purposes* are both broader, more inclusive term than *subsistence uses*. *Uses* seems to refer to the strictly utilitarian, practical, and/or "economic" elements of subsistence. Such usage is, in fact, what is reflected in most of Title VIII and specifically in §810 analyses. *Uses*, however, are just a subset of subsistence needs or purposes. Although Congress clearly emphasized the concept of *subsistence uses* throughout ANILCA (e.g., providing a definition for the term, using it conspicuously in §810), our lawmakers also had a broader vision when they affirmed in §802.1 that "the purpose of this title is to provide the opportunity for rural residents engaged in a subsistence way of life to do so." Opportunities for subsistence uses (i.e., for consumption, barter, and trade) clearly contribute to "a subsistence way of life," but such uses *sensu strictu* do not define the entirety of subsistence *as* a way of life. As the Gwich'in explain, such a way of life incorporates "the nutritional, cultural and spiritual needs of our People" (Gwich'in Steering Committee 2012). ANILCA specifies that the purpose of Title VIII is to provide the opportunity for people to maintain that way of life.

The Gwich'in People have repeatedly made clear that exploration and development of the 1002 area is unacceptable to them and compromises their freedom to exercise their "inherent right to continue [their] own way of life" (Gwich'in Steering Committee 2012). In effect, they see an *undisturbed* 1002 area as "public lands needed for subsistence purposes" in that broader sense. That position has been re-affirmed every two years since 1988 in *Gwich'in Niintsyaa, Resolution to Protetct the Birthplace and Nursery Grounds of the Porcupine Caribou Herd*, as well as, most recently, in testimony by Sam Alexander on behalf of the Gwich'in Nation before the Senate Committee on Natural Resources on November 2, 2017 (https://www.energy.senate.gov/public/index.cfm/files/serve?File_id=B3D46943-CF5D-488D-8AB9-7ED2D52702BA). For the Gwich'in, exploration or development of the 1002 area threatens their nutritional needs via a loss of food security. In addition, it *also* leaves their cultural and spiritual needs unmet because of what they perceive will be a violation of "*Izhik Gwats'an Gwandaii Goodlit,*" the sacred place where life begins.

Conclusion: The winter exploration anticipated as a result of this proposed regulatory amendment will result in the cultural and spiritual subsistence needs of the Gwich'in people being unmet and unfulfilled.

Summary of Sub-component 1 – This proposal is unlikely to result in any reductions in subsistence uses of most terrestrial animals. Polar bears may be an exception to that conclusion. If disturbance to denning bears resulted in a population decline, there could be a reduction in subsistence use of that resource. Similarly, reductions of aquatic resources and/or their habitats could lead to a reduction in the availability and therefore the use of those fresh-water resources. Elsewhere on the North Slope, however, extensive mitigation tactics have been devised to minimize the impacts of development on both bears and aquatic resources. A conscientious application of those tactics during winter exploration in the 1002 area is likely to ensure that even if impacts to these resources result in a reduction of subsistence use, they will not lead to a *significant restriction* of subsistence uses, which is the standard to be applied in a §810 finding. Similarly, although winter exploration will likely cause temporary changes in the spatial and temporal patterns of subsistence use, such changes will not rise to the level of a significant restriction on subsistence uses. Finally, the cultural and spiritual subsistence needs of the Gwich'in people will not be met by this proposal. Indeed, they view exploration and development of the 1002 as "a threat to the very heart of [their] people" and a significant assault on "the rights of the Gwich'in People to continue to live [their] way of live." Ultimately, however, a finding under §810 deals only with significant restrictions on subsistence *uses*, and not needs, despite the fact that both uses and needs are to be evaluated in the §810 analysis.

Sub-component 2

The second sub-component of a §810 evaluation shall "evaluate the availability of other lands for the purpose sought to be achieved." The purpose of this action, however, is specifically to allow opportunities for the submission of applications for permits for surface geological and geophysical and/or seismic exploration *on the Arctic Refuge 1002* lands described in ANILCA. Therefore, only permitted exploration in the 1002 fulfills the purpose of this proposed action.

Sub-component 3

The third sub-component of a §810 evaluation shall "evaluate alternatives which would reduce or eliminate the proposed action(s) from lands needed for subsistence." Despite the extensive use of the 1002 area by subsistence practitioners (particularly from Kaktovik), however, the 1002 area was specifically identified by Congress as an area in which "to authorize exploratory activity within the coastal plain in a manner that avoids significant adverse effects on the fish and wildlife and other resources." This proposal creates a mechanism for fulfilling Congress' intent in this regard. Thus, there are no suitable alternatives to the proposal because of its specific focus on the 1002 area.

Finding

This evaluation concludes that the action will not result in a significant restriction of subsistence uses.